VISIT @PROCBSE IN TELEGRAM TO GET FREE BOOKS

Best Seller

FOR 2023 EXAM

OSWAAL BOOKS®

LEARNING MADE SIMPLE

UPDATED SYLLABUS
For Annual Scheme of Assessment-Academic Session 2022-23
April 21, 2022

CBSE QUESTION BANK

CHAPTERWISE & TOPICWISE SOLVED PAPERS

CLASS 10

SCIENCE

Strictly as per the Latest CBSE Syllabus released on 21st April 2022 (CBSE CIR No. Acad-48/2022)

- Questions from • Previous Years' Papers 2015-2021 • CBSE Official Question Bank 2021
- • Board Marking Scheme Answers 2015-2021 • Topper's Answers
- •Revision Notes •Mind Maps •Mnemonics •Concept Videos
- Includes Latest Term-I & Term-II Board Papers- Fully Solved
- Commonly Made Errors & Answering Tips
- Latest Typologies of Questions including Case-based Questions

Prepare, Revise & Practice Online on www.Oswaal360.com or Oswaal 360 on

@PROCBSE

PRO CBSE

EDUCATE • EMPOWER • EVOLVE

@PROCBSE

DISCLAIMER

WE DON'T OWN CREDIT! WE ARE JUST FORWARDING THE MATERIAL WHICH ARE ALREADY AVAILABLE ON INTERNET. AND DON'T SUPPORT PIRACY IN ANYWAY. FOR MORE CHECK DMCA.

JOIN US ON DIFFERENT PLATFORM

CLICK TO VEIW / OPEN

CONTACT US

If you are rightful owner of any content posted here, and object to them being displayed or if you are one of representetives of Copyrights department then contact us at @procbsecontactbot

18th EDITION

YEAR 2022-23

ISBN "978-93-5595-139-7"

SYLLABUS COVERED

CENTRAL BOARD OF SECONDARY EDUCATION
DELHI

COPYRIGHT RESERVED
BY THE PUBLISHERS

All rights reserved. No part of this book may be reproduced, stored in a retrieval system, or transmitted, in any form or by any means, without written permission from the publishers. The author and publisher will gladly receive information enabling them to rectify any error or omission in subsequent editions.

PUBLISHED BY

OSWAAL BOOKS & LEARNING PVT. LTD.

1/11, Sahitya Kunj, M.G. Road,
Agra - 282002, (UP) India

1/1, Cambourne Business Centre
Cambridge, Cambridgeshire
CB 236DP, United kingdom

0562-2857671

contact@oswaalbooks.com

www.OswaalBooks.com

DISCLAIMER

Oswaal Books has exercised due care and caution in collecting all the data before publishing this book.
In spite of this, if any omission, inaccuracy or printing error occurs with regard to the data contained in this book, Oswaal Books will not be held responsible or liable.
Oswaal Books will be grateful if you could point out any such error or offer your suggestions which will be of great help for other readers.

Kindle Edition

@PROCBSE

TABLE OF CONTENTS

- Latest CBSE Syllabus released on 21st April 2022 for Academic Year 2022-2023 (CBSE Cir. No. Acad 48/2022) 9 - 13
- Latest Term-I & Term-II Board Papers 2021-22 - Fully solved 15 - 32
- Latest Topper's Answers 2020 33 - 48

In each chapter, for better understanding, questions have been classified with the typology issued by CBSE as :

R - *Remembering,* U - *Understanding,*
A - *Applying* AE - *Analyzing & Evaluating* C - *Creating*

Unit I

Chemical Substances : Nature and Behaviour

1. **Chemical Reactions** 1 - 18
   - **Topic 1.** Chemical Reactions and Equations
   - **Topic 2.** Types of Chemical Reactions, –Corrosion and Rancidity
2. **Acids, Bases and Salts** 19 - 40
   - **Topic 1.** Acids and Bases
   - **Topic 2.** Salts, Their Properties and Uses
3. **Metals and Non-Metals** 41 - 61
   - **Topic 1.** Properties of Metals and Non-Metals
   - **Topic 2.** Ionic compounds, Metallurgy and Corrosion
4. **Carbon Compounds** 62 - 93
   - **Topic 1.** Carbon and its properties, Homologous series and IUPAC Names
   - **Topic 2.** Ethanol, Ethanoic acid, Soap and Detergents

*5. **Periodic Classification of Elements** 94 - 118
   - **Topic 1.** Periodic Laws and their Limitations
   - **Topic 2.** Periodic Elements and Periodic Properties

- **Self Assessment Test - 1** 119 - 120

Unit II

World of Living

6. **Life Processes** 121 - 149
   - **Topic 1.** Nutrition
   - **Topic 2.** Respiration
   - **Topic 3.** Circulation and Transportation
   - **Topic 4.** Excretion
7. **Control and Co-ordination** 150 - 170
   - **Topic 1.** Control and Co-ordination in Plants
   - **Topic 2.** Control and Co-ordination in Animals
8. **Reproduction** 171 - 201
   - **Topic 1.** Asexual Reproduction and Vegetative Propagation
   - **Topic 2.** Sexual Reproduction in Plants
   - **Topic 3.** Reproduction in Human Beings
9. **Heredity and Evolution** 202 - 229
   - **Topic 1.** Heredity and Mendel's Contribution
   - **Topic 2.** Basic Concepts of Evolution

* Evolution, Evolution and Classification and Evolution should not be equated with progress

- **Self Assessment Test - 2** 230 - 231

Unit III

Natural Phenomena

10. **Light – Reflection and Refraction** 232 - 279
    - **Topic 1.** Reflection of Light, Image Formed by Spherical Mirrors
    - **Topic 2.** Refraction, Lenses and Power of Lens
11. **Human Eye and The Colourful World** 280 - 304
    - **Topic 1.** Human eye, Defects of vision and corrections
    - **Topic 2.** Refraction of Light through prism, Dispersion of Light and Scattering of Light

*Colour of sun at sunrise and sunset

- **Self Assessment Test - 3** 305 - 305

Unit IV

Effects of Current

12. **Electricity** 306 - 334
    - **Topic 1.** Electric Current, Ohm's Law
    - **Topic 2.** Resistance in Series and Parallel Combination, Electric Power and Heating Effect

@PROCBSE

TABLE OF CONTENTS

13. **Magnetic Effects of Electric Current** 335 - 356
- **Topic 1.** Magnetic Effects
- **Topic 2.** Electric Generator and Electric Motor

*Electric Motor, *Electromagnetic induction, *Induced Current, *Fleming's Right Hand, *Electric Generator

- **Self Assessment Test - 4** 357 - 358

Unit V

Natural Resources

*14. **Sources of Energy** 359 - 375
- **Topic 1.** Conventional Sources of Energy
- **Topic 2.** Alternative or Non-Conventional Sources of Energy

15. **Our Environment** 376 - 401
- **Topic 1.** Ecosystem and Food Chain
- **Topic 2.** Biodegradable and Non-Biodegradable substances and Global Warming

*16. **Management of Natural Resources** 402 - 420
- **Topic 1.** Natural Resources, Sustainable Development and Biodiversity
- **Topic 2.** Water Conservation and Fossil Fuels

- **Self Assessment Test - 5** 421 - 422

❑❑



*Kindly note that this Chapter/Topic has been deleted from the Latest CBSE Syllabus for Academic Year 2022-23. Hence it is optional to study it.

@PROCBSE

LET THE ADVENTURE BEGIN!



The new way of learning; Blended Learning

The pandemic introduced us all to a phenomenon which now seems to be the way forward for learners & teachers alike, it is **blended learning.** In just a span of a year, we have witnessed a rapid advancement in e-learning. Many researchers say that, in no time e-learning will become mainstream. Oswaal Books identified this as an opportunity and thus we decided to prepare students for this turbulent yet a very useful change with Oswaal 360. Through Oswaal 360 we aim to help the students learn at their own pace. Hence, we wish to make learning adaptive in order to simplify it for every student.

India is currently one of the youngest economies in the world. Hence, it's imperative for our education system to churn out more learners than ever before. Considering the current learning mindset of students CBSE has recently introduced the curriculum for classes IX to XII containing academic content, syllabus for examinations with learning outcomes, pedagogical practices and assessment guidelines. The Board will conduct the annual scheme of assessment at the end of the Academic session 2022-23 as per the given curriculum.

What Oswaal Question Banks have for you?

The structural changes in Education that are being brought in by the latest Syllabus and the new National Educational Policy (NEP) resonate with our approach of focusing on deeper understanding instead of rote learning. We have designed this book to make learning simpler for every student. Our **cognitive and innovative** exercises make us the leaders of simplified learning. Our study material proves to be so effective because it is based on **Bloom's Taxonomy** and also helps retain information for a longer period of time. The last year saw a sudden rise in the need for online classes and self-study. So as **blended learning** replaces traditional learning methods, Oswaal Books provides the right material to adapt and learn faster. This book takes an **intuitive approach** for skill development to unleash a student's maximum potential. Questions like Tabular Based Questions, Passage Based Questions, Picture Based Questions, Fill in the Blanks, Match the Following, etc. have been exclusively developed by the **Oswaal Editorial Board** to help students master these new Typologies of Questions.

Benefits of studying from Oswaal Question Banks

- **Previous Years' Questions with Board Marking Scheme Answers**
- **Revision Notes** for in-depth study
- **Modified & Empowered Mind Maps & Mnemonics** for quick learning
- **Chapterwise learning Outcomes & Art integration** as per NEP
- Include **Questions from CBSE official Question Bank** released in April 2021
- Unitwise Self-Assessment Tests & Practice Papers
- **Concept videos** for blended learning

Our Heartfelt Gratitude!

We have taken due care in developing this book. There have been a lot of people who have helped us in our journey. We would like to offer heartfelt gratitude to them- our authors, editors, reviewers, and especially students like you who regularly send us suggestions which help us in continuous improvement of this book.

Wish you all Happy Learning and a Successful Academic Year 2022-23!!

@PROCBSE

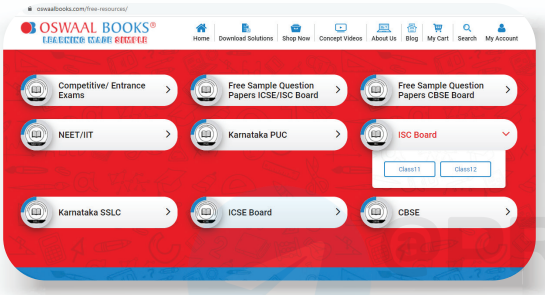
Get Unlimited Access to Free Resources



at: oswaalbooks.com/free-resources/

How? It's Easy as

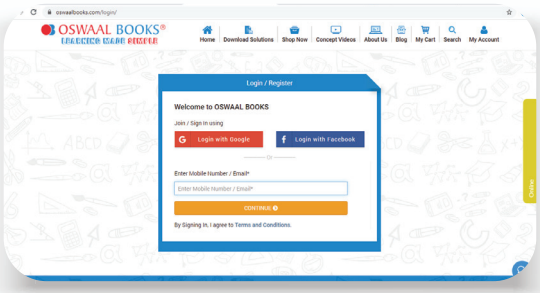


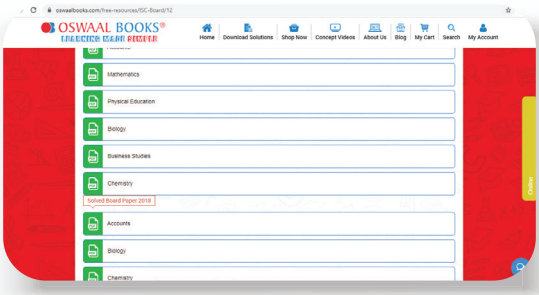


Step 1: Visit oswaalbooks.com/ free-resources/ and choose your board and class.

PROCBSE
JOIN NOW !

Step 2: Not Registered? Register here quickly for the ocean of knowledge inside. (If registered already, simply login and move ahead)





Step 3: You are here! Enjoy this unlimited treat of FREE resources.

@PROCBSE

WISH TO KNOW WHAT WE HAVE FOR YOU UNDER FREE RESOURCES?

HERE YOU GO:

- Date Sheet
- Board Syllabus 2023 Exams
- Solved Board Paper 2019, 2020, 2021
- Toppers' Answers 2015 to 2020
- Latest Sample Question Paper
- Project Report
- Lab Activities (Science & Math only)
- Flowcharts & Mind Maps

Where to report any plausible content or technical error?

Write to us on:
contact@OswaalBooks.com
and remember to mention the following.



- Full name of the book with its ISBN
- Mention the page number and specify the error
- You may also upload an image with the error marked, with a little detail of the error.

How to decode icons given throughout the book?

- Topic-wise & Chapter-wise
- Mnemonics
- Previous Years' Board Papers
- Mind Maps
- Topper's Answer
- Concept Videos
- Highly Expected Questions for the upcoming exam

@PROCBSE
JOIN NOW !

@PROCBSE

CBSE CIRCULAR 2022-23

केन्द्रीय माध्यमिक शिक्षा बोर्ड
CENTRAL BOARD OF SECONDARY EDUCATION

आज़ादी का अमृत महोत्सव

CBSE/Acad/2022 **April 21, 2022**

Cir No Acad-48/2022

All Heads of Institutions affiliated to CBSE

Subject : CBSE - Secondary and Senior School Curriculum 2022-23

1. CBSE annually provides curriculum for classes IX to XII containing academic content, syllabus for examinations with learning outcomes, pedagogical practices and assessment guidelines.
2. Considering the feedback of stakeholders and other prevailing conditions, the Board will conduct the annual scheme of assessment at the end of the Academic Session 2022-23 and the curriculum has been designed accordingly. Details are available at the link https://cbseacademic.nic.in/curriculum_2023.html
3. It is important that schools ensure curriculum transaction as per the directions given in the initial pages of the curriculum document. The subjects should be taught as per the curriculum released by the Board with the help of suitable teaching-learning strategies such as Art-Integrated Education, Experiential Learning, and Pedagogical Plans etc. wherever possible.
4. Before making annual pedagogical plan to ensure curriculum transaction for optimal learning, it is desirable that the Head of the School may take a session with all the teachers on the important topics covered in initial pages of the curriculum document as well as the topics covered under subject-wise syllabus.
5. Sample Question Papers with detailed design of the Question Paper will be made available on CBSE's website in due course of time.
6. Schools are requested to share the curriculum available on https://cbseacademic.nic.in/curriculum_2023.html including initial pages to all the teachers and students.

With Best wishes,

(Dr. Joseph Emmanuel)
Director (Academics)

@PROCBSE

SYLLABUS

Science

Class - X (Code No. 086)

Latest Syllabus issued by CBSE for Academic Year 2022-23

(Annual Examination)

3 Hours **Marks 80**

Unit No.	Unit	Marks
I	Chemical Substances – Nature and Behaviour	25
II	World of Living	23
III	Natural Phenomena	12
IV	Effects of Current	13
V	Natural Resources	07
	Total	80
	Internal Assessment	20
	Grand Total	**100**

@PROCBSE JOIN NOW !

Theme : Materials

(55 Periods)

Unit I : Chemical Substances - Nature and Behaviour

Chemical Reactions : Chemical equation, Balanced chemical equation, implications of a balanced chemical equation, types of chemical reactions: combination, decomposition, displacement, double displacement, precipitation, endothermic exothermic reactions, oxidation and reduction.

Acids, bases and salts : Their definitions in terms of furnishing of H^+ and OH^- ions, General properties, examples and uses, neutralization, concept of pH scale (Definition relating to logarithm not required), importance of pH in everyday life; preparation and uses of Sodium Hydroxide, Bleaching powder, Baking soda, Washing soda and Plaster of Paris.

Metals and non-metals : Properties of metals and non-metals; Reactivity series; Formation and properties of ionic compounds; Basic metallurgical processes; Corrosion and its prevention.

Carbon compounds : Covalent bonding in carbon compounds. Versatile nature of carbon. Homologous series. Nomenclature of carbon compounds containing functional groups (halogens, alcohol, ketones, aldehydes, alkanes and alkynes), difference between saturated hydro carbons and unsaturated hydrocarbons. Chemical properties of carbon compounds (combustion, oxidation, addition and substitution reaction). Ethanol and Ethanoic acid (only properties and uses), soaps and detergents.

Theme : The World of the Living

(50 Periods)

Unit II : World of Living

Life processes : 'Living Being'. Basic concept of nutrition, respiration, transport and excretion in plants and animals.

@PROCBSE

SYLLABUS

Control and co-ordination in animals and plants : Tropic movements in plants; Introduction of plant hormones; Control and co-ordination in animals: Nervous system; Voluntary, involuntary and reflex action; Chemical co-ordination: animal hormones.

Reproduction : Reproduction in animals and plants (asexual and sexual) reproductive health - need and methods of family planning. Safe sex vs HIV/AIDS. Child bearing and women's health.

Heredity and Evolution : Heredity; Mendel's contribution- Laws for inheritance of traits: Sex determination: brief introduction: (topics excluded - evolution; evolution and classification and evolution should not be equated with progress).

Theme : Natural Phenomena

(23 Periods)

Unit III : Natural Phenomena

Reflection of light by curved surfaces; Images formed by spherical mirrors, centre of curvature, principal axis, principal focus, focal length, mirror formula (Derivation not required), magnification.

Refraction; Laws of refraction, refractive index.

Refraction of light by spherical lens; Image formed by spherical lenses; Lens formula (Derivation not required); Magnification. Power of a lens.

Functioning of a lens in human eye, defects of vision and their corrections, applications of spherical mirrors and lenses.

Refraction of light through a prism, dispersion of light, scattering of light, applications in daily life (excluding colour of the sun at sunrise and sunset).

@PROCBSE
JOIN NOW !

Theme : How Things Work

(32 Periods)

Unit IV : Effects of Current

Electric current, potential difference and electric current. Ohm's law; Resistance, Resistivity, Factors on which the resistance of a conductor depends. Series combination of resistors, parallel combination of resistors and its applications in daily life. Heating effect of electric current and its applications in daily life. Electric power, Interrelation between P, V, I and R.

Magnetic effects of current : Magnetic field, field lines, field due to a current carrying conductor, field due to current carrying coil or solenoid; Force on current carrying conductor, Fleming's Left Hand Rule, Direct current. Alternating current: frequency of AC. Advantage of AC over DC. Domestic electric circuits.

Theme : Natural Resources

(20 Periods)

Unit V : Natural Resources

Our environment: Eco-system, Environmental problems, Ozone depletion, waste production and their solutions. Biodegradable and non-biodegradable substances.

Note for the Teachers:

1. The chapter Management of Natural Resources (NCERT Chapter 16) will not be assessed in the year-end examination. However, learners may be assigned to read this chapter and encouraged to prepare a brief write up to any concept of this chapter in their Portfolio. This may be for Internal Assessment and credit may be given Periodic Assessment/Portfolio).

@PROCBSE

2. The NCERT text books present information in boxes across the book. These help students to get conceptual clarity. However, the information in these boxes would not be assessed in the year-end examination.

PRACTICALS

Practical should be conducted alongside the concepts taught in theory classes

LIST OF EXPERIMENTS

1. A. Finding the pH of the following samples by using pH paper/universal indicator: **Unit-I**

- **(i)** Dilute Hydrochloric acid
- **(ii)** Dilute NaOH solution
- **(iii)** Dilute Ethanoic Acid solution
- **(iv)** Lemon juice
- **(v)** Water
- **(vi)** Dilute Hydrogen carbonate solution.

B. Studying the properties of acids and bases (HCl & NaOH) on the basis of their reaction with: **Unit-I**

- **a.** Litmus solution (Blue/Red)
- **b.** Zinc metal
- **c.** Solid sodium carbonate

@PROCBSE JOIN NOW!

2. Performing and observing the following reactions and classifying them into: **Unit-I**

- **a.** Combination reaction
- **b.** Decomposition reaction
- **c.** Displacement reaction
- **d.** Double displacement reaction
  - **(i)** Action of water on quick lime.
  - **(ii)** Action of heat on ferrous sulphate crystals.
  - **(iii)** Iron nails kept in copper sulphate solution.
  - **(iv)** Reaction between sodium sulphate and barium chloride solutions.

3. Observing the action of Zn, Fe, Cu and Al metals on the following salt solutions: **Unit-I**

(i) $ZnSO_4$ (aq) **(iii)** $FeSO_4$ (aq)

(ii) $CuSO_4$(aq) **(iv)** $Al_2(SO_4)_3$ (aq)

Arranging Zn, Fe, Cu and Al (metals) in the decreasing order of reactivity based on the above result.

4. Studying the dependence of potential difference (V) across a resistor on the current (I) passing through it and determine its resistance. Also plotting a graph between V and I. **Unit-IV**

5. Determination of the equivalent resistance of two resistors when connected in series and parallel. **Unit-IV**

6. Preparing a temporary mount of a leaf peel to show stomata. **Unit- II**

7. Experimentally show that carbon dioxide is given out during respiration. **Unit-II**

8. Study of the following properties of acetic acid (ethanoic acid): **Unit- I**

@PROCBSE

(i) odour **(ii)** solubility in water

(iii) effect on litmus **(iv)** reaction with sodium Hydrogen Carbonate

9. Study of the comparative cleaning capacity of a sample of soap in soft and hard water. **Unit- I**

10. Determination of the focal length of: **Unit-III**

(i) Concave mirror

(ii) Convex lens

by obtaining the image of a distant object.

11. Tracing the path of a ray of light passing through a rectangular glass slab for different angles of incidence. Measure the angle of incidence, angle of refraction, angle of emergence and interpret the result. **Unit - III**

12. Studying (a) binary fission in *Amoeba*, and (b) budding in yeast and Hydra with the help of prepared slides. **Unit-II**

13. Tracing the path of the rays of light through a glass prism. **Unit-III**

14. Identification of the different parts of an embryo of a dicot seed (Pea, gram or red kidney bean). **Unit-II**

Prescribed Books

- Science-Textbook for class IX-NCERT Publication
- Science-Text book for class X- NCERT Publication
- Assessment of Practical Skills in Science-Class IX - CBSE Publication
- Assessment of Practical Skills in Science- Class X- CBSE Publication
- Laboratory Manual-Science-Class IX, NCERT Publication
- Laboratory Manual-Science-Class X, NCERT Publication
- Exemplar Problems Class IX – NCERT Publication
- Exemplar Problems Class X – NCERT Publication

❑❑

@PROCBSE

SYLLABUS

Question Paper Design
(Class X)
Science (086)

Theory (80 marks)

Competencies	Total
Demonstrate Knowledge and Understanding	46%
Application of Knowledge/Concepts	22%
Formulate, Analyze, Evaluate and Create	32%
	100%

Note:

- Typology of Questions: VSA including objective type questions, Assertion – Reasoning type questions; SA; LA; Source-based/ Case-based/ Passage-based/ Integrated assessment questions.
- An internal choice of approximately 33% would be provided.

Internal Assessment (20 Marks)

- **Periodic Assessment -** 05 marks + 05 marks
- **Subject Enrichment** (Practical Work) - 05 marks
- **Portfolio** - 05 marks

@PROCBSE
JOIN NOW !

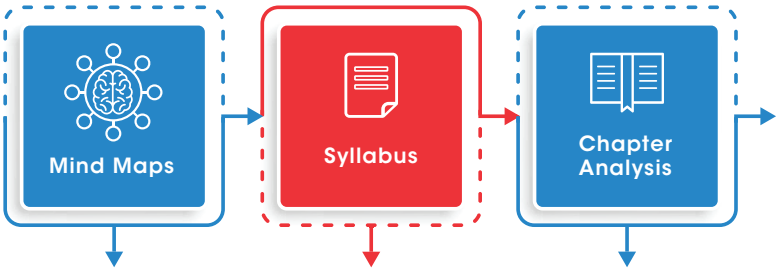
Suggestive verbs for various competencies

- **Demonstrate Knowledge and Understanding**
  State, name, list, identify, define, suggest, describe, outline, summarise, etc.
- **Application of Knowledge/Concepts**
  Calculate, illustrate, show, adapt, explain, distinguish, etc.
- **Analyse, Evaluate and Create**
  Interpret, analyse, compare, contrast, examine, evaluate, discuss, construct, etc.

@PROCBSE

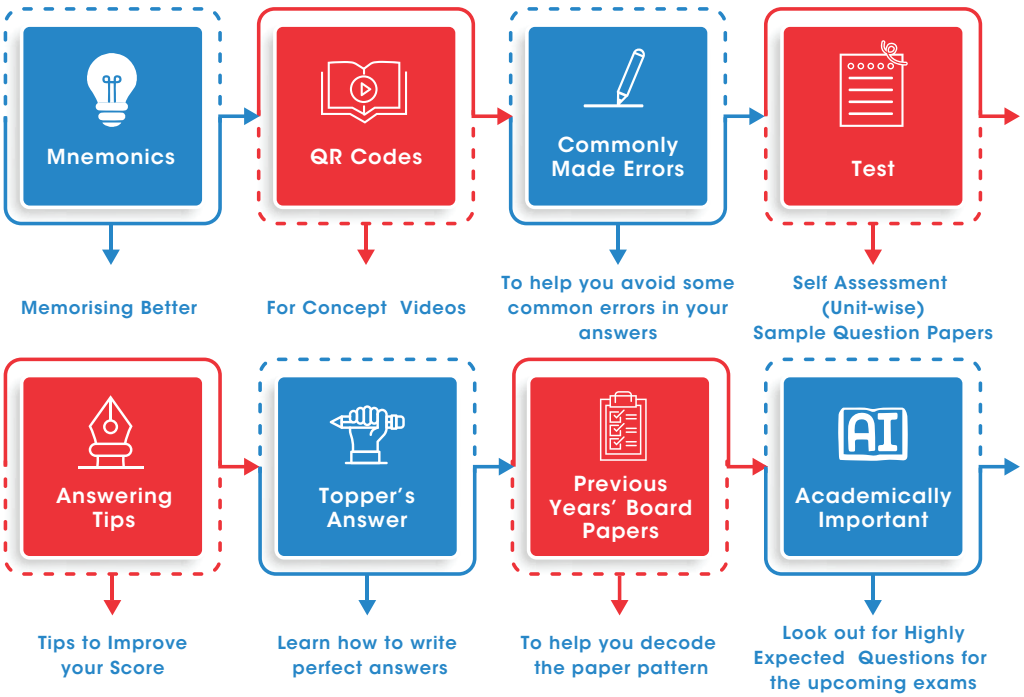
HOW TO USE THIS BOOK?

Chapter Navigation Tools



@PROCBSE
JOIN NOW

Find Exam Oriented Preparation Tools in the Chapter



@PROCBSE

Sample Question Paper, 2021-22

(Issued by CBSE Board on 14th January 2022)

SCIENCE (Term-II)

SOLVED

General Instructions :

(i) *All questions are compulsory.*

(ii) *The question paper has **three sections** and **15 questions**.*

(iii) *Section–A has 7 questions of 2 marks each; Section–B has 6 questions of 3 marks each; and Section–C has 2 case based questions of 4 marks each.*

(iv) *Internal choices have been provided in some questions. A student has to attempt only one of the alternatives in such questions.*

Section - A

1. The table shows the electronic structures of four elements. **[2]**

Element	P	Q	R	S
Electronic Structure	2, 6	2, 8, 1	2, 8, 7	2, 8, 8

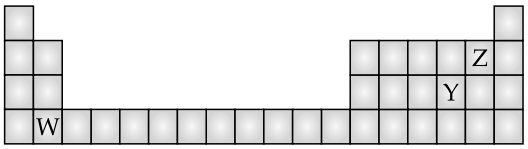
(a) Identify which element(s) will form covalent bonds with carbon.

(b) "Carbon reacts with an element in the above table to form several compounds." Give suitable reason.

2. The diagram below shows part of the periodic table. **[2]**

(a) Which elements would react together to form covalent compounds?

(b) Between the two elements W and Z, which will have a bigger atomic radius? Why?



3. **(a)** Trace the path a male gamete takes to fertilise a female gamete after being released from the penis. **[2]**

(b) State the number of sets of chromosomes present in a zygote.

4. Rajesh observed a patch of greenish black powdery mass on a stale piece of bread. **[2]**

(a) Name the organism responsible for this and its specific mode of asexual reproduction.

(b) Name its vegetative and reproductive parts.

5. Mustard was growing in two fields- A and B, while field A produced brown coloured seeds, field B produced yellow coloured seeds. **[2]**

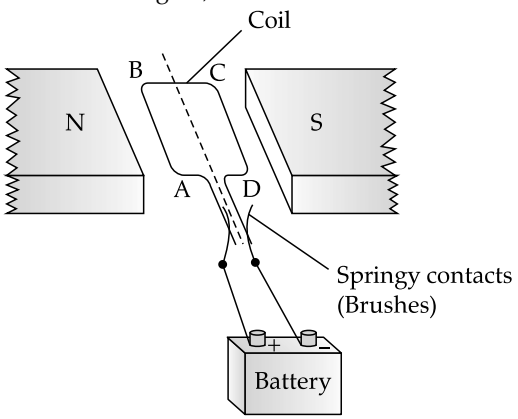
It was observed that in field A, the offsprings showed only the parental trait for consecutive generations, whereas in field B, majority of the offsprings showed a variation in the progeny.

What are the probable reasons for these?

OR

In an asexually reproducing species, if a trait X exists in 5% of a population and trait Y exists in 70% of the same population, which of the two traits is likely to have arisen earlier? Give reason.

6. A simple motor is made in a school laboratory. A coil of wire is mounted on an axle between the poles of a horseshoe magnet, as illustrated. **[2]**



In the example above, coil ABCD is horizontal and the battery is connected as shown.

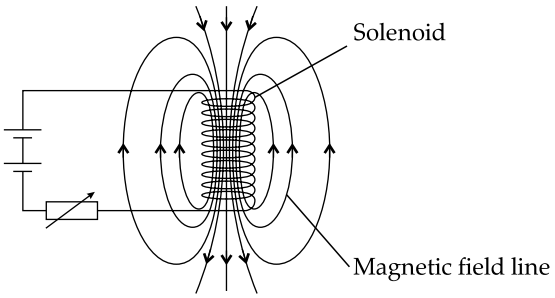
(a) For this position, state the direction of the force on the arm AB.

(b) Why does the current in the arm BC not contribute to the turning force on the coil?

OR

A circuit contains a battery, a variable resistor and a solenoid. The figure below shows the magnetic field pattern produced by the current in the solenoid.

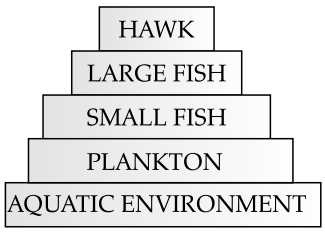
@PROCBSE



(a) State how the magnetic field pattern indicates regions, where the magnetic field is stronger.

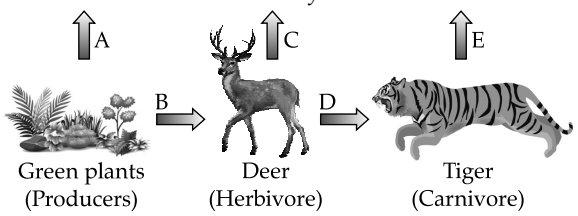
(b) What happens to the magnetic field when the current in the circuit is reversed?

7. DDT was sprayed in a lake to regulate breeding of mosquitoes. How would it affect the trophic levels in the following food chain associated with a lake? Justify your answer. **[2]**



OR

In the following food chain, vertical arrows indicate the energy lost to the environment and horizontal arrows indicate the energy transferred to the next trophic level. Which one of the three vertical arrows (A, C and E) and which one of the two horizontal arrows (B and D) will represent more energy transfer? Give reason for your answer.



Food chain in a forest ecosystem

Section - B

8. Choose an element from period 3 of modern periodic table that matches the description given below in each instance. Give reason for your choice. **[3]**

(a) It has a similar structure to diamond.

(b) It has same valency as Lithium.

(c) It has variable valency and is a member of the Oxygen family (group 16).

9. **(a)** How many isomers are possible for the compound with the molecular formula C_4H_8? Draw electron dot structure of branched chain isomer. **[3]**

(b) How will you prove that C_4H_8 and C_5H_{10} are homologous?

OR

A carbon compound 'A' having melting point 156K and boiling point 351K, with molecular formula C_2H_6O is soluble in water in all proportions.

(a) Identify 'A' and draw its electron dot structure.

(b) Give the molecular formulae of any two homologous of 'A'.

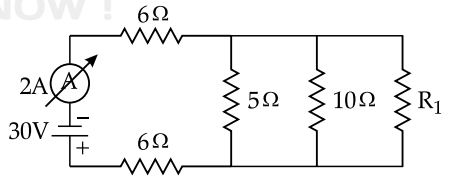
10. Two pea plants-one with round yellow (RRYY) seeds and another with wrinkled green (rryy) seeds produce F_1 progeny that have round, yellow (RrYy) seeds. **[3]**

When F_1 plants are self-pollinated, which new combination of characters is expected in F_2 progeny? How many seeds with these new combinations of characters will be produced when a total of 160 seeds are produced in F_2 generation? Explain with reason.

11. **(a)** It would cost a man ₹3.50 to buy 1.0 kW h of electrical energy from the Main Electricity Board. His generator has a maximum power of 2.0 kW. The generator produces energy at this maximum power for 3 hours. Calculate how much it would cost to buy the same amount of energy from the Main Electricity Board. **[1]**

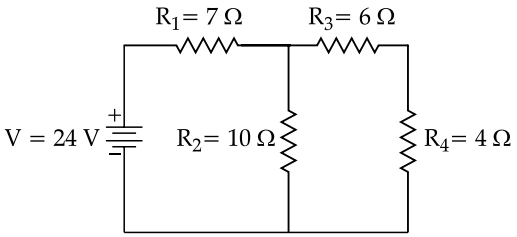
(b) A student boils water in an electric kettle for 20 minutes. Using the same mains supply, he wants to reduce the boiling time of water. To do so, should he increase or decrease the length of the heating element? Justify your answer. **[2]**

12. **[3]**



In the above circuit, if the current reading in the ammeter A is 2A, what would be the value of R_1?

OR



Calculate the total resistance of the circuit and find the total current in the circuit.

13. Gas A, found in the upper layers of the atmosphere, is a deadly poison but is essential for all living beings. The amount of this gas started declining sharply in the 1980's. **[3]**

(a) Identify Gas A. How is it formed at higher levels of the atmosphere?

(b) Why is it essential for all living beings? State the cause for the depletion of this gas.

@PROCBSE

Section - C

This section has 02 case-based questions (14 and 15). Each case is followed by 03 sub-questions (a), (b), (c). Parts (a) and (b) are compulsory. However, an internal choice has been provided in part (c).

14. Sahil performed an experiment to study the inheritance pattern of genes. He crossed tall pea plants (TT) with short pea plants (tt) and obtained all tall plants in F_1 generation. **[1]**

(a) What set of genes will be present in the F_1 generation?

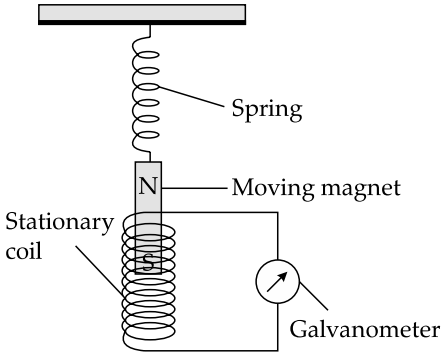
(b) Give reason, why only tall plants are observed in F_1 progeny. **[1]**

(c) When F_1 plants were self - pollinated, a total of 800 plants were produced. How many of these would be tall, medium height or short plants? Give the genotype of F_2 generation. **[2]**

OR

When F_1 plants were cross-pollinated with plants having tt genes, a total of 800 plants were produced. How many of these would be tall, medium, or short plants? Give the genotype of F_2 generation.

15. Ansari Sir was demonstrating an experiment in his class with the setup as shown in the figure below. **[4]**



A magnet is attached to a spring. The magnet can go in and out of the stationary coil.

He lifted the magnet and released it to make it oscillate through the coil. Based on your understanding of the phenomenon, answer the following questions.

(a) What is the principle which Ansari Sir is trying to demonstrate? **[1]**

(b) What will be observed when the magnet starts oscillating through the coil. Explain the reason behind this observation. **[1]**

(c) Consider the situation where the magnet goes in and out of the coil. State two changes which could be made to increase the deflection in the galvanometer. **[2]**

OR

Is there any difference in the observations in the galvanometer when the magnet swings in and then out of the stationary coil? Justify your answer. **[2]**

❑❑❑

@PROCBSE JOIN NOW !

Marking Scheme Answers 2021-22 (Issued by CBSE)

Section - A

1. **(a)** P and R ½+½

(b) Carbon has a valency of four or tetravalency & catenation ½+½

2. **(a)** Y and Z **1**

(b) W has bigger atomic radius. ½

Reason:

Down the group, number of shells increases. ½

3. **(a)** Male gamete (sperm) travels in the female reproductive tract after being released. The path which it takes to fertilise the female gamete (egg) is vagina, uterus, fallopian tube where it fuses with the egg cell resulting in the formation of a zygote

(Alternative: labelled figure of human female reproductive system indicating the passage of sperm from vagina to uterus and then to fallopian tube for fertilisation, resulting in the formation of a zygote.) **1**

(b) Zygote has 2 sets of chromosomes. **1**

4. **(a)** The greenish black powdery mass on a stale piece of bread is due to bread mould (Rhizopus) which reproduces by spore formation. ½ + ½

(b) Hyphae or thread like structures are the vegetative part and tiny blob like structures or sporangia are the reproductive parts. ½ + ½

5. In field A, the reason for parental trait in consecutive generations of the offsprings is self-pollination. **1**

In field B, variation is seen because of recombination of genes as cross-pollination is taking place. **1**

OR

Trait Y, which exists in 70% (larger fraction) of the population, is likely to have arisen earlier because in asexual reproduction, identical, copies of DNA are produced and variations do not occur. **1**

New traits come in the population due to sudden mutation and then are inherited. 70 % of the population with trait Y is likely to have been replicating that trait for a longer period, than 5 % of population with trait X. **1**

@PROCBSE

6. **(a)** downwards **1**

(b) Because BC is in the same direction as the direction of field lines. Force is minimum when the direction of current in the conductor is the same as that of the magnetic field. BC will not contribute as the force on this part of the coil will be cancelled by the force on DA. **1**

OR

(a) Relative closeness of field lines indicates the strength of magnetic field. Since, field lines are crowded around the ends of the solenoid, hence these are the regions of strongest magnetism. **1**

(b) The direction of the field will also be reversed. **1**

7. ● DDT being a non-biodegradable pesticide will enter the food chain from the first trophic level *i.e.*, Plankton. ½

● Non-biodegradable pesticides accumulate progressively at each trophic level. This phenomenon is known as biological magnification. **1**

● Hawk will have the highest level of pesticide. ½

OR

A will represent more energy transfer as compared to C and E. ½

B will represent more energy transfer as compared to D. ½

When green plants are eaten by primary consumers, a great amount of energy is lost as heat in to the environment, some amount goes into digestion and in doing work and the rest goes towards growth and reproduction. An average of 10% of the food eaten is made available for the next level of consumers. This loss of energy takes place at every trophic level. 1

(Alternatively accept- In accordance with 10% law of transfer of energy in a food chain, only 10% of energy available at one trophic level is transferred to the next trophic level.)

Section - B

8. **(a)** Silicon

Reason: Tetrahedral structure

OR

Tetravalency or four valeny and catenation

OR

Covalent bonding like carbon ½+½

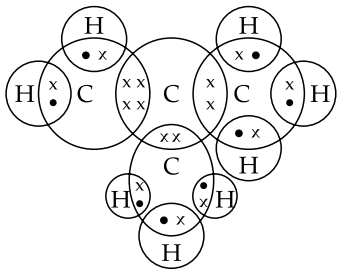
(b) Sodium

Reason: It has 1 valence electron like Lithium ½+½

(c) Sulphur

Reason: It forms oxides SO_2 and SO_3 ½+½

9. **(a)** **Five** **1½**



(b) C_4H_8 and C_5H_{10} are homologous ½

as they differ in

● "$-CH_2-$"

● differ in 14u molecular mass

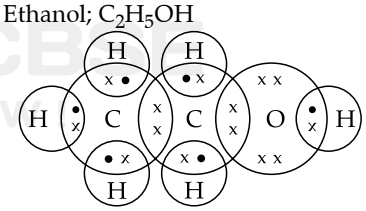
● Same functional group

● Same general formula ½+½

(Any two reasons)

OR

(a) Ethanol; C_2H_5OH **1+1**



ethanol

(b) CH_3OH and C_3H_7OH are homologous of ethanol. **1**

OR

CH_4O and C_3H_8O **1**

10. Round green: 30 ½+½

Wrinkled yellow: 30 ½+½

New combinations are produced because of the independent inheritance of seed shape and seed colour trait. **1**

11. **(a)** $E = P \times T$

So, $E = 3 \times 2 = 6$ kWh **1**

Cost of buying electricity from the main electricity board = 6 x 3.50 = ₹21.0

(b) To reduce the boiling time using the same mains supply, the rate of heat production should be large. We know that $P = V^2/R$. Since V is constant, R should be decreased. Since R is directly proportional to L so, length should be decreased. **2**

12. 5 ohm, 10 ohm and R_1 are in parallel connection

$$1/R_p = 1/5 + 1/10 + 1/R_1$$
$$1/R_p = (2+1)/10 + 1/R_1$$
$$= 3/10 + 1/R_1$$
$$1/R_p = (3R_1 + 10)/10R_1$$

@PROCBSE JOIN NOW

$R_p = 10R_1/(3R_1 + 10)$

Now, 6 ohm, 6 ohm and Rp are in series

Thus,

$R_{eq} = 12 + 10\,R_1/(3R_1 + 10)$ ....(i) **1**

$V = I\,R_{eq}$

From the circuit

$R_{eq} = 30/2 = 15\ \Omega$ ...(ii) 1

Equating (i) and (ii)

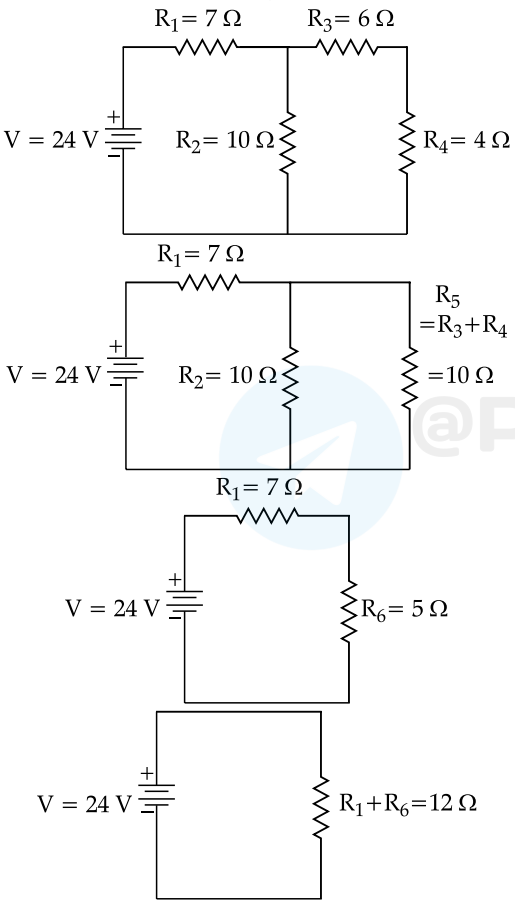
$12 + 10\,R_1/(3R_1 + 10) = 15$

$10R_1/(3R_1 + 10) = 3$

$10R_1 = (9R_1 + 30)$

Thus, $R_1 = 30$ ohm. **1**

OR



R_3 and R_4 are in series, hence the equivalent resistance of those two = $R_5 = R_3 + R_4 = 10$ ohm. ½

R_5 and R_2 are in parallel, Let R_6 be the equivalent resistance for them. Hence, $R_6 = (R_5R_2)/(R_5 + R_2) = 100/20 = 5$ ohm ½

Now R_1 and R_6 are in series and hence the final equivalent resistance of the entire circuit is $R = R_1 + R_6 = 12$ ohm. **1**

By Ohm's Law, we know that V = IR, hence I = V/R.

Hence the current in the circuit is 24/12 A = 2A **1**

13. **(a)** Gas A is Ozone. ½

Ozone at the higher levels of the atmosphere is a product of UV radiation acting on oxygen (O_2) molecule. The higher energy UV radiations split apart some molecular oxygen (O_2) into free oxygen (O) atoms. These atoms then combine with molecular oxygen to form ozone. **1**

$O_2 \xrightarrow{UV} O + O$

$O + O_2 \rightarrow O_3$

(b) Ozone shields the surface of the earth and protects living organisms from ultraviolet (UV) radiations released by the sun. ½

Chlorofluorocarbons (CFC's) which are used as refrigerants in fire extinguishers lead to depletion of ozone layer. ½+½

Section - C

14. **(a)** Tt **1**

(b) Both the recessive and dominant trait are passed on in F_1 progeny. Out of the two trait only one of them is able to express itself in the progeny, which is called the dominant (T), while the other one is called the recessive (t). Here, the 'tall' trait is the dominant one. **1**

(c) Out of 800 plants, 600 plants will be tall and 200 plants will be small.

1:2:1 (TT:Tt:tt) **1+1**

OR

In the cross between Tt X tt, 400 Tall (Tt) and 400 short (tt) plants will be produced. **1**

1:1(Tt:tt) **1**

15. **(a)** Sir is trying to demonstrate the principle of Electromagnetic induction. **1**

(b) There will be fluctuating induced current in the coil due to relative motion between the magnet and the coil. Accordingly the galvanometer needle will fluctuate on either side of 0 mark. Changing the magnetic field around the coil generates induced current. **1**

(c) Using a stronger magnet, or using a coil with more number of turns. **2**

OR

When the magnet moves into the coil, the galvanometer shows a momentary deflection towards one side, say left. ½

When the magnet moves out of the coil, the galvanometer shows a momentary deflection now towards right. ½

This is due to changing magnetic field /flux associated with the coil as the magnet moves in and out.

Alternatively, the flux increases when the magnet goes in and it decreases when the magnet goes out. **1**

■■■

@PROCBSE JOIN NOW

Solved Paper, 2021-22

SCIENCE

Term-I, Set-4

Series : JSK/2	Question Paper Code No. 031/2/4

Time allowed : 90 Minutes **Max. Marks : 40**

General Instructions :

*(i) This question paper contains **60** questions out of which **50** questions are to be attempted. All questions carry equal marks.*

(ii) The question paper consists three sections – Section A, B and C.

*(iii) **Section–A** consists of **24** questions. Attempt any **20** questions from **Q. No. 1 to 24**.*

*(iv) **Section–B** also consists of **24** questions. Attempt any **20** questions from **Q. No. 25 to 48**.*

*(v) **Section–C** consists of three Case Studies containing **12** questions and 4 questions in each case. Attempt any **10** from **Q. No. 49 to 60**.*

(vi) There is only one correct option for every Multiple Choice Question (MCQ). Marks will not be awarded for answering more than one option.

(vii) There is no negative marking.

SECTION-A

Section-A consists of 24 questions (Q. No. 1 to 24). Attempt any 20 questions from this section. The first attempted 20 questions would be evaluated.

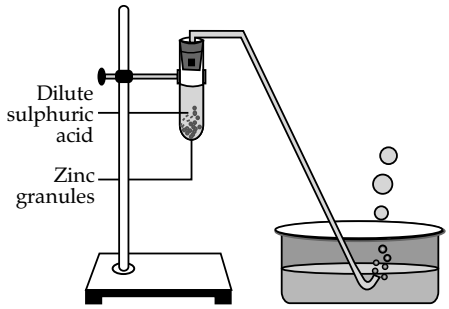
1. A student took sodium sulphate solution in a test tube and added barium chloride solution to it. He observed that an insoluble substance has formed. The colour and molecular formula of the insoluble substance is:

(a) Grey, Ba_2SO_4 **(b)** Yellow, $Ba(SO_4)_2$
(c) White, $BaSO_4$ **(d)** Pink, $BaSO_4$

2. Which of the following oxide(s) is/are soluble in water to form alkalies?

(i) Na_2O **(ii)** SO_2
(iii) K_2O **(iv)** NO_2
(a) (i) and (iii) **(b)** (i) only
(c) (ii) and (iv) **(d)** (iii) only

3. Study the diagram given below and identify the gas formed in the reaction.



(a) Carbon dioxide which extinguishes the burning candle.
(b) Oxygen due to which the candle burns more brightly.
(c) Sulphur dioxide which produces a suffocating smell.
(d) Hydrogen which while burning produces a popping sound.

4. Sodium reacts with water to form sodium hydroxide and hydrogen gas. The balanced equation which represents the above reaction is;

(a) $Na(s) + 2H_2O(\lambda) \rightarrow 2NaOH(aq) + 2H_2(g)$
(b) $2Na(s) + 2H_2O(\lambda) \rightarrow 2NaOH(aq) + H_2(g)$
(c) $2Na(s) + 2H_2O(\lambda) \rightarrow NaOH(aq) + 2H_2(g)$
(d) $2Na(s) + H_2O(\lambda) \rightarrow 2NaOH(aq) + 2H_2(g)$

5. Which of the options in the given table are correct?

Option	Natural Source	Acid Present
(i)	Orange	Oxalic acid
(ii)	Sour milk	Lactic acid
(iii)	Ant sting	Methanoic acid
(iv)	Tamarind	Acetic acid

(a) (i) and (ii) **(b)** (i) and (iv)
(c) (ii) and (iii) **(d)** (iii) and (iv)

6. $C_6H_{12}O_6(aq) + 6O_2(aq) \rightarrow 6CO_2(aq) + 6H_2O(\lambda)$
The above reaction is a/an

(a) displacement reaction
(b) endothermic reaction
(c) exothermic reaction
(d) neutralisation reaction

@PROCBSE
JOIN NOW
@PROCBSE

7. Which of the following statements about the reaction given below are correct?

$MnO_2 + 4HCl \rightarrow MnCl_2 + 2H_2O + Cl_2$

(i) HCl is oxidized to Cl_2
(ii) MnO_2 is reduced to $MnCl_2$
(iii) $MnCl_2$ acts as an oxidizing agent
(iv) HCl acts as on oxidizing agent

(a) (ii), (iii) and (iv) **(b)** (i), (ii) and (iii)
(c) (i) and (ii) only **(d)** (iii) and (iv) only

8. Select from the flowing the statement which is true for bases.

(a) Bases are bitter and turn blue litmus red.
(b) Bases have a pH less than 7.
(c) Bases are sour and change red litmus to blue.
(d) Bases turn pink when a drop of phenolphthalein is added to them.

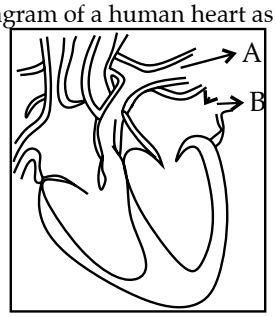
9. Study the following table and choose the correct option:

	Salt	Parent Acid	Parent Base	Nature of Salt
(a)	Sodium Chloride	HCl	NaOH	Basic
(b)	Sodium Carbonate	H_2CO_3	NaOH	Neutral
(c)	Sodium Sulphate	H_2SO_4	NaOH	Acidic
(d)	Sodium Acetate	CH_3COOH	NaOH	Basic

10. It is important to balance the chemical equations to satisfy the law of conservation of mass. Which of the following statements of the law is incorrect?

(a) The total mass of the elements present in the reactants is equal to the total mass of the elements present in the products.
(b) The number of atoms of each element reamains the same, before and after a chemical reaction.
(c) The chemical coomposition of the reactants is the same before and after the reaction.
(d) Mass can neither be created nor can it be destroyed in a chemical reaction.

11. Consider the following statements in connection with the functions of the blood vessels marked A and B in the diagram of a human heart as shown.



(i) Blood vessel A – It carries carbon dioxide rich blood to the lungs.
(ii) Blood vessel B – It carries oxygen rich blood from the lungs.
(iii) Blood vessel B – Left atrium relaxes as it receives blood from this blood vessel.
(iv) Blood vessel A – Right atrium has thick muscular wall as it has to pump blood to this blood vessel.

The correct statements are

(a) (i) and (ii) only **(b)** (ii) and (iii) only
(c) (ii), (iii) and (iv) **(d)** (i), (ii) and (iii)

12. In living organisms during respiration which of the following products are not formed if oxygen is not available?

(a) Carbon dioxide + Water
(b) Carbon dioxide + Alcohol
(c) Lactic acid + Alcohol
(d) Carbon dioxide + Lactic Acid

13. The correct statements with references to single celled organisms are

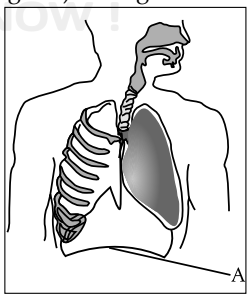
(i) Complex substances are not broken down into simpler substances.
(ii) Simple diffusion is sufficient to meet the requirements of exchange of gases.
(iii) Specialised tissues perform different functions in the organism.
(iv) Entire surface of the organism is in contact with the environment for taking in food.

(a) (i) and (iii) **(b)** (ii) and (iii)
(c) (ii) and (iv) **(d)** (i) and (iv)

14. Which one among the following is not removed as a waste product from the body of a plant?

(a) Resins and Gums **(b)** Urea
(c) Dry Leaves **(d)** Excess Water

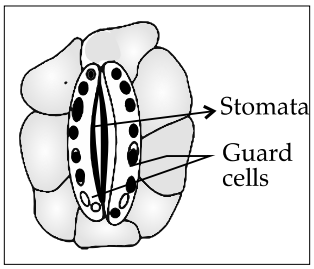
15. Which of the following statements are correct in reference to the role of A (shown in the given diagram) during a breathing cycle in human beings?



(i) It helps to decrease the residual volume of air in lungs.
(ii) It flattens as we inhale.
(iii) It gets raised as we inhale.
(iv) It helps the chest cavity to become larger.

(a) (ii) and (iv) **(b)** (iii) and (iv)
(c) (i) and (ii) **(d)** (i), (ii) and (iv)

16. Which one of the following conditions is true for the state of stomata of a green leaf shown in the given diagram?

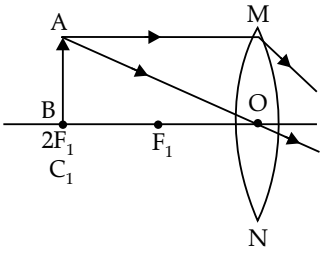


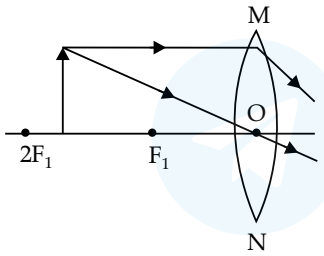
@PROCBSE

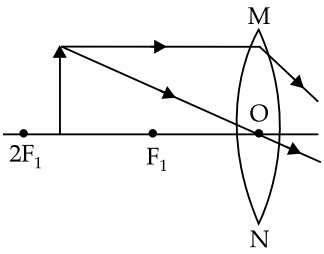
(a) Large amount of water flows into the guard cells.
(b) Gaseous exchange is occurring in large amount.
(c) Large amount of water flows out from the guard cells.
(d) Large amount of sugar collects in the guard cells.

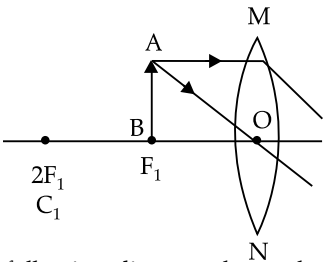
17. In which of the following is a concave mirror used?
(a) A solar cooker
(b) A rear view mirror in vehicles
(c) A safety mirror in shopping malls
(d) In viewing full size image of distant tall buildings

18. A student wants to obtain magnified image of an object *AB* as on a screen. Which one of the following arrangements shows the correct position of *AB* for him/her to be successful?

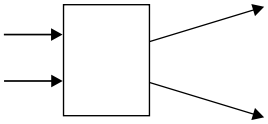
(a)


(b)


(c)


(d)


19. The following diagram shows the use of an optical device to perform an experiment of light. As per the arrangement shown, the optical device is likely to be a;

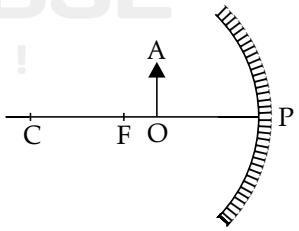


(a) Concave mirror
(b) Concave lens
(c) Convex mirror
(d) Convex lens

20. A ray of light starting from air passes through medium A of refractive index 1.50, enters medium B of refractive index 1.33 and finally enters medium C of refractive index 2.42. If this ray emerges out in air from C, then for which of the following pairs of media the bending of light is least?
(a) air-A **(b)** A-B
(c) B-C **(d)** C-air

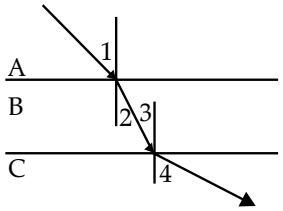
21. Which of the following statements is <u>not true</u> for scattering of light?
(a) Colour of the scattered light depends on the size of particles of the atmosphere.
(b) Red light is least scattered in the atmosphere.
(c) Scattering of light takes place as various colours of white light travel with different speed in air.
(d) The fine particles in the atmospheric air scatter the blue light more strongly than red. So the scattered blue light enters our eyes.

22. For the diagram shown, according to the new Cartesian sign convention the magnification of the image formed will have the following specifications:



(a) Sign – Positive, Value – Less than 1
(b) Sign – Positive, Value – More than 1
(c) Sign – Negative, Value – Less than 1
(d) Sign – Negative, Value – More than 1

23. A ray of light is incident as shown. If A, B and C are three different transparent media, then which among the following options is true for the given diagram?

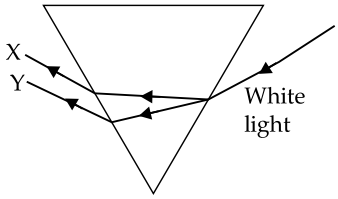


(a) $\angle 1 > \angle 4$ **(b)** $\angle 1 < \angle 2$
(c) $\angle 3 = \angle 2$ **(d)** $\angle 3 > \angle 4$

24. In the diagram given below, X and Y are the end colours of the spectrum of white light. The colour of 'Y' represents the

@PROCBSE JOIN NOW !

@PROCBSE



(a) Colour of sky as seen from earth during the day.
(b) Colour of the sky as seen from the moon.
(c) Colour used to paint the danger signals.
(d) Colour of sun at the time of noon.

SECTION-B

Section-B consists of 24 questions (Q. No. 25 to 48). Attempt any 20 questions from this section. The first attempted 20 questions would be evaluated.

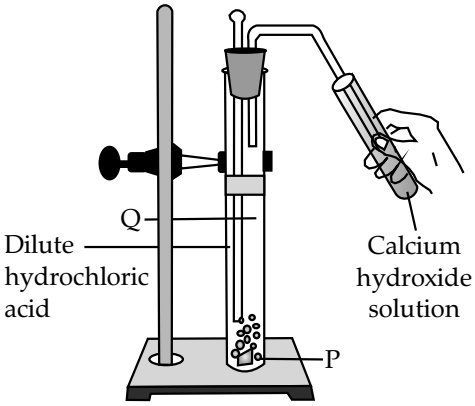
25. Which one of the following reactions is categorised as thermal decomposition reaction?
(a) $2H_2O(\lambda) \rightarrow 2H_2(g) + O_2(g)$
(b) $2AgBr(s) \rightarrow 2Ag(s) + Br_2(g)$
(c) $2AgCl(s) \rightarrow 2Ag(s) + Cl_2(g)$
(d) $CaCO_3(s) \rightarrow CaO(s) + CO_2(g)$

26. Consider the pH value of the following acidic samples:

S.No.	Sample	pH Value
1.	Lemon Juice	2.2
2.	Gastric Juice	1.2
3.	Vinegar	3.76
4.	Dil. Acetic acid	3.0

The decreasing order of their H^+ ion concentration is
(a) 3 > 4 > 1 > 2 **(b)** 2 > 1 > 3 > 4
(c) 2 > 1 > 4 > 3 **(d)** 3 > 4 > 2 > 1

27. Study the experimental set up shown in given figure and choose the correct option from the following:



	P	Q	Change observed in calcium hydroxide solution
(a)	K_2CO_3	Cl_2 gas	No change
(b)	$KHCO_3$	CO_2 gas	No change
(c)	$KHCO_3$	H_2 gas	Turns milky
(d)	K_2CO_3	CO_2 gas	Turns milky

28. Which one of the following structures correctly depicts the compound $CaCl_2$?
(a) $Ca^{2+}\left[\cdot\!\underset{\times}{\underset{\cdot}{Cl}}\!\cdot\right]^{2-}$ **(b)** $\left[\times\!\underset{\times}{\overset{\times}{Ca}}\!\times\right]^{2+}\left[\cdot\!\underset{\times}{\underset{\cdot}{Cl}}\!\cdot\right]_2$
(c) $Ca^{2+}\left[\cdot\!\underset{\times}{\underset{\cdot}{Cl}}\!\cdot\right]_2$ **(d)** $\left[\times\!\underset{\times}{\overset{\times}{Ca}}\!\times\right]^{2+}\left[\cdot\!\underset{\times}{\underset{\cdot}{Cl}}\!\cdot\right]_2^-$

29. The pair(s) which will show displacement reaction is/ are
(i) NaCl solution and copper metal
(ii) $AgNO_3$ solution and copper metal
(iii) $Al_2(SO_4)_3$ solution and magensium metal
(iv) $ZnSO_4$ solution and iron metal
(a) (ii) only **(b)** (ii) and (iii)
(c) (iii) and (iv) **(d)** (i) and (ii)

30. Which of the following salts do not have the water of crystallisation?
(i) Bleaching Powder **(ii)** Plaster of Paris
(iii) Washing soda **(iv)** Baking soda
(a) (ii) and (iv) **(b)** (i) and (iii)
(c) (ii) and (iii) **(d)** (i) and (iv)

Question No. 31-35 consists of two statements – Assertion (A) and Reason (R). Answer these questions selecting the appropriate option given below:
(a) Both (A) and (R) are true and (R) is the correct explanation of (A).
(b) Both (A) and (R) are true but (R) is not the correct explanation of (A).
(c) (A) is true but (R) is false.
(d) (A) is false but (R) is true.

31. **Assertion (A) :** Sodium hydrogen carbonate is used as an ingredient in antacids.
Reason (R) : $NaHCO_3$ is a mild non-corrosive basic salt.

32. **Assertion (A) :** Burning of natural gas is an endothermic process.
Reason (R) : Methane gas combines with oxygen to produce carbon dioxide and water.

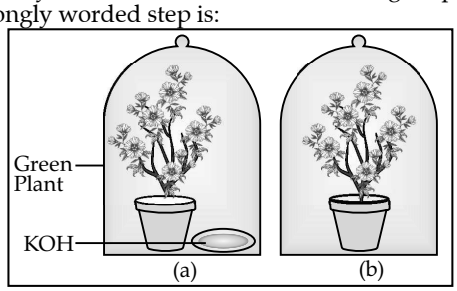
33. **Assertion (A) :** Nitrogen is an essential element for plant growth and is taken up by plants in the form of inorganic nitrates or nitrites.
Reason (R) : The soil is the nearest and richest source of raw materials like Nitrogen, Phosphorus and other minerals for the plants.

@PROCBSE

34. **Assertion (A) :** Sun appears reddish at the time of Sunrise and Sunset.
Reason (R) : Distance travelled by sunlight in the atmosphere is lesser during sunrise and sunset as compared to noon.

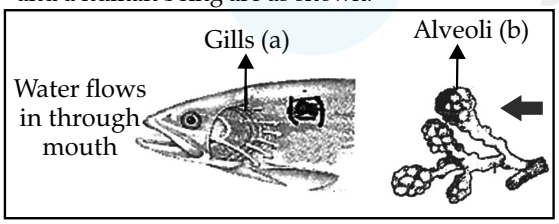
35. **Assertion (A) :** Hydrochloric acid helps in the digestion of food in the stomach.
Reason (R) : Hydrochloric acid creates an acidic medium to activate protein digesting enzymes.

36. A student was asked to write a stepwise procedure to demonstrate that carbon dioxide is necessary for photosynthesis. He wrote the following steps. The wrongly worded step is:



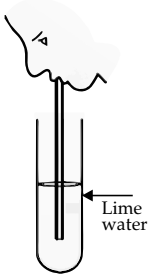
(a) Both potted plants are kept in dark room for at least three days.
(b) Bottom of the bell jars is sealed to make them air tight.
(c) Both potted plants are kept in sunlight after the starch test.
(d) A leaf from both the plants is taken to test the presence of starch.

37. Respiratory structures of two different animals-a fish and a human being are as shown.



Observe (a) and (b) and select one characteristic that holds true for both of them.
(a) Both are placed internally in the body of animal.
(b) Both have thin and moist surface for gaseous exchange.
(c) Both are poorly supplied with blood vessels to conserve energy.
(d) In both the blood returns to the heart after being oxygenated.

38. Observe the diagram of an activity given below. What does it help to conclude, when the person exhales into the test-tube?



(a) Percentage of carbon dioxide is more in inhaled air.
(b) Fermentation occurs in the presence of oxygen.
(c) Percentage of carbon dioxide is more in the exhaled air.
(d) Fermentation occurs in the presence of carbon dioxide.

39. If a lens can converge the sun rays at a point 20 cm, away from its optical centre, the power of this lens is
(a) +2D **(b)** –2D
(c) +5D **(d)** –5D

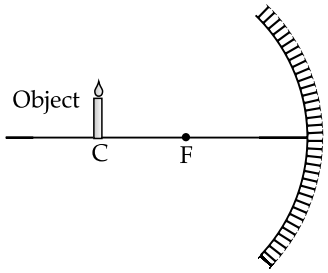
40. The radius of curvature of a converging mirror is 30 cm. At what distance from the mirror should an object be placed as to obtain a virtual image?
(a) Infinity
(b) 30 cm
(c) Between 15 cm and 30 cm
(d) Between 0 cm and 15 cm

41. The length of small intestine in a deer is more as compared to the length of small intestine of a tiger. The reason for this is
(a) Mode of intake of food.
(b) Type of food consumed.
(c) Presence or absence of villi in intestines.
(d) Presence or absence of digestive enzymes.

42. Identify the two components of phloem tissue that help in transportation of food in plants.
(a) Phloem parenchyma & sieve tubes
(b) Sieve tubes & companion cells
(c) Phloem parenchyma & companion cells
(d) Phloem fibres and sieve tubes

43. A converging lens forms a three times magnified image of an object, which can be take on a screen. If the focal length of the lens is 30 cm, then the distance of the object from the lens is:
(a) –55 cm **(b)** –50 cm
(c) –45 cm **(d)** –40 cm

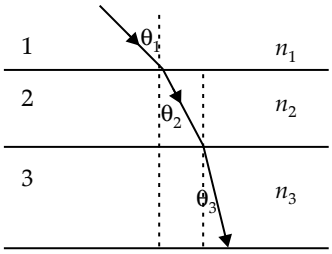
44. Which of the following statements is <u>not</u> true in reference to the diagram shown above?



(a) Image formed is real.
(b) Image formed is enlarged.
(c) Image is formed at a distance equal to double the focal length.
(d) Image formed is inverted.

@PROCBSE JOIN NOW
@PROCBSE

45. In the diagram shown above n_1, n_2 and n_3 are refractive indices of the media 1, 2 and 3 respectively. Which one of the following is true in this case?



(a) $n_1 = n_2$ **(b)** $n_1 > n_2$

(c) $n_2 > n_3$ **(d)** $n_3 > n_1$

46. The refractive index of medium A is 1.5 and that of medium B is 1.33. If the speed of light in air is 3×10^8 m/s, what is the speed of light in medium A and B respectively?

(a) 2×10^8 m/s and 1.33×10^8 m/s

(b) 1.33×10^8 m/s and 2×10^8 m/s

(c) 2.25×10^8 m/s and 2×10^8 m/s

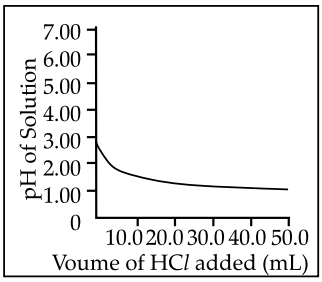
(d) 2×10^8 m/s and 2.25×10^8 m/s

47. An object of height 4 cm is kept at a distance of 30 cm from the pole of a diverging mirror. If the focal length of the mirror is 10 cm, the height of the image formed is

(a) +3.0 cm **(b)** +2.5 cm

(c) +1.0 cm **(d)** +0.75 cm

48. 50.0 mL of tap water was taken in a beaker. Hydrochloric acid was added drop by drop to water. The temperature and pH of the solution was noted. The following graph was obtained. Choose the correction statements related to this activity.



(i) The process of dissolving an acid in water is highly endothermic.

(ii) The pH of the solution increases rapidly on addition of acid.

(iii) The pH of the solution decreases rapidly on addition of acid.

(iv) The pH of tap water was around 7.0

(a) (i) and (ii) **(b)** (i) and (iii)

(c) (iii) and (iv) **(d)** (ii) and (iv)

SECTION-C

Section-C consists of three cases followed by questions. There are a total of 12 questions (Q. No. 49 to 60) in this section. Attempt any 10 questions from this section. The first attempted 10 questions would be evaluated.

Case-I : A student, took four metals P, Q, R and S and carried out different experiments to study the properties of metals. Some of the observations were :

- All metals could not be cut with knife except metal R.
- Metal P combined with oxygen to form an oxide M_2O_3 which reacted with both acids and bases.
- Reaction with water.

  P – Did not react either with cold or hot water but reacted with steam

  Q – Reacted with hot water and the metal started floating

  R – Reaction violently with cold water.

  S – Did not react with water at all.

Based on the above observations answer the following:

49. Out of the given metals, the one which needs to be stored using kerosene is

(a) P **(b)** R

(c) S **(d)** Q

50. Out of the given metals, the metal Q is

(a) Iron **(b)** Zinc

(c) Potassium **(d)** Magnesium

51. Metal which forms amphoteric oxides is

(a) P **(b)** Q

(c) R **(d)** S

52. The increasing order of the reactivity of the four metals is

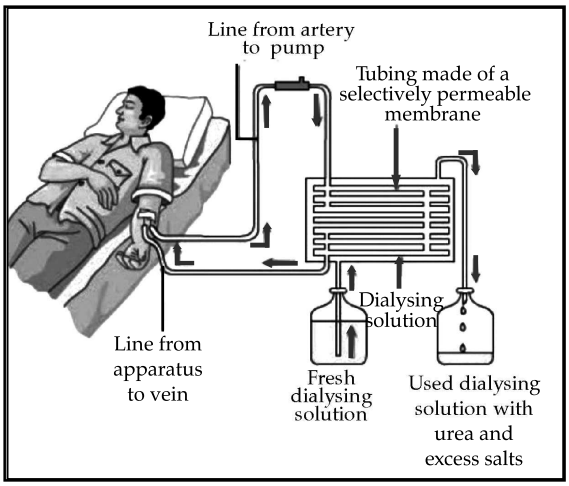
(a) P < Q < R < S **(b)** S < R < Q < P

(c) S < P < Q < R **(d)** P < R < Q < S

Case-II : The figure shown below represents a common type of dialysis called as Haemodialysis. It removes waste products from the blood, such as excess salts, and urea which are insufficiently removed by the kidney in patients with kidney failure. During the procedure, the patient's blood is cleaned by filtration through a series of semi-permeable membranes before being returned to the blood of the patients. On the basis of this, answer the following questions:

@PROCBSE JOIN NOW

@PROCBSE



53. The haemodialyser has semi-permeable lining of tubes which help to:

(a) To maintain osmotic pressure of blood.

(b) To filter nitrogenous wastes from the dialysing solution.

(c) In passing the waste products in the dialysing solution.

(d) To pump purified blood back into the body of the patient.

54. Which one of the following is not a function of Artificial Kidney?

(a) To remove nitrogeneous wastes from the blood.

(b) To remove excess fluids from the blood.

(c) To reabsorb essential nutrients from the blood.

(d) To filter and purify the blood.

55. The 'used dialysing' solution is rich in;

(a) Urea and excess salts

(b) Blood cells

(c) Lymph

(d) Proteins

56. Which part of the nephron in human kidney, serves the function of reabsorption of certain substances?

(a) Glomerulus

(b) Bowmans Capsule

(c) Tubules

(d) Collecting duct

Case III : A compound microscope is an instrument which consists of two lenses L_1 and L_2. The lens L_1 called objective, forms a real, inverted and magnified image of the given object. This serves as the object for the second lens L_2; the eye piece. The eye piece functions like a simple microscope or magnifier. It produces the final image, which is inverted with respect to the original object, enlarged and virtual.

57. What types of lenses must be L_1 and L_2?

(a) Both concave

(b) Both convex

(c) L_1 – concave and L_2 – convex

(d) L_1 – convex and L_2 – concave

58. What is the value and sign of magnification (according to the new Cartesian sign convention) of the image formed by L_1?

(a) Value = Less than 1 and Sign = Positive

(b) Value = More than 1 and Sign = Positive

(c) Value = Less than 1 and Sign = Negative

(d) Value = More than 1 and Sign = Negative

59. What is the value and sign of magnification (according to the new Cartesian sign convention) of the image formed by L_2?

(a) Value = Less than 1 and Sign = Positive

(b) Value = More than 1 and Sign = Positive

(c) Value = Less than 1 and Sign = Negative

(d) Value = More than 1 and Sign = Negative

60. If power of the eyepiece (L_2) is 5 diopters and it forms an image at a distance of 80 cm from its optical centre, at what distance should the object be?

(a) 12 cm

(b) 16 cm

(c) 18 cm

(d) 20 cm

❑❑❑

SOLUTIONS

SECTION-A

1. **(c)** White, $BaSO_4$

Explanation: On adding a solution of barium chloride to sodium sulphate solution, a white colour precipitate of barium sulphate is formed along with the formation of sodium chloride salt. The chemical reaction is as follows:

$$\underset{\text{Barium chloride}}{BaCl_2(aq)} + \underset{\text{Sodium sulphate}}{Na_2SO_4(aq)} \longrightarrow \underset{\text{Barium sulphate}}{BaSO_4(s)\downarrow} + \underset{\text{Sodium chloride}}{2NaCl(aq)}$$

2. **(a)** (i) and (iii)

Explanation: Most of the metal oxides are insoluble in water but sodium oxide (Na_2O) and potassium oxide (K_2O) dissolve in water to form alkalies. On the other hand, most non-metallic oxides dissolve in water to form acids.

3. **(d)** Hydrogen which while burning produces a popping sound.

@PROCBSE JOIN NOW

@PROCBSE

Explanation: Zinc reacts with dilute sulphuric acid to form zinc sulphate and hydrogen gas. When a burning candle is brought near the hydrogen gas, it burns with a pop sound which confirms the presence of hydrogen gas.

$$Zn + H_2SO_4 \rightarrow ZnSO_4 + H_2\uparrow$$

4. **(b)** $2Na(s) + 2H_2O(l) \rightarrow 2NaOH(aq) + H_2(g)$

Explanation: Sodium reacts with water to form sodium hydroxide solution and hydrogen gas. The balanced chemical equation for the given reaction is represented as:

$$2Na(s) + 2H_2O(l) \rightarrow 2NaOH(aq) + H_2(g)$$

5. **(c)** (ii) and (iii)

Explanation: Lactic acid is present in sour milk and methanoic acid is present in ant sting.

6. **(c)** exothermic reaction

Explanation: The given reaction is an example of respiration. During respiration, energy is being released. Therefore, it is an exothermic reaction.

7. **(c)** (i) and (ii) only

Explanation: In this reaction, MnO_2 is losing oxygen to form $MnCl_2$, so manganese dioxide (MnO_2) is being reduced to manganese dichloride ($MnCl_2$). On the other hand, HCl is losing hydrogen to form Cl_2, so hydrochloric acid (HCl) is being oxidised to chlorine (Cl_2).
Therefore, manganese dioxide (MnO_2) is the oxidising agent while hydrochloric acid (HCl) is the reducing agent.

8. **(d)** Bases turn pink when a drop of phenolphthalein is added to them.

Explanation: Phenolphthalein changes color from colourless to pink in basic solution. Rest all are the properties of acids.

9. **(d)** **Salt :** Sodium Acetate, **Parent acid :** CH_3COOH, **Parent Base :** NaOH, **Nature of salt: Basic.**

Explanation: A basic salt is made up of combination of a weak acid and a strong base. Since, sodium acetate is made up of weak acid (acetic acid) and a strong base (NaOH), it is basic in nature.

10. **(c)** The chemical composition of the reactants is the same before and after the reaction.

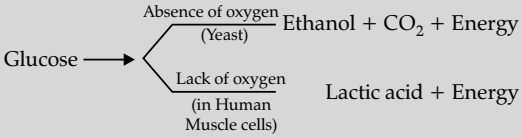
Explanation: During a chemical reaction, wen atoms or molecules of reactants collide to form new bonds and break old bonds the reacting atoms rearrange themselves to form the product. As a result, the chemical composition of the reactants gets modified after the reaction. Hence, this is the incorrect statement.

11. **(d)** (i), (ii) and (iii)

Explanation: Blood vessel A is the pulmonary artery and blood vessel B is a pulmonary vein. The pulmonary vein carries oxygenated blood from the lungs to the left atrium that relaxes to receive the blood from this blood vessel.
The pulmonary artery carries deoxygenated blood from the right ventricle of the heart to the lungs.

12. **(a)** Carbon dioxide + water

Explanation: During respiration, under anaerobic conditions, carbon dioxide and water is not formed. Water is produced only under aerobic conditions *i.e.*, presence of oxygen.



13. **(c)** (ii) and (iv)

Explanation: In single celled organisms like *Amoeba*, the complex food substances are broken down into simpler substances by the process of digestion that takes place inside the food vacuole. Simple diffusion is sufficient to meet the requirement of the exchange of gases. Specialised tissues are not formed because the tissue is formed by a group of cells, not a single cell. The entire surface of the organism is in direct contact with the environment so that they can capture their food.

14. **(b)** Urea

Explanation: Urea is not formed in the plants. The excretory products that are produced by the plants are resins, gums, latex, dry leaves and excess water.

15. **(a)** (ii) and (iv)

Explanation: The diaphragm contracts and flattens during inhalation to increase the chest cavity. It gets raised and relaxed during the exhalation to push out the air from the lungs.

16. **(c)** Large amount of water flows out from the guard cells.

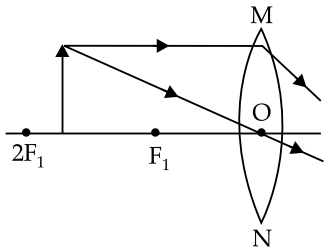
Explanation: The given diagram represents closed stomatal pores. The stomatal pores close when a large amount of water flows out of the guard cells due to environmental stress such as high temperature.

@PROCBSE

17. **(a)** A solar cooker

Explanation: A concave mirror is used in the solar cooker as concave mirrors absorb the entire incident light and reflect it to a single focal point. This reflected light is very powerful because it carries a lot of thermal energy.

18. **(c)**



Explanation: The students want to obtain a magnified image on the screen then the position of the object should be between F and 2F because only real image can be formed on the screen.

19. **(b)** Concave lens

Explanation: In the given diagram, rays are diverging from the optical device. Thus, it is a concave lens, which is also known as diverging lens.

20. **(b)** A-B

Explanation: The difference of refractive index is minimum when the ray of light travels from medium A to medium B. Thus, the change in speed of light is minimum for A-B interface and therefore, the bending of light is least for A-B interface.

21. **(c)** Scattering of light takes place as various colours of white light travel with different speed in air.

Explanation: When a white light enters the atmosphere, it is scattered by small particles present in the atmosphere according to their wavelengths. As the red light has the highest wavelength among all the colours in the visible light, it is scattered the least but blue light scatters the most.

22. **(b)** Sign- Positive, Value- More than 1

Explanation: In the given figure, object OA is placed in front of a concave mirror between pole and focus. Thus, a virtual, erect and enlarged image will form behind the mirror. Therefore, magnification is positive and its value should be more than 1.

23. **(c)** $\angle 3 = \angle 2$

Explanation: From the given diagram, $\angle 1 > \angle 2$, $\angle 4 > \angle 3$ and $\angle 1 = \angle 4$
From the geometry of the figure, the two normals are parallel to each other and $\angle 2$ and $\angle 3$ are alternate interior angles.
Therefore, $\angle 3 = \angle 2$

24. **(c)** Colour used to paint the danger signals.

Explanation: When white light is incident on a prism, it splits into seven colours. The red light bends the least while the violet bends the most. Thus, in the given diagram, Y represents red colour used to paint the danger signals.

SECTION-B

25. **(d)** $CaCO_3(s) \rightarrow CaO(s) + CO_2(g)$

Explanation: Decomposition of calcium carbonate ($CaCO_3$) is an example of thermal decomposition reaction because in this reaction, a single reactant decomposes into multiple products by the action of heat.

26. **(c)** 2 > 1 > 4 > 3

Explanation: The decreasing order of H^+ ion concentration is 2 > 1 > 4 > 3. It is because, more is the concentration of H^+ ions, lesser is the value of pH.

27. **(d)** P – K_2CO_3, Q – CO_2 gas, Change observed in calcium hydroxide solution – Turns milky.

Explanation: Metal carbonates or metal hydrogen carbonate upon reaction with acid lead to the formation of salt, water and carbon dioxide. The carbon dioxide gas thus produced turns the lime water milky. Therefore, P is K_2CO_3, Q is CO_2 gas, and the calcium hydroxide solution *i.e.* lime water turns milky.

28. **(d)** $\left[\times\underset{\times\times\times}{\overset{\times\times\times}{\times Ca\times}}\right]^{2+}\ \left[\times\underset{\bullet\bullet\bullet}{\overset{\bullet\bullet\bullet}{Cl}}\bullet\right]^{-}_{2}$

Explanation: Calcium with electronic configuration 2, 8, 8, 2 loses two electrons to form Ca^{2+} ion and attains noble gas configuration whereas, chlorine with electronic configuration 2, 8, 7 gains one electron to form Cl^- ion. Therefore, two electrons lost by calcium are gained by two chlorine atoms to form $CaCl_2$.
Thus, the correct structure for calcium chloride is : $\left[\times\underset{\times\times\times}{\overset{\times\times\times}{\times Ca\times}}\right]^{2+}\ \left[\times\underset{\bullet\bullet\bullet}{\overset{\bullet\bullet\bullet}{Cl}}\bullet\right]^{-}_{2}$

@PROCBSE JOIN NOW !

@PROCBSE

29. **(b)** (ii) and (iii)

Explanation: A displacement reaction is a chemical reaction in which a more reactive element displaces a less reactive element from its compound. Since, Cu is more reactive than Ag; it can displace Ag from its nitrate solution and show a displacement reaction.

$AgNO_3(aq) + Cu(s) \rightarrow Cu(NO_3)_2(aq) + 2Ag(s)$

Similarly, magnesium being more reactive than aluminium displaces it from its sulphate solution.

$Al_2(SO_4)_3(aq) + 3Mg(s) \rightarrow 3MgSO_4(aq) + 2Al(s)$

30. **(d)** (i) and (iv)

Explanation: The chemical formula of the given salts are :

Bleaching powder: $CaOCl_2$

Plaster of Paris: $CaSO_4.½H_2O$

Washing soda: $Na_2CO_3.10H_2O$

Baking soda: $NaHCO_3$

Therefore, bleaching powder and baking soda do not have the water of crystallisation.

31. **(b)** Both (A) and (R) are true but (R) is not the correct explanation of (A).

Explanation: Sodium hydrogen carbonate ($NaHCO_3$) is used as an ingredient in antacids because being alkaline, it neutralises excess acid in the stomach and provides relief. It is a mild, non corrosive salt.

32. **(d)** (A) is false, but (R) is true.

Explanation: Burning of natural gas is an exothermic process as heat is evolved in the process. Burning of methane gas leads to the production of carbon dioxide, water and heat.

33. **(b)** Both (A) and (R) are true but (R) is not the correct explanation of (A).

Explanation: Nitrogen is an essential element for plant growth but it cannot fix atmospheric nitrogen directly. Thus, is taken up by plants in the form of inorganic nitrates or nitrites, or ammonia. Soil is composed of minerals such as nitrogen, phosphorous and potassium.

34. **(c)** (A) is true, but (R) is false.

Explanation: The Sun appears reddish at the time of sunrise or sunset because light from the Sun near the horizon passes through thicker layers of air and larger distance in the earth's atmosphere before reaching our eyes. The distance covered by sunlight is larger in the case of sunrise and sunset where it is lesser during noon.

35. **(a)** Both (A) and (R) are true and (R) is the correct explanation of (A).

Explanation: The gastric glands present in the wall of the stomach release hydrochloric acid, pepsinogen and mucus. Hydrochloric acid provides the acidic medium for the activation of pepsinogen into pepsin.

36. **(c)** Both potted plants are kept in sunlight after the starch test.

Explanation: The given experiment is performed to test the role of carbon dioxide in photosynthesis. In fig. (a) KOH is used to absorb carbon dioxide. The steps are as follows:

(i) Two healthy potted plants are taken and kept in dark for three days so that all starch produced is consumed.

(ii) The potted plants are then kept in airtight situation inside the bell jars to prevent further entry of carbon dioxide into it.

(iii) Then the plants are kept in sunlight for two hours before the starch test so that plant can undergo photosynthesis and produce new starch.

(iv) A leaf was plucked from each plant to carry the starch detection test.

37. **(b)** Both have thin and moist surface for gaseous exchange.

Explanation: Both the structures, gills and alveoli have thin and moist surface which help in the easy diffusion of respiratory gases. Gills are located externally beneath the operculum of a fish while alveoli are located internally in the lungs of humans. Both are richly supplied with blood to facilitate exchange of gases.

In the case of humans, the blood returns to the heart after it becomes oxygenated while in case of fish, they have single circulation so blood does not enter the heart after being oxygenated.

38. **(c)** Percentage of carbon dioxide is more in the exhaled air.

Explanation: When we blow through a pipe, the exhaled air contains more percentage of carbon dioxide, which turns the lime water milky. So, the given test confirms the presence of high percentage of carbon dioxide in the exhaled air.

39. **(c)** + 5 D

Explanation: Focal length of the converging lens (convex lens), $f = +20$ cm $= 0.20$ m

Power of the lens is given as:

$$P = \frac{1}{f}$$

Or $$P = \frac{1}{0.20} = +5\ \text{D}$$

40. **(d)** Between 0 cm and 15 cm

Explanation: Radius of curvature of converging mirror = 30 cm

To obtain virtual image, in case of concave mirror (converging mirror), object should be between pole and focus.

@PROCBSE

Using Focal length, $f = \frac{\text{Radius of curvature}}{2}$

Or $f = \frac{30}{2} = 15$ cm

Therefore, the object should be placed between 0 cm and 15 cm.

41. **(b)** Type of food consumed.

Explanation: Herbivores like deer consume plants that contain cellulose. Hence, they need a longer small intestine to allow the cellulose to be digested. Carnivores like tiger eat meat. Since, meat is easier to digest as compared to cellulose; hence, they have a shorter small intestine compared to length of small intestine of deer (herbivores).

42. **(b)** Sieve tubes & companion cells

Explanation: The translocation of food and other substances takes place in the sieve tubes with the help of adjacent companion cells both in upward and downward directions. Phloem parenchyma helps in food storage and phloem fiber gives strength to the plant.

43. **(d)** –40 cm

Explanation: Magnification of convex lens, $m = -3$

Focal length, $f = 30$ cm

Object distance, $u = ?$

As we know, magnification, $m = \frac{v}{u} = -3$

Or $v = -3u$

$$\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$$

$$\frac{1}{-3u} - \frac{1}{u} = \frac{1}{30}$$

$$-\frac{4}{3} \times \frac{1}{u} = \frac{1}{30}$$

$$u = -40 \text{ cm}$$

44. **(c)** Image is formed at a distance equal to double the focal length.

Explanation: Since, the candle is at the centre of curvature of the concave lens, the image will form at the centre of curvature of the mirror itself. Hence, the image formed will be real, inverted and of same size as that of the candle.

45. **(d)** $n_3 > n_1$

Explanation: When the light enters from optically rarer to optically denser medium, it bends towards the normal. While travelling from n_1 to n_2, light bends towards the normal, so $n_2 > n_1$.

Similarly, $n_3 > n_2$

Therefore, $n_3 > n_1$

46. **(d)** 2×10^8 m/s and 2.25×10^8 m/s

Explanation: Speed of light in air, $c = 3 \times 10^8$ m/s

Let the speed of light in medium A and B be v_A and v_B respectively.

Speed of light in a medium of refractive index n is given by :

$$v = \frac{c}{n}$$

Thus, $v_A = 3 \times \frac{10^8}{1.5} = 2 \times 10^8$ m/s

Now, $v_B = 3 \times \frac{10^8}{1.33} = 2.25 \times 10^8$ m/s

47. **(c)** +1.0 cm

Explanation: Height of the object, $h = 4$ cm

Object distance, $u = -30$ cm

Focal length, $f = 10$ cm (for diverging mirror)

Using mirror formula,

$$\frac{1}{v} + \frac{1}{u} = \frac{1}{f}$$

$$\frac{u}{v} = \frac{u}{f} - 1$$

$$\frac{u}{v} = \left(-\frac{30}{10}\right) - 1 = -4$$

$$\text{Magnification, } m = \frac{\text{Image height}}{\text{Object height}} = \frac{hi}{ho}$$

$$= \frac{(-v)}{u} = \frac{1}{4}$$

$$\text{Image height (hi)} = \frac{h}{4} = \frac{4}{4} = +1 \text{ cm}$$

48. **(c)** (iii) and (iv)

Explanation: Based on the given graph, the pH of the solution decreases as the volume of the added HCl increases. This means, more is the concentration of the acid, less is the pH of the solution. Also, the pH of tap water is around 7.0.

@PROCBSE

SECTION-C

49. **(b)** R

Explanation: Metal R is sodium that can be cut by knife and needs to be stored under kerosene because it reacts violently with cold water.

50. **(d)** Magnesium

Explanation: Metal Q is magnesium as magnesium reacts with hot water to form magnesium hydroxide and hydrogen. It also starts floating due to the bubbles of hydrogen gas sticking to its surface.

51. **(a)** P

Explanation: Metal P forms an oxide M_2O_3, which show both acidic as well as basic behaviour. Such metal oxides, which react with both acids as well as bases to produce salts and water, are known as amphoteric oxides.

52. **(c)** S < P < Q < R

Explanation: Since, metal S did not react with water, it is the least reactive metal. Metal P is more reactive than S as it did not react either with cold or hot water but reacted with steam. Metal Q is more reactive than P because it reacted with hot water. Metal R is the most reactive metal as it reacted violently with cold water. Therefore, the order of reactivity of metals is S < P < Q < R.

53. **(c)** In passing the waste products in the dialysing solution.

Explanation: Haemodialyser helps in the passing of nitrogenous waste products such as urea in the dialysing solution. During this passage, the waste products from the blood pass into the dialysing fluid through diffusion and the purified blood is pumped back into the patient.

54. **(c)** To reabsorb essential nutrient from the blood.

Explanation: The artificial kidney is similar to normal kidney except the process of reabsorption of essential nutrients from the blood which does not occur in it.

55. **(a)** Urea and excess salts

Explanation: In artificial kidney, the used dialysing solution is rich in nitrogenous wastes like urea and excess salts. Blood cells, proteins and lymph are not removed during dialysis.

56. **(c)** Tubules

Explanation: The selective reabsorption of certain substances like sodium ion, potassium ion, glucose, salts and major amount of water occurs in the tubules of the nephron in the human kidney.

57. **(b)** Both convex

Explanation: Both the images formed by lens L_1 and L_2 are magnified, but the concave lens always form diminished image. Thus, both the lenses L_1 and L_2 are convex lens.

58. **(d)** Value = More than 1 and Sign = Negative

Explanation: Image formed by L_1 is real, inverted and magnified. Thus, its magnification is negative and more than 1.

59. **(b)** Value = More than 1 and Sign = Positive

Explanation: Image formed by L_2 is virtual and enlarged. Thus, its magnification should be positive and more than 1.

60. **(b)** 16 cm

Explanation: Power of the lens, L_2, P = 5 D

Focal length of lens, $f = \frac{1}{P}$

or $f = \frac{1}{5} = 0.2$ m or 20 cm

Image distance, $v = -80$ cm

Object distance, u = ?

$$\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$$

$$\left(\frac{1}{-80}\right) - \frac{1}{u} = \frac{1}{20}$$

$$\frac{1}{u} = \frac{1}{(-80)} - \frac{1}{20}$$

$$u = -16 \text{ cm}$$

Hence, distance of object from optical centre is 16 cm on the same side.

❑❑❑

@PROCBSE JOIN NOW !

@PROCBSE

Term – I

OMR SHEET

Booklet Series: **A**

Use English Numbers / Letters only. Use Blue / Black Ball Point Pen to write in box.

Booklet Series: Ⓐ Ⓑ Ⓒ Ⓓ

Roll Number: 0 1 2 3 4 5 6 7 8 9

Subject

Name

Test Date

Invigilator's Signature

Certified that all the entries in this section have been properly filled by the student

Student's Signature

Proper Marking

The OMR Sheet will be computer checked Fill the circles completely and dark enough for proper detection, Use ballpen (black or blue) for marking.

Ⓐ Ⓑ ● Ⓓ

Avoid Improper Marking

Partially Filled

Lightly Filled

Test Center Code: 0 1 2 3 4 5 6 7 8 9

IMPORTANT

The candidate should check that the Test Book Series printed on the OMR Sheet is the same as printed on the Test Booklet. In case of discrepancy, the candidate should immediately report the matter to the invigilator for replacement of both the Test Booklet and the Answer Sheet.

Darken the circle for each question.

Q.No.	Response	Q.No.	Response	Q.No.	Response	Q.No.	Response
01	Ⓐ Ⓑ Ⓒ Ⓓ	16	Ⓐ Ⓑ Ⓒ Ⓓ	31	Ⓐ Ⓑ Ⓒ Ⓓ	46	Ⓐ Ⓑ Ⓒ Ⓓ
02	Ⓐ Ⓑ Ⓒ Ⓓ	17	Ⓐ Ⓑ Ⓒ Ⓓ	32	Ⓐ Ⓑ Ⓒ Ⓓ	47	Ⓐ Ⓑ Ⓒ Ⓓ
03	Ⓐ Ⓑ Ⓒ Ⓓ	18	Ⓐ Ⓑ Ⓒ Ⓓ	33	Ⓐ Ⓑ Ⓒ Ⓓ	48	Ⓐ Ⓑ Ⓒ Ⓓ
04	Ⓐ Ⓑ Ⓒ Ⓓ	19	Ⓐ Ⓑ Ⓒ Ⓓ	34	Ⓐ Ⓑ Ⓒ Ⓓ	49	Ⓐ Ⓑ Ⓒ Ⓓ
05	Ⓐ Ⓑ Ⓒ Ⓓ	20	Ⓐ Ⓑ Ⓒ Ⓓ	35	Ⓐ Ⓑ Ⓒ Ⓓ	50	Ⓐ Ⓑ Ⓒ Ⓓ
06	Ⓐ Ⓑ Ⓒ Ⓓ	21	Ⓐ Ⓑ Ⓒ Ⓓ	36	Ⓐ Ⓑ Ⓒ Ⓓ	51	Ⓐ Ⓑ Ⓒ Ⓓ
07	Ⓐ Ⓑ Ⓒ Ⓓ	22	Ⓐ Ⓑ Ⓒ Ⓓ	37	Ⓐ Ⓑ Ⓒ Ⓓ	52	Ⓐ Ⓑ Ⓒ Ⓓ
08	Ⓐ Ⓑ Ⓒ Ⓓ	23	Ⓐ Ⓑ Ⓒ Ⓓ	38	Ⓐ Ⓑ Ⓒ Ⓓ	53	Ⓐ Ⓑ Ⓒ Ⓓ
09	Ⓐ Ⓑ Ⓒ Ⓓ	24	Ⓐ Ⓑ Ⓒ Ⓓ	39	Ⓐ Ⓑ Ⓒ Ⓓ	54	Ⓐ Ⓑ Ⓒ Ⓓ
10	Ⓐ Ⓑ Ⓒ Ⓓ	25	Ⓐ Ⓑ Ⓒ Ⓓ	40	Ⓐ Ⓑ Ⓒ Ⓓ	55	Ⓐ Ⓑ Ⓒ Ⓓ
11	Ⓐ Ⓑ Ⓒ Ⓓ	26	Ⓐ Ⓑ Ⓒ Ⓓ	41	Ⓐ Ⓑ Ⓒ Ⓓ	56	Ⓐ Ⓑ Ⓒ Ⓓ
12	Ⓐ Ⓑ Ⓒ Ⓓ	27	Ⓐ Ⓑ Ⓒ Ⓓ	42	Ⓐ Ⓑ Ⓒ Ⓓ	57	Ⓐ Ⓑ Ⓒ Ⓓ
13	Ⓐ Ⓑ Ⓒ Ⓓ	28	Ⓐ Ⓑ Ⓒ Ⓓ	43	Ⓐ Ⓑ Ⓒ Ⓓ	58	Ⓐ Ⓑ Ⓒ Ⓓ
14	Ⓐ Ⓑ Ⓒ Ⓓ	29	Ⓐ Ⓑ Ⓒ Ⓓ	44	Ⓐ Ⓑ Ⓒ Ⓓ	59	Ⓐ Ⓑ Ⓒ Ⓓ
15	Ⓐ Ⓑ Ⓒ Ⓓ	30	Ⓐ Ⓑ Ⓒ Ⓓ	45	Ⓐ Ⓑ Ⓒ Ⓓ	60	Ⓐ Ⓑ Ⓒ Ⓓ

@PROCBSE JOIN NOW !

Topper's* Answers	C.B.S.E. 2020 Class–X Delhi/Outside Delhi Set	Science

Time : 3 Hours **Max. Marks : 80**

***Note :** *This paper is solely for reference purpose. The pattern of the paper has been changed for the academic year 2022-23.*

General Instructions :

(i) *The question paper comprises three Sections, A, B and C. There are 30 questions in the question paper. All questions are compulsory.*

(ii) *Section A – all questions / or parts (question no. 1 to 14) thereof in this section are one mark questions comprising MCQ, VSA type and Assertion–Reason type questions. They are to be answered in one word or in one sentence.*

(iii) *Section B – question no. 15 to 24 are short answer type questions, carrying 3 marks each. Answer to these questions should not exceed 50 to 60 words.*

(iv) *Section C – question no. 25 to 30 are long answer type questions, carrying 5 marks each. Answer to these questions should not exceed 80 to 90 words.*

(v) *Answer should be brief and to the point. Also the above mentioned word limit be adhered to as far as possible.*

(vi) *There is no overall choice in the question paper. However, an internal choice has been provided in some questions in each section. Only one of the choices in such questions have to be attempted.*

(vii) *In addition to this, separate instructions are given with each section and question, wherever necessary.*

@PROCBSE Join Now !

SECTION – A

Note : For question numbers 1 and 2, two statements are given-one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below :

(a) Both (A) and (R) are true and (R) is correct explanation of the assertion.

(b) Both (A) and (R) are true but (R) is not the correct explanation of the assertion.

(c) (A) is true but (R) is false.

(d) (A) is false but (R) is true.

1. **Assertion (A) :** Following are the members of a homologous series :

CH_3OH, CH_3CH_2OH, $CH_3CH_2CH_2OH$

Reason (R) : A series of compounds with same functional group but differing by $-CH_2-$ unit is called a homologous series. **1**

Ans. a) ✓

@PROCBSE

2. **Assertion (A) :** Alloys are commonly used in electrical heating devices like electric iron and heater.
Reason (R) : Resistivity of an alloy is generally higher than that of its constituent metals but the alloys have low melting points then their constituent metals. **1**

Ans. c) ✓

3. How are covalent bonds formed ? **1**

Ans. Covalent bonds are formed by the sharing of electrons between two atoms. The electrons shared belong to the valence shell of the atoms.

4. Define electropositivity. **1**

OR

The atomic radii of first group elements are given below : **1**

Group-I element	Atomic Radii (pm)
Na	86
K	231
Rb	244
Cs	282

State the reason behind the observed trend in the above elements. **1**

Ans. The reason for the observed trend is because atomic size increases down a group since a new shell is added as we move down a group. This increases the distance between the nucleus and the outermost shell of the atom, even though nuclear charge increases.

5. A cylindrical conductor of length '*l*' and uniform area of cross section 'A' has resistance 'R'. The area of cross section of another conductor of same material and same resistance but of length '2*l*' is

(a) $\frac{A}{2}$ **(b)** $\frac{3A}{2}$ **(c)** 2A **(d)** 3A **1**

Ans. c) 2 A ✓

6. The maximum resistance which can be made using four resistors each of resistance $\frac{1}{2}\ \Omega$ is

(a) 2 Ω **(b)** 1 Ω **(c)** 2.5 Ω **(d)** 8 Ω **1**

Ans. a) 2 Ω ✓

7. The sky appears dark to passengers flying at very high altitudes mainly because :

(a) Scattering of light is not enough at such heights.

(b) There is no atmosphere at great heights.

(c) The size of molecules is smaller than the wavelength of visible light.

(d) The light gets scattered towards the earth. **1**

Ans. a) Scattering of light is not enough at such heights

@PROCBSE

8. An element 'X' is forming an acidic oxide. Its position in modern periodic table will be

(a) Group 1 and Period 3 **(b)** Group 2 and Period 3

(c) Group 13 and Period 3 **(d)** Group 16 and Period 3 **1**

OR

Consider the following statements about an element 'X' with number of protons 13.

(A) It forms amphoteric oxide **(B)** Its valency is three **(C)** The formula of its chloride is XCl_3

The correct statements(s) is/are

(a) only (A) **(b)** only (B) **(c)** (A) and (C) **(d)** (A), (B) and (C) **1**

Ans. d) (A), (B) and (C)

9. An aqueous solution 'A' turns phenolphthalein solution pink. On addition of an aqueous solution 'B' to 'A', the pink colour disappears. The following statement is true for solution 'A' and 'B'.

(a) A is strongly basic and B is a weak base.

(b) A is strongly acidic and B is a weak acid.

(c) A has pH greater than 7 and B has pH less than 7.

(d) A has pH less than 7 and B has pH greater than 7. **1**

Ans. c) A has pH greater than 7 and B has pH less than 7.

10. In which of the following, the identity of initial substance remains unchanged ?

(a) Curdling of milk

(b) Formation of crystals by process of crystallisation

(c) Fermentation of grapes

(d) Digestion of food **1**

@PROCBSE JOIN NOW !

Ans. b) Formation of crystals by process of crystallization

11. Several factories were pouring their wastes in rivers A and B. Water samples were collected form these two rivers. It was observed that sample collected from river A was acidic while that of river B was basic. The factories located near A and B are **1**

(a) Soaps and detergents factories near A and alcohol distillery near B.

(b) Soaps and detergents factories near B and alcohol distillery near A.

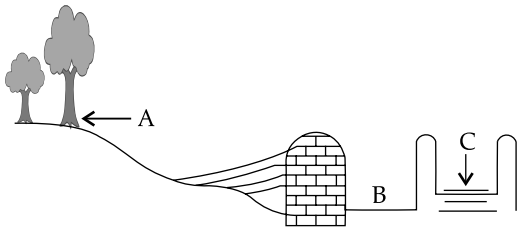
(c) Lead storage battery manufacturing factories near A and soaps and detergents factories near B.

(d) Lead storage battery manufacturing factories near B and soaps and detergents factories near A. **1**

Ans. c) lead storage battery manufacturing factories near A and soaps and detergents factories near B.

12. A diagram of traditional water harvesting system is given below :

The statement which defines the system and its parts is



@PROCBSE

(a) This is an ideal setting of the Khadin system and A = Catchment area; B = Saline area & C = Shallow dugwell

(b) This is an ideal setting of the Shallow dugwell system and A = Catchment area; B = Saline area and C = Khadin

(c) This is an ideal setting of Catchement area and A = Khadin, B = Saline area and C = Shallow dugwell

(d) This is showing Saline area and A = Catchment area; B = Khadin and C = Shallow dugwell **1**

OR

The major ill effect of mono culture practice in forests is on the

(a) biodiversity which faces large destruction

(b) local people whose basic needs can no longer be met from such forests

(c) industries

(d) forest department **1**

Ans.

12 a) This is an ideal setting of the khadin system and A = catchment area; B = saline area & C = Shallow dugwell.

13. Answer question numbers 13(a) to 13(d) on the basis of your understanding of the following paragraph and the related studies concepts.

The Tehri dam is the highest dam in India and one of the highest in the World. The Tehri dam withholds a reservoir of capacity 4.0 km^3 and surface area 52 km^2. It is used for irrigation, municipal water supply and the generation of 1000 MW of hydro electricity.

The Tehri Dam has been the object of protests. Environment activist Shri Sunder Lal Bahuguna led the "Anti Tehri Dam Movement" from 1980s to 2014. The protest was against the displacement of town inhabitants and environmental consequences of the weak ecosystem. The relocation of more than 1,00,000 people from the area has led to protracted legal battles over resettlement rights and ultimately resulted in the delayed completion of the project.

(a) How is hydropower harnessed ? **1**

(b) Define 1 MW. **1**

(c) Mention two disadvantages of constructing Tehri Dam. **1**

(d) What happens when water from great heights is made to fall on blades of turbine ? **1**

Ans.

13 a) Hydropower can be harnessed by building dams. Hydropower can be harnessed from the potential energy of water at a height or kinetic energy of flowing water. Potential energy of water stored at a height in a reservoir of a dam can be used to rotate a turbine and generate electricity.

b) 1 MW is the power when 10^6 joules of work is done is one second. $1 MW = 10^6 W = \frac{10^6 J}{1 s}$

c) Two disadvantages are
- large scale displacement of town inhabitants
- environmental consequences of the weak ecosystem - loss of biodiversity and large scale deforestation.
- Large areas of land have to be sacrificed as they get submerged.

d) When water falls from great heights, the blade of the turbine rotates. This mechanical energy is converted to electrical energy by a generator connected to the turbine.

@PROCBSE JOIN NOW !

14. Questions numbers 14(a) to 14(d) are based on table given below. Study the table in which the levels of Thyroid Stimulating Hormone (TSH) in women are given and answer the questions that follow on the basis of understanding of the following paragraph and the related studied concepts.

Age Range	Normal (mU/L)	Low (mU/L)
18 – 29 years	0.4 – 2.34 mU/L	< 0.4 mU/L
30 – 49 years	0.4 – 4.0 mU/L	< 0.4 mU/L
50 – 79 years	0.46 – 4.68 mU/L	< 0.46 m U/L

Women are at greater risk for developing abnormal TSH levels during menstruation, while giving birth and after going through menopause. Around 5% of women in the United States have some kind of thyroid problem compared to 3% of men. Despite claims that high TSH increases your risk for heart disease, a 2013 study found no link between high TSH and heart diseases. But a 2017 study showed that older women are especially at risk for developing thyroid cancer if they have high TSH levels along with thyroid nodules.

(a) A 35 year old woman has TSH level 6.03 mU/L. What change should she bring in her diet to control this level ? **1**

(b) When do women face a greater risk of abnormal TSH level ? **1**

(c) State the consequence of low TSH level. **1**

(d) Name the mineral that is responsible for synthesis of hormone secreted by thyroid gland. **1**

Ans.

14 a) She should eat more fruits and vegetables and reduce her intake of iodised salt.

b) Women face a greater risk of abnormal TSH level during menstruation, while giving birth and after going through menopause.

c) Low TSH level can cause goitre. (swelling of thyroid gland).

d) Iodine is responsible for synthesis of hormone secreted by thyroid gland.

SECTION – B

15. Identity the type of each of the following reactions.

Also write balanced chemical equation for each reaction.

(i) A reaction in which the reaction mixture becomes warm.

(ii) A reaction in which an insoluble substance is formed. **3**

Ans.

15 i) Exothermic reaction

$CaO + H_2O \rightarrow Ca(OH)_2 + heat$

quick lime — slaked lime

ii) Precipitation reaction (double displacement reaction)

$Pb(NO_3)_{2(aq)} + KI_{(aq)} \rightarrow PbI_{2(s)} + KNO_{3(aq)}$

yellow precipitate

@PROCBSE

16. Study the data of the following three categories A, B and C.

Category	Name of the element	Atomic Mass
A	Li	7
	Na	23
	K	39
B	N	14
	P	31
	As	74
C	B	10.8
	Al	27
	Ga	69.7

(i) From the given three categories A, B and C, pick the one which forms Dobereiner's Triads.

(ii) Why did Mendeleev placed elements of category A, B and C in three different groups ?

(iii) Is Newland law of octaves applicable to all the three categories ? Give reason to justify your answer. **3**

Ans.

16 i Group Category A (Li, Na, K) forms a Dobereiner's triad. ((39+7)/2 = 23)

ii Mendeleev placed the elements in different groups as they had different chemical properties : the formula of their oxides and hydrides were different. However, the elements in the same category have same chemical property.

iii Newland's law of octaves is not applicable to all three. It is applicable only upto calcium. Since Ga and As are found after Ca it is not applicable for group B and C. Every eight element does not show property similar to 1st one in this case.

17. Complete and balance the following chemical equations :

(i) $NaOH(aq) + Zn(s) \rightarrow$

(ii) $CaCO_3(s) + H_2O(l) + CO_2(g) \rightarrow$

(iii) $HCl(aq) + H_2O(l) \rightarrow$ **3**

OR

During electrolysis of brine, a gas 'G' is liberated at anode. When this gas 'G' is passed through slaked lime, a compound 'C' is formed, which is used for disinfecting drinking water.

(i) Write formula of 'G' and 'C'.

(ii) State the chemical equation involved.

(iii) What is common name of compound 'C' ? Give its chemical name. **3**

Ans.

17 i $2NaOH_{(aq)} + Zn_{(s)} \rightarrow Na_2ZnO_2 + H_{2(g)}$ (sodium zincate)

ii $CaCO_{3(s)} + H_2O_{(l)} + CO_{2(g)} \rightarrow Ca(HCO_3)_{2(aq)}$

iii $HCl_{(aq)} + H_2O_{(l)} \rightarrow H_3O^+ + Cl^-$ (hydronium)

@PROCBSE JOIN NOW!

18. **(a)** State with reason the consequence of decrease in number of carnivores in an ecosystem.

(b) In a food chain, state the trophic level at which the concentration of harmful chemicals is maximum. Why is it so ? **3**

OR

How is ozone layer formed ? State its importance to all life forms on earth ? Why the amount of ozone in the atmosphere dropped sharply in the 1980s ? **3**

Ans.

a) Ozone is formed by the action of UV radiations on molecular oxygen. The high energy UV rays split an O_2 molecule into two free oxygen atoms. This free atom combine with molecular oxygen to give ozone. (O_3)

$$O_2 \xrightarrow{UV\ rays} O + O$$

$$O + O_2 \longrightarrow \underset{ozone}{O_3}$$

Ozone protects all organisms from the harmful ultraviolet radiation from the sun. This radiations is highly damaging to organisms and can cause skin cancers. O_3 prevents UV rays from reaching Earth's surface.

answer continued below

~~In 1987, UNEP (United Nations Environment Programme) succeeded in forging an agreement to free CFC production at 1986 levels. These CFCs used to destroy the ozone layer. After this rule manufacturers had to make refrigerators without CFCs.~~

In 1980s, the production of chlorofluorocarbons (CFCs) increased. CFCs are used in refrigerators and fire extinguishers as coolants.

These CFCs destroy the ozone layer. Since the ozone layer was getting destroyed by the CFCs, amount of ozone in the atmosphere dropped sharply.

19. **(a)** State the role played by the following in the process of digestion.

(i) Enzyme trypsin

(ii) Enzyme lipase

(b) List two functions of finger like projections present in the small intestine. **3**

Ans.

a) i Enzyme trypsin helps in the digestion of proteins into amino acids.

ii) Enzyme lipase helps in digestion of fats into fatty acids and glycerol.

Both trypsin and lipase are secreted by pancreas and into the small intestine.

b Function of villi –

- Villi increase the surface area for absorption of digested food.
- Villi are richly supplied with blood vessels which transport the absorbed food to each and every cell in the ~~food~~ body, where it is used up for growth, repair and development of the body. It helps energy from food get supplied to cells.

@PROCBSE

20. A green stemmed rose plant denoted by GG and a brown stemmed rose plant denoted by gg are allowed to undergo a cross with each other.

(a) List your observations regarding

(i) Colour of stem in their F_1 progeny

(ii) Percentage of brown stemmed plants in F_2 progeny if F_1 plants are self pollinated.

(iii) Ratio of GG and Gg in the F_2 progeny.

(b) Based on the findings of this cross, what conclusion can be drawn ? **3**

Ans.

a) Parent GG × gg

Gamete (G) (g)

F_1

Gg × Gg

green

F_2

	G	g
G	GG green	Gg green
g	Gg green	gg brown

genotypic ratio → GG : Gg : gg

1 : 2 : 1

phenotypic ratio → ~~Colour~~ green : brown

3 : 1

i Colour of stem in F_1 progeny is green. ✓

ii Percentage of brown stemmed plants = $\frac{1}{4} \times 100 = 25\%$ ✓

iii Ratio of GG and Gg = 1 : 2 ✓

b Based on the findings, ~~who~~ we can say that green stem colour is dominant trait while brown stem colour is a recessive trait. In F_1 generation no midway traits are seen and all F_1 progeny are green. In F_2 generation we get green stem and brown stem in ratio 3:1. The law of dominance is proved. Every progeny inherits two copies of factors controlling traits. They may be same or different based on parentage.

21. **(a)** Classify the following as homologous or analogous pairs :

(i) Broccoli and Cabbage

(ii) Ginger and Raddish

(iii) Fore limbs of birds and lizard

(iv) Wings of a bat and Wings of a bird

(b) State the main feature that categorises a given pair of oragans as homologous or analogous. **3**

@PROCBSE JOIN NOW

Ans.

a) i) homologous pairs ✓
ii) analogous pairs ✓
iii) homologous pairs ✓
iv) analogous pairs ✓

b) Organs are homologous if they have the same basic design, structure and components, though they may be modified to perf perform different functions. They show common ancestry.
Analogous organs may look similar as they perform the same function but their basic structural design is different. ✓

Thus basic structural design is main feature to classify organs as homologous or analogous.

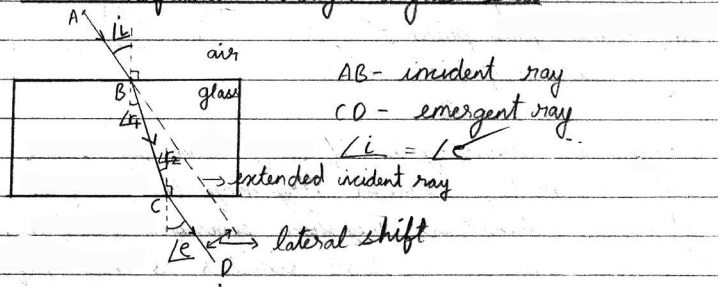
22. (a) State Snell's law of refraction of light.

(b) When a ray of light travelling in air enters obliquely into a glass slab, it is observed that the light ray emerges parallel to the incident ray but it is shifted sideways slightly. Draw a labelled ray diagram to illustrate it. **3**

Ans.

a) Snell's law of refraction states that the ~~sine~~ ratio of sine of angle of incidence to ~~sign~~ sine of angle of refraction is a constant ~~called refraction~~ for a given pair of media and a given colour of light.
This constant is refractive index of second medium with respect to the first.

b)



23. (a) With the help of labelled ray diagram show the path followed by a narrow beam of monochromatic light when it passes through a glass prism.

(b) What would happen if this beam is replaced by a narrow beam of white light ?

OR

(a) A person is suffering from both myopia and hypermetropia.

(i) What kind of lenses can correct this defect ?

(ii) How are these lenses prepared ?

(b) A person needs a lens of power + 3D for correcting his near vision and 3D for correcting his distant vision. Calculate the focal lengths of the lenses required to correct these defects. **3**

@PROCBSE JOIN NOW !

Ans. a) i) ~~bifocal~~ ~~f~~ bifocal lenses are used

ii) A bifocal lense consists of a concave lense at the top to help in distant vision and a convex lens at the bottom to help in near vision. A ~~bi~~ bifocal lens consists of both a concave and convex lens.

b) $P = +3D$

$f = \frac{1}{P}$

$= \frac{1}{3}m = \frac{100}{3}cm = \boxed{33.33\ cm}$

To correct near vision she needs a lens of focal length 33.33 cm (convex lens)

$P = -3D$

$P = \frac{1}{f} \Rightarrow f = \frac{1}{P}$

$= \frac{1}{-3} = \boxed{-33.33\ cm}$

To correct distant vision, she needs a lens of focal length −33.33 cm (concave lens).

24. Give reasons for the following:

(i) There is either a convergence or a divergence of magnetic field lines near the ends of a current carrying straight solenoid.

(ii) The current carrying solenoid when suspended freely rests along a particular direction.

(iii) The burnt out fuse should be replaced by another fuse of identical rating. **3**

Ans. i) Magnetic field lines are close together when ~~field~~ field is strong. This is seen inside the magnet. However as the distance from the magnet increases, field strength decreases and the field lines begin to spread out. Thus at north pole, the field lines diverge and at south pole they again converge to form parallel lines within the magnet where they move from S to N.

ii) When current is passed through a solenoid, it gains a magnetic field. One end of the solenoid acts as the north pole while the other behaves like the south pole. Thus when freely suspended, it behaves like a freely suspended magnet and points in north-south direction.

iii) A fuse is a protective device which melts when current above a specified values passes through it and hence breaks the circuit protecting it from unduly high current. A fuse is selected based on the current required to flow through the appliance. If a fuse melts it should be replaced with one of same rating. Otherwise, if the rating is higher, more current than required will flow. If the rating is lower, it will melt even when less current flows. Thus since a specific value of current should flow through a circuit, a fuse of same rating should be used.

@PROCBSE

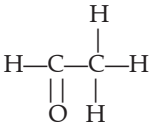
SECTION – C

25. **(a)** Compare soaps and detergents on the basis of their composition and cleansing action in hard water.

(b) What happens when ethanol is treated with sodium metal ? State about the behaviour of ethanol in this reaction.

(c) Draw the structure of cyclohexane.

(d) Name the following compound.



Ans.

25a)

Soaps	Detergents
→ Composition –	
Sodium or potassium salts of long chain carboxylic acids.	Sodium salts of sulphonic acids or ammonium salts with chloride or bromide ends.
→ Action in hard water	
• React with Ca^+ and Mg^+ ions in hard water to form white sticky precipitate called scum.	• The charged particles do not react with Ca^+ and Mg^+ ions in hard water, so no scum is formed.
• less lathes formed	• same lathes formed as in normal water
• not effective in hard water	• effective even in hard water.

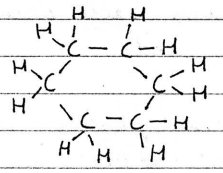
b Ethanol reacts with sodium metal to form sodium ethoxide and hydrogen

$$2\,CH_3-CH_2OH + Na \longrightarrow CH_3CH_2ONa + H_2$$

sodium ethoxide

Ethanol behave like an acid as it reacts with a metal to give a salt and hydrogen. Ethanol loses an atom of hydrogen an replaces it with Na. Even some bases show this behaviour.

c Cyclohexane – C_6H_{12}



d The compound is ethanal.

5

26. A metal 'M' is stored under kerosene. It vigorously catches fire, if a small piece of this metal is kept open in air. Dissolution of this metal in water releases great amount of energy and the metal catches fire. The solution so formed turns red litmus blue.

(a) Name the metal 'M'

(b) Write formula of the compound formed when this metal is exposed to air.

(c) Why is metal 'M' stored under kerosene ?

(d) If oxide of this metal is treated with hydrochloric acid, what would be the products ?

@PROCBSE JOIN NOW !

@PROCBSE

(e) Write balanced equations for :
- **(i)** Reaction of 'M' with air.
- **(ii)** Reaction of 'M' with water.
- **(iii)** Reaction of metal oxide with hydrochloric acid. **5**

OR

(a) Write electron dot structures of Ca (At. No. 20) and O(At. No. 8).
(b) Show the formation of calcium oxide by transfer of electrons.
(c) Name the ions present in this compound.
(d) List four important characteristics of this compound. **5**

Ans.

a) Calcium → $\cdot Ca \cdot$

Oxygen → $:\dot{O}:$

b) $Ca \longrightarrow Ca^{2+} + 2e^-$
$(2,8,8,2) \quad (2,8,8)$

$O + 2e^- \longrightarrow O^{2-}$

$Ca + O \longrightarrow Ca^{2+} + O^{2-}$

$\longrightarrow Ca^{2+}O^{2-}$

$\longrightarrow CaO$

c) The ions present are Ca^{2+} - calcium ion which is a cation
O^{2-} - oxide ion which is an anion.

d) CaO is an ionic compound. Its properties are -
- High melting and boiling point.
- hard solid, brittle - breaks when pressure is applied.
- soluble in water.
- insoluble in organic solvents like petrol, kerosene.
- conducts electricity is molten and aqueous states.
- Does not conduct electricity in solid state.
- Imparts specific colour to the flame.

27. **(a)** Write the correct sequence of steps followed during journey of oxygen rich blood from lungs to various organs of human body.
(b) What happens when the system of blood vessels develop a leak ? **5**

Ans.

a) • Blood in the alveolar sac take up oxygen and carbon dioxide is released.
Blood carries oxygen through a respiratory pigment called haemoglobin which has a high affinity for oxygen.
Carbon dioxide is transported in dissolved form in our blood as it is more soluble.
Oxygen rich blood is carried to the left atrium of the heart through the pulmonary vein. The left atrium relaxes as it receives the blood.
This chamber then contracts while the left ventricle relaxes and the blood is transported to the left ventricle.

@PROCBSE

- The left ventricle contracts to pump the blood to the various parts of the body through the aorta.
- Valves in heart prevent blood backflow.
- The aorta divides into numerous arteries which carry the blood to different parts. At the tissue, the artery divides into smaller and smaller vessels. The smallest vessel is the capillary which has a one cell thick wall through which ~~blood~~ transfer of O_2 and glucose take place.

b) If the system of blood vessels develop a leak, it may lead to loss of blood, which can lead to loss in pressure and reduce efficiency of the pumping system.
Thus, to prevent this blood has cells called platelets which circulate around the body. When a leak develops, the platelets help plug the leak by clotting blood at the point of injury.

28. **(a)** Suggest any two categories of contraceptive methods to control the size of human population which is essential for the prosperity of a country. Also explain about each method briefly.

(b) Name two bacterial and two viral infections each that can get sexually transmitted.

(c) List two advantages of using condom during sexual act. **5**

OR

(a) Draw a diagram to show spore formation in Rhizopus.

(b) With the help of an example differentiate between the process of Budding and Fragmentation.

(c) Why is vegetative propagation practiced for growing some type of plants ? **5**

Ans. a) ~~Hormonal~~ Chemical methods - oral pills are taken which alter the hormonal balance of the body and ensure egg is not released and fertilisation does not occur. However this has side effects due to change in hormonal balance.

b) Surgical methods - the vas deferens in males and the ~~oviduct~~ fallopian tube in females is blocked by surgical methods. This prevents transfer of sperms in males and ensures egg doesn't reach the uterus in females. In both cases fertilisation cannot occur.

b) Viral - HIV-AIDS and warts
Bacterial - gonorrhoea, and syphilis

c) Advantages of using condom -
- Condoms act as a physical barrier and prevent transfer of sperms. Thus it acts as a contraceptive method and prevents unwanted pregnancy.
- Condoms prevent transmission of STDs (sexually transmitted diseases)

@PROCBSE

29. **(a)** A security mirror used in a big showroom has radius of curvature 5 m. If a customer is standing at a distance of 20 m from the cash counter, find the position, nature and size of the image formed in the security mirror.

(b) Neha visited a dentist in his clinic. She observed that the dentist was holding an instrument fitted with a mirror. State the nature of this mirror and reason for its use in the instrument used by dentist. **5**

OR

Rishi went to a palmist to show his palm. The palmist used a special lens for this purpose.

(i) State the nature of the lens and reason for its use.

(ii) Where should the palmist place/hold the lens so as to have a real and magnified image of an object ?

(iii) If the focal length of this lens is 10 cm, the lens is held at a distance of 5 cm from the palm, use lens formula to find the position and size of the image. **5**

Ans. 29 a) Nature of lens is convex. It is used to provide a magnified image of the palm. It is a converging lens. Convex lens is used as it can provide a magnified image in certain positions.

b) The palmist should hold the mirror between 2F and F to obtain a real, magnified image.

c) $f = 10\ cm \quad u = -5\ cm$

$\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$

$\frac{1}{v} = \frac{1}{f} + \frac{1}{u}$

$= \frac{1}{10} + \frac{1}{-5} = \frac{1}{10} - \frac{1}{5} = \frac{1-2}{10} = -\frac{1}{10}$

$\Rightarrow v = -10\ cm$

$\Rightarrow$ Image is formed at the focus on the same side of object (behind object)



- The image size is enlarged. $M = \frac{v}{u} = \frac{-10}{-5} = 2$
- Image is twice the size of the palm (object) $h' = 2h$
- Image is virtual and erect.

30. **(a)** An electric bulb is rated at 200 V; 100 W. What is its resistance ?

(b) Calculate the energy consumed by 3 such bulbs if they glow continuously for 10 hours for complete month of November.

(c) Calculate the total cost if the rate is ₹ 6.50 per unit.

OR

(a) What is meant by the statement, "The resistance of a conductor is one ohm" ?

(b) Define electric power. Write an expression relating electric power, potential difference and resistance.

(c) How many 132 Ω resistors in parallel are required to carry 5 A on a 220 V line ? **5**

Ans. a) $P = 100\ W$

$V = 200\ V$

$P = \frac{V^2}{R}$

$\Rightarrow R = \frac{V^2}{P} = \frac{200 \times 200\ V}{100\ W}$

Resistance of bulb $= 400\ \Omega$

@PROCBSE JOIN NOW !

@PROCBSE

b Energy = (P × t) × 3

Time, t = 10 × 30

= 300

⇒ Energy = Pt × 3

= 100 × 300 × 3

= 900 × 100

= 90000 Whr

= 90 kWhr //

c Total cost = No. of units × rate

= 90 × 6·5 = ₹ 585 //

❑❑

@PROCBSE
JOIN NOW !

@PROCBSE

WRITING YOUR NOTES

Just in case you have forgotten today, takedown your notes!
But why is it so important?

Tools for the hands are tools for the brain writes Hetty Roessingh.
Handwritten notes are a powerful tool for encrypting embodied cognition and in turn supporting the brain's capacity for recuperation of information. If that sounds so scientific then in simple words: Writing notes by hand help you in:

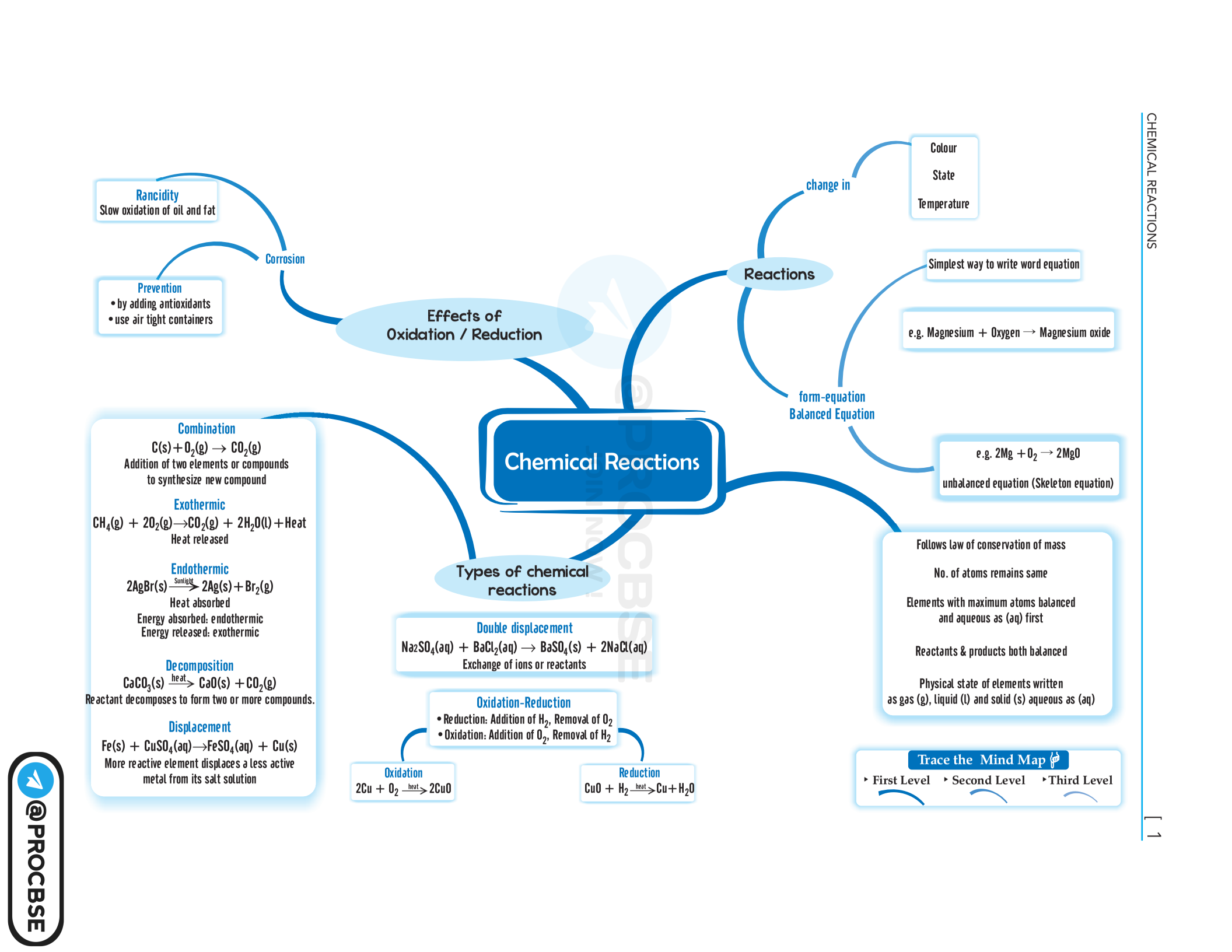
◆ Increasing your comprehension ◆ Strengthening your memory ◆ Igniting your creativity
◆ Engaging your mind ◆ Increasing your attention span

Are these reasons enough to get you started?

1. .....
2. .....
3. .....
4. .....
5. .....
6. .....
7. .....
8. .....
9. .....
10. .....
11. .....
12. .....
13. .....
14. .....
15. .....
16. .....
17. .....
18. .....
19. .....

@PROCBSE
JOIN NOW !

@PROCBSE


Chemical Reactions
Reactions
change in
Colour
State
Temperature
form-equation
Balanced Equation
Simplest way to write word equation
e.g. Magnesium + Oxygen → Magnesium oxide
e.g. 2Mg + O2 → 2MgO
unbalanced equation (Skeleton equation)
Follows law of conservation of mass
No. of atoms remains same
Elements with maximum atoms balanced and aqueous as (aq) first
Reactants & products both balanced
Physical state of elements written as gas (g), liquid (l) and solid (s) aqueous as (aq)
Effects of Oxidation / Reduction
Corrosion
Rancidity
Slow oxidation of oil and fat
Prevention
• by adding antioxidants
• use air tight containers
Types of chemical reactions
Combination
C(s) + O2(g) → CO2(g)
Addition of two elements or compounds to synthesize new compound
Exothermic
CH4(g) + 2O2(g) → CO2(g) + 2H2O(l) + Heat
Heat released
Endothermic
2AgBr(s) —Sunlight→ 2Ag(s) + Br2(g)
Heat absorbed
Energy absorbed: endothermic
Energy released: exothermic
Decomposition
CaCO3(s) —heat→ CaO(s) + CO2(g)
Reactant decomposes to form two or more compounds.
Displacement
Fe(s) + CuSO4(aq) → FeSO4(aq) + Cu(s)
More reactive element displaces a less active metal from its salt solution
Double displacement
Na2SO4(aq) + BaCl2(aq) → BaSO4(s) + 2NaCl(aq)
Exchange of ions or reactants
Oxidation-Reduction
• Reduction: Addition of H2, Removal of O2
• Oxidation: Addition of O2, Removal of H2
Oxidation
2Cu + O2 —heat→ 2CuO
Reduction
CuO + H2 —heat→ Cu + H2O
Trace the Mind Map
First Level
Second Level
Third Level

@PROCBSE

UNIT I: CHEMICAL SUBSTANCES: NATURE AND BEHAVIOUR

CHAPTER 1

CHEMICAL REACTIONS

Syllabus

Chemical equation, balanced chemical equation, implications of a balanced chemical equation, types of chemical reactions: Combination, decomposition, displacement, double displacement, precipitation, neutralization, oxidation and reduction.

Trend Analysis

List of Concepts	2018	2019		2020	
	OD/D	OD	D	OD	D
Types of chemical reactions	1 Q (3 M)	1 Q (3 M)	1 Q (3 M) Or 1 Q (3 M)	1 Q (3 M)	1 Q (3 M)

@PROCBSE JOIN NOW !

TOPIC - 1
Chemical Reactions and Equations

Revision Notes

1. A chemical reaction

- A chemical reaction is a process in which the original substance(s) loses its nature and identity and forms new substance(s) with different properties.
- Breaking of the chemical bonds and formation of new chemical bonds is responsible for the occurrence of a chemical reaction.
- The substances which take part in a chemical reaction are called **Reactants.**
- The substances which are formed in a chemical reaction are called **Products.**
- **Examples of chemical reaction**:
  - **(i)** Digestion of food
  - **(ii)** Respiration
  - **(iii)** Rusting of iron
  - **(iv)** Burning of magnesium ribbon
  - **(v)** Formation of curd

TOPIC - 1
Chemical Reactions and Equations Page No. 2
TOPIC - 2
Type of Chemical Reactions, Corrosion and Rancidity Page No. 6

@PROCBSE

➢ **A chemical reaction can be identified by either of the following observations:**

(i) Change in state
(ii) Change in colour
(iii) Evolution of gas
(iv) Change in temperature
(v) Formation of a precipitate

Scan to know more about this topic

Chemical Reactions

2. More about chemical equations:

➢ **A chemical equation is written in the following way:**

(i) The symbols of elements and the formulae of reacting substances (reactants) are written on the left hand side of the equation, with a plus (+) sign between them.
(ii) The symbols and formulae of the substances formed (products) are written on the right hand side of the equation, with a plus sign (+) between them.
(iii) An arrow sign (→) is put between the reactants and the products.
(iv) The physical states of the reactants and products are also mentioned in a chemical equation.

3. More about chemical equations:

➢ **Balanced Equation:** The equation in which atoms of various elements on both sides of a chemical equation are equal in accordance with the law of conservation of mass.

➢ The process of equalizing the atoms of various elements both on either sides of an equation is called the balancing of chemical equation. This is known as hit and trial method. We can balance a chemical equation by following the steps given below:

Step 1. Write the chemical equation and draw boxes around each formula:

$$\boxed{Fe + H_2O \rightarrow Fe_3O_4 + H_2}$$

Step 2. Count the number of atoms of each element on both the sides of the arrow :

Element	No. of atoms at reactant side	No. of atoms at product side
1. Fe	1	3
2. H	2	2
3. O	1	4

Step 3. Equalize the number of the atoms of element which has the maximum number of atoms (oxygen).

$$Fe + 4H_2O \rightarrow Fe_3O_4 + H_2$$

Step 4. Try to equalize all the atoms of elements on reactant and product side by adding coefficient in front of it.

$$3Fe + 4H_2O \rightarrow Fe_3O_4 + 4H_2$$

Now, all the atoms of elements are equal on both sides.

Step 5. Write the physical states of reactants and products.

$$3Fe\,(s) + 4H_2O\,(g) \rightarrow Fe_3O_4\,(s) + 4H_2\,(g)$$

Solid state = (*s*), Liquid state = (*l*), Gaseous state = (*g*), Aqueous state = (*aq*)

Step 6. Write necessary conditions of temperature, pressure or catalyst at above or below the arrow.

e.g.

(i) $CO(g) + 2H_2\,(g) \xrightarrow{340\ atm} CH_3OH(l)$

(ii) $6CO_2(g) + 6H_2O(l) \xrightarrow[\text{chlorophyll}]{\text{sunlight}} \underset{\text{Glucose}}{C_6H_{12}O_6(aq)} + 6O_2\,(g)$

How is it done on the GREENBOARD?

Q. (a) Write two observations when lead nitrate is heated in a test tube.
(b) Name the type of reaction.
(c) Write a balanced chemical equation to represent the above reaction.

Solution:
Step 1: (a) It turns yellow due to formation of lead oxide and reddish brown fumes evolve.
Step 2: (b) Thermal decomposition reaction.
Step 3: (c) It is an exothermic reaction.

$$2Pb(NO_3)_2 \xrightarrow{Heat} 2PbO + 4NO_2 + O_2$$

@PROCBSE

Objective Type Questions — 1 mark each

A Multiple Choice Questions

Q. 1. Which of the following is not a physical change?
(a) Boiling of water to give water vapour
(b) Melting of ice to give water
(c) Dissolution of salt in water
(d) Combustion of liquified petroleum gas (LPG) [NCERT Exemp.]

Ans. Correct option : (d)

Explanation : During combustion of liquified petroleum gas (LPG), it forms CO_2 and H_2O.

Q. 2. Which one of the following processes involve chemical reactions?

(a) Storing of oxygen gas under pressure in a gas cylinder

(b) Liquification of air

(c) Keeping petrol in a china dish in the open

(d) Heating copper wire in presence of air at high temperature [NCERT Exemp.]

Ans. Correct option : (d)

Explanation : Chemical changes involve formation of new compounds from one or more substances. On heating copper wire in presence of air at high temperature copper (II) oxide is formed.

Q. 3. In which of the following chemical equations, the abbreviations represent the correct states of the reactants and products involved at reaction temperature?

(a) $2H_2(l) + O_2(l) \longrightarrow 2H_2O(g)$

(b) $2H_2(g) + O_2(l) \longrightarrow 2H_2O(l)$

(c) $2H_2(g) + O_2(g) \longrightarrow 2H_2O(l)$

(d) $2H_2(g) + O_2(g) \longrightarrow 2H_2O(g)$ [NCERT Exemp.]

Ans. Correct option: (c)

Explanation : It is because, the standard state for hydrogen and oxygen is gas and for water is liquid at reaction temperature.

B Assertions and Reasons Type Questions

Directions: In the following questions, a statement of assertion (A) is followed by a statement of reason (R). Mark the correct choice as:

(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

(b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).

(c) Assertion (A) is true but reason (R) is false.

(d) Assertion (A) is false but reason (R) is true.

Q. 1. Assertion (A): Carbon dioxide turns lime water milky.

Reason (R): Carbon dioxide sullies the water.

Ans. Correct option: (c)

Explanation : Carbon dioxide reacts with lime water (calcium hydroxide) to form milky precipitate of calcium carbonate.

Q. 2. Assertion (A): A chemical reaction becomes faster at higher temperatures.

Reason (R): At higher temperatures, molecular motion becomes more rapid.

Ans. Correct option: (a)

Explanation : It is mentioned at the beginning. A chemical reaction becomes faster at higher temperatures because at high temperature, the movement of particles are greater.

Q. 3. Assertion (A): After white washing the walls, a shiny white finish on walls is obtained after two to three days.

Reason (R): Calcium oxide reacts with carbon dioxide to form calcium hydrogen carbonate which gives shiny white finish.

Ans. Correct option: (c)

Explanation : Calcium hydroxide is present in whitewash. It reacts slowly with the carbon dioxide in air to form a thin layer of calcium carbonate on the walls. Calcium carbonate is formed after two to three days of white washing. Hence the shiny white finish appears after two to three days on the walls.

C Very Short Answer Type Questions

Q. 1. Name the law based on which chemical equations must be balanced. R

Ans. Law of conservation of mass

Mass can neither be created nor can it be destroyed during a chemical reaction. ½ + ½

AI **Q. 2. Name the product formed when quick lime is added to water? Write the reaction involved.**

Ans. Quick lime reacts with water vigorously to produce slaked lime and a large amount of heat. U

$CaO(s) + H_2O(l) \longrightarrow Ca(OH)_2 + \text{Heat}$
(Quick lime) (Slaked lime) ½ + ½

Q. 3. Write a balanced chemical equation: A
$Pb(NO_3)_2 + KI \rightarrow KNO_3 + PbI_2$

Ans. Balance the following chemical equation:

$Pb(NO_3)_2 + 2\,KI \rightarrow 2\,KNO_3 + PbI_2$ **1**

@PROCBSE

COMMONLY MADE ERROR

- While writing the equation of a chemical reaction, students tend to not balance the chemical reaction.

ANSWERING TIP

- While writing the chemical reactions, students should balance each element. For this he/she needs to do more practice.

Short Answer Type Questions-I — 2 marks each

Q. 1. List any two observations when ferrous sulphate is heated in a dry test tube.

Ans. (i) Initial light green colour changes to reddish brown colour.

(ii) Colourless gas is evolved.

(iii) Gas with choking smell is evolved. (Any two)

Q. 2. Identify the products formed when 1 mL of dil. Hydrochloric acid is added to 1g of sodium metal?

Ans. Sodium Chloride and Hydrogen gas.

Q. 3. 1 g of copper powder was taken in a China dish and heated. What change takes place on heating? When hydrogen is passed over this heated substance, a visible change is seen in it. Give the chemical equations of reactions.

Ans. The black colour substance formed by the reaction of copper with oxygen is Copper (II) oxide (CuO).

Chemical Reaction: $2Cu + O_2 \rightarrow 2CuO$

Hydrogen gas is passed over this heated material (CuO), the black coating on the surface turns brown as the reverse reaction takes place and copper is obtained.

$$CuO + H_2 \rightarrow Cu + H_2O$$

Q. 4. List the changes that are observed when dil. HCl is added to a small amount of copper oxide in a beaker. Write balanced chemical equation for the reaction.

Ans. When dil HCl is added to a small amount of CuO in a beaker, the colour changes to blue green due to formation of copper chloride

$$CuO + 2HCl \rightarrow CuCl_2 + H_2O$$

@PROCBSE JOIN NOW !

Short Answer Type Questions-II — 3 marks each

Q. 1. When a copper wire was left in silver nitrate solution for sometime, it was observed that the solution turned bluish green.

(i) Explain the observation.

(ii) Write the balanced chemical equation to represent the change taking place. A [Board Term-I, 2016]

Ans. (i) Copper is more reactive than silver. Hence, when copper wire is dipped in silver nitrate solution, it displaces silver from $AgNO_3$ solution forming copper nitrate which is bluish green in colour.

(ii) $Cu + 2AgNO_3 \longrightarrow Cu(NO_3)_2 + 2Ag$

(Copper (II) nitrate : bluish green) (Silver)

[CBSE Marking Scheme, 2016] **2 + 1**

Q. 2. 2 g of ferrous sulphate crystals are heated in a dry boiling tube. Answer the following:

(i) List any two observations.

(ii) Name the type of chemical reaction taking place.

(iii) Write the chemical equation of the reaction.

U [Board Term-I, 2016]

Ans. (i) Two observations are:

(a) Change in state and colour.

(b) Evolution of gas

(ii) Decomposition reaction

(iii) $2FeSO_4(s) \xrightarrow{\text{Heat}} Fe_2O_3(s) + SO_2(g) + SO_3(g)$

1 + 1 + 1

Q. 3. (i) Solution of a substance 'X' is used for testing carbon dioxide. Write the equation of the reaction of 'X' with carbon dioxide.

(ii) How is 'X' obtained? Write chemical equation.

A [Board Term-I, 2015]

Ans. (i) Substance X-Calcium Hydroxide.

$Ca(OH)_2(aq) + CO_2(g) \longrightarrow CaCO_3(s) + H_2O(l)$

(White ppt.)

(ii) Calcium hydroxide is obtained by reaction of calcium oxide and water. It is a *n* exothermic reaction.

$CaO(s) + H_2O(l) \longrightarrow Ca(OH)_2(aq) + \text{Heat}$ **1 + 2**

AI **Q. 4. Write the chemical equations involved in the following chemical reactions:**

(i) White washing.

(ii) Black and white photography.

A [Board Term-I 2016]

Ans. (i) In white washing, quicklime reacts with water to form slaked lime.

$CaO + H_2O \longrightarrow Ca(OH)_2 + \text{Heat}$

Quick lime Slaked lime

@PROCBSE

(ii) Silver bromide, when exposed to light decomposes to silver and bromine.

$$2\,AgBr(s) \xrightarrow{\text{Sunlight}} 2\,Ag(s) + Br_2(g)$$

(Silver bromide) (Silver) (Bromine)

[CBSE Marking Scheme, 2016] **1½ + 1½**

Long Answer Type Questions — 5 marks each

AI **Q. 1. (a) Mention with reason the colour changes observed when:**

(i) Silver chloride is exposed to sunlight.

(ii) a piece of zinc is dropped in copper sulphate solution. [Outside Delhi Set -I, 2020]

Justify your answer by giving reactions involved.

(b) Name the colour of precipitate formed when lead nitrate solution is added to potassium iodide solution?

Ans. (a) (i) When silver chloride is exposed to sunlight, it decomposes to give silver metal and chlorine gas. In this reaction white colour of silver chloride changes to greyish white due to the formation of silver metal. This is a photochemical decomposition reaction.

$$2AgCl(s) \xrightarrow{\text{sunlight}} 2Ag(s) + Cl_2(g)$$

(ii) Zinc being more reactive than copper, displaces copper from its compound and forms new product. This is a displacement reaction.

$$Zn(s) + CuSO_4(aq) \longrightarrow ZnSO_4(aq) + Cu(s)$$

(copper sulphate) (zinc sulphate)

(b) Yellow colour of lead iodide is formed.

Q. 2. Define a chemical reaction. State four observations which help us to determine that a chemical reaction has taken place. Write one example of each observation with a balanced chemical equation.

R [Board Term-I, 2016]

Ans. Process in which new substances with new properties are formed by the rearrangement of atoms.

(i) Evolution of gas: The chemical reaction between zinc and dilute H_2SO_4.

$$Zn(s) + H_2SO_4(aq) \longrightarrow ZnSO_4(aq) + H_2(g) \uparrow$$

(ii) Change in colour: The chemical reaction between potassium iodide and lead nitrate.

$$Pb(NO_3)_2(aq) + 2KI(s) \longrightarrow 2KNO_3(aq) + PbI_2(s)$$

Colourless Yellow

(iii) Formation of precipitate: The chemical reaction between sulphuric acid and barium chloride.

$$BaCl_2(aq) + H_2SO_4(aq) \longrightarrow 2HCl(aq) + BaSO_4(s)$$

(iv) Change in temperature: The chemical reaction between quick lime and water.

$$CaO(s) + H_2O(l) \longrightarrow Ca(OH)_2(aq) + Heat$$

[CBSE Marking Scheme, 2016] **1 + 1 + 1 + 1 + 1**

AI **Q. 3. Write the balanced chemical equation for the following:**

(a) Calcium hydroxide + Carbon dioxide → Calcium carbonate + water

(b) Zinc + Silver nitrate → Zinc nitrate + Silver

(c) Aluminium + copper chloride → Aluminium chloride + copper

(d) Zinc carbonate → Zinc oxide + Carbon dioxide

(e) Potassium + water → Potassium hydroxide + hydrogen

Ans. (a) $Ca(OH)_2 + CO_2 \rightarrow CaCO_3 + H_2O$

(b) $Zn + 2AgNO_3 \rightarrow Zn(NO_3)_2 + 2Ag$

(c) $2Al + 3CuCl_2 \rightarrow 2AlCl_3 + 3Cu$

(d) $ZnCO_3 \rightarrow ZnO + CO_2$

(e) $2K + 2H_2O \rightarrow 2KOH + H_2$

TOPIC - 2
Types of Chemical Reactions, Corrosion and Rancidity

Revision Notes

➢ **Reactions**

I. Combination Reaction: The reaction in which two or more reactants combine to form a single product.

e.g., (i) Burning of coal

$C(s) + O_2(g) \rightarrow CO_2(g)$

@PROCBSE

(ii) Formation of water

$2H_2(g) + O_2(g) \rightarrow 2H_2O(l)$

(iii) $CaO(s) + H_2O(l) \rightarrow Ca(OH)_2(aq) + Heat$

(Quick lime) (Slaked lime)

Exothermic Reactions: Reaction in which heat is released along with formation of products.

e.g., (i) Burning of natural gas.

$CH_4(g) + 2O_2(g) \rightarrow CO_2(g) + 2H_2O(g) + Heat$

(ii) Respiration is also an exothermic reaction.

$C_6H_{12}O_6(aq) + 6O_2(g) \rightarrow 6CO_2(aq) + 6H_2O(l) + energy$

(Glucose)

II. Decomposition Reaction:

The reaction in which a compound splits into two or more simpler substances is called decomposition reaction.

$$A \rightarrow B + C$$

(a) Thermal decomposition: When decomposition is carried out by heating.

e.g., (i) $2FeSO_4(s) \xrightarrow{Heat} Fe_2O_3(s) + SO_2(g) + SO_3(g)$

(Ferrous sulphate) (Ferric oxide)

Green colour Red-brown colour

(ii) $CaCO_3(s) \xrightarrow{Heat} CaO(s) + CO_2(g)$

(Lime stone) (Quick lime)

(b) Electrolytic Decomposition: When decomposition is carried out by passing electricity.

e.g., $2H_2O(l) \xrightarrow[current]{Electric} 2H_2(g) + O_2(g)$

(c) Photolytic Decomposition: When decomposition is carried out in presence of sunlight.

e.g., (i) $2AgCl(s) \xrightarrow{Sunlight} 2Ag(s) + Cl_2(g)$

(ii) $2AgBr(s) \xrightarrow{Sunlight} 2Ag(s) + Br_2(g)$

This reaction is used in black and white photography.

@PROCBSE JOIN NOW !

Endothermic Reaction: The reactions which require energy in the form of heat, light or electricity to break reactants are called endothermic reactions.

Scan to know more about this topic

Displacement Reaction

III. Displacement Reaction: The chemical reactions in which more reactive element displaces less reactive element from its salt solution.

e.g., (i) $Fe(s) + CuSO_4(aq) \rightarrow FeSO_4(aq) + Cu(s)$

(Iron) (Copper sulphate) (Ferrous sulphate) (Copper)

The iron nail becomes brownish in colour by deposition of Cu and blue colour of $CuSO_4$ changes into dirty green colour due to formation of $FeSO_4$.

(ii) Zinc displaces copper forming zinc sulphate. Zn is more reactive than copper.

$$Zn(s) + CuSO_4(aq) \rightarrow ZnSO_4(aq) + Cu(s)$$

(Zinc Sulphate)

IV. Double Displacement Reaction: A reaction in which new compounds are formed by mutual exchange of ions between two compounds.

$Na_2SO_4(aq) + BaCl_2(aq) \rightarrow BaSO_4(s) + 2NaCl(aq)$

(Sodium sulphate) (Barium chloride) (Barium sulphate) (Sodium chloride)

White precipitate of $BaSO_4$ is formed, so it is also called precipitation reaction.

V. Oxidation and Reduction:

Oxidation: Loss of electrons

Reduction: Gain of electrons

Oxidation: It is a process of gaining oxygen during a reaction by an atom, molecule or ion.

$$2Cu + O_2 \xrightarrow{Heat} 2CuO$$

Reduction: It is the gain of electrons or a decrease in the oxidation state of an atom by another atom, an ion or a molecule.

$$CuO + H_2 \longrightarrow Cu + H_2O$$

@PROCBSE

In this reaction, CuO is reduced to Cu and H_2 is oxidised to H_2O. In other words, one reactant gets oxidised while the other gets reduced. Such reactions are called oxidation-reduction reactions or redox reactions.

Effects of oxidation in everyday life:

- **Corrosion:** The surface of the reactive metal is attacked by air, water and other substances around it, and it corrodes. This process is called corrosion. It is a redox reaction where metal gets oxidised to metal oxide and oxygen gets reduced to oxide ion.
- Rust is mainly hydrated iron (III) oxide, $Fe_2O_3.xH_2O$. Rusting weakens the structure of the body of vehicles, bridges, iron railing etc.
- **Prevention of rusting:**

  (i) The iron articles should be painted.

  (ii) The machine parts should be oiled and greased.

  (iii) Galvanizing of iron is done to avoid corrosion. It is a process of coating iron l with zinc to provide protection against corrosion.

  (iv) Iron can be coated with chromium to prevent rusting.
- **Rancidity:** Rancidity is the process of slow oxidation of oil and fat, present in the food materials resulting in the production of foul odour and taste in them.
- When cooked food items are placed for a long time, they become rancid and unsuitable for the consumption.
- **Methods to prevent rancidity:**

  (i) Packing of food materials in air tight containers.

  (ii) Refrigeration of cooked food at low temperature.

Mnemonics

Concept: Types of chemical reactions	Concept: Types of decomposition reaction
Mnemonics: **ROC. D^3**	Mnemonics: **PET**
Interpretation: **R**eduction **O**xidation **C**ombination **D**ecomposition **D**isplacement **D**ouble Displacement	**Interpretation:** **P**hotolytic reaction, **E**lectrolytic reaction, **T**hermal reaction
Concept: Oxidation and reduction reaction	**Concept: Preventive ways of rusting**
Mnemonics: **OIL RIG**	Mnemonics: **POGG**
Interpretation: **O**xidation: **L**oss of electrons **R**eduction: **G**ain of electrons	**Interpretation:** **P**ainting **O**iling **G**reasing **G**alvanising

Objective Type Questions — 1 mark each

A Multiple Choice Questions

Q. 1. Which of the following reactions is an endothermic reaction?

(i) Burning of coal.

(ii) Decomposition of vegetable matter into compost.

(iii) Process of respiration.

(iv) Decomposition of calcium carbonate to form quick lime and carbon dioxide. [Board SQP, 2020]

Ans. Correct option: (d)

Explanation: The reactions which require energy in the form of heat, light or electricity to break reactants are called endothermic reactions.

Q. 2. The following reaction is an example of a

$4NH_3(g) + 5O_2(g) \rightarrow 4NO(g) + 6H_2O(g)$

@PROCBSE

(i) **Displacement reaction**
(ii) **Combination reaction**
(iii) **Redox reaction**
(iv) **Neutralisation reaction** [NCERT Exemp.]

(a) (i) and (iv) (b) (ii) and (iii)
(c) (i) and (iii) (d) (iii) and (iv)

Ans. Correct option : (c)

Explanation : The given reaction is a redox reaction because oxidation and reduction both take place simultaneously. Also, it is a displacement reaction because hydrogen of NH_3 has been displaced by oxygen.

Q. 3. Three beakers labelled as A, B and C each containing 25 mL of water were taken. A small amount of NaOH, anhydrous $CuSO_4$ and NaCl were added to the beakers A, B and C respectively. It was observed that there was an increase in the temperature of the solutions contained in beakers A and B, whereas in case of beaker C, the temperature of the solution falls. Which one of the following statement(s) is (are) correct?

(i) **In beakers A and B, exothermic process has occurred.**
(ii) **In beakers A and B, endothermic process has occurred.**
(iii) **In beaker C, exothermic process has occurred.**
(iv) **In beaker C, endothermic process has occurred.**

(a) (i) only (b) (ii) only
(c) (i) and (iv) (d) (ii) and (iii)

[NCERT Exemp.]

Ans. Correct option : (c)

Explanation : In beakers A and B, heat is given out, so the temperature of the solution increases, hence it is an exothermic reaction while in beaker C, heat is absorbed from water, so temperature falls, hence it is an endothermic process.

Q. 4. A dilute ferrous sulphate solution was gradually added to the beaker containing acidified permanganate solution. The light purple colour of the solution fades and finally disappears. Which of the following is the correct explanation for the observation?

(a) **$KMnO_4$ is an oxidising agent, it oxidises $FeSO_4$.**
(b) **$FeSO_4$ acts as an oxidising agent and oxidises $KMnO_4$.**
(c) **The colour disappears due to dilution; no reaction is involved.**
(d) **$KMnO_4$ is an unstable compound and decomposes in presence of $FeSO_4$ to a colourless compound.**

[NCERT Exemp.]

Ans. Correct option : (a)

Explanation : A dilute ferrous sulphate solution was gradually added to the beaker containing acidified permanganate solution. A permanganate solution is usually purple in colour. The light purple colour of the solution fades and finally disappears. This is because potassium permanganate ($KMnO_4$) is relatively an unstable compound, it tends to decompose in the presence of ferrous sulphate ($FeSO_4$). This changes the colour of the solution from purple to colourless. $FeSO_4$ gets oxidised to $Fe_2(SO_4)$ as $KMnO_4$ acts as a good oxidising agent in an acidic medium

B Assertions and Reasons Type Questions

Directions: In the following questions, a statement of assertion (A) is followed by a statement of reason (R). Mark the correct choice as:

(a) **Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).**
(b) **Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).**
(c) **Assertion (A) is true but reason (R) is false.**
(d) **Assertion (A) is false but reason (R) is true.**

Q. 1. Assertion (A): Sodium metal is stored under kerosene.

Reason (R): Metallic sodium melts when exposed to air.

Ans. Correct option: (c)

Explanation: Sodium is a very reactive metal. It is kept in kerosene to prevent it from coming in contact with oxygen and moisture. If this happens, it will react with the moisture present in air and form sodium hydroxide. This is a strongly exothermic reaction, and lot of heat is generated.

Q. 2. Assertion (A): To dilute sulphuric acid, acid is added to water and not water to acid.

Reason (R): Specific heat of water is quite large.

Ans. Correct option: (a)

Explanation: The mixing of water to an acid is highly exothermic in nature. If water is added to an acid it produces very large amount of heat which can break the container and some times even causes burning. So it is advised to add concentrated acid to water in very slow manner.

C Very Short Answer Type Questions

Q. 1. Silver chloride when kept in the open turns grey. Illustrate this with a balanced chemical equation.

U [SQP-2020-21]

Ans. It happens because silver chloride decomposes in presence of sunlight.

$$2AgCl(s) \rightarrow 2Ag(s) + Cl_2(g)$$

Q. 2. Name the type of reaction when:

Calcium oxide reacts vigorously with water to produce slaked lime.

U [Modified, Delhi Set -1-2020]

Ans. Combination and Exothermic reaction.

@PROCBSE JOIN NOW

Q. 3. State the type of reaction:
When hydrogen sulphide gas is passed through a blue solution of copper sulphate, a black precipitate of copper sulphide is obtained and the sulphuric acid so formed remains in the solution.
[Modified, Delhi Set -1-2020]

Ans. Double displacement reaction.

Q. 4. The following characteristics are observed in a reaction between sodium sulphate solution and barium chloride solution.
- **exchange of ions takes place**
- **a precipitate is produced.**
- **an insoluble salt is produced**

Name the type of reaction.
R **[Modified, Delhi Set -1-2020]**

Ans. Double displacement.

COMMONLY MADE ERROR
- Students do not give importance to characteristics of reactions and make mistakes.

ANSWERING TIP
- While learning emphasise the main point which will help you to understand the type of reaction.

Q. 5. Why is hydrogen peroxide kept in coloured bottles ?
U **[Board Term-I Set-36, Set (A1), 2011, 2010]**

Ans. Hydrogen peroxide decomposes into H_2O and O_2 in the presence of sunlight and hence to prevent decomposition, they are kept in coloured bottles.

$2H_2O_2 \xrightarrow{\text{Sunlight}} 2H_2O + O_2$ **1**

Q. 6. $N_2 + 3H_2 \longrightarrow 2NH_3$, Name the type of reaction.
A **[Board Term-I Set-A2, 2010]**
[DDE, 2017]

Ans. It is a combination reaction. **1**

Q. 7. Why do silver articles become black after sometime, when exposed to air ?
U **[Board Term-I, 2011]**

Ans. They get tarnished by reacting with atmospheric air to form silver sulphide. **1**

AI **Q. 8. Give reason why do chips manufacturers usually flush bags of chips with gas such as nitrogen ?**
U **[Board Term-I Set (12), 2011]**
[DDE, 2017]

Ans. To prevent the oil and fats of the chips from being oxidized or become rancid. **1**

Q. 9. Write a chemical equation for double displacement reaction. A **[DDE, 2017]**
[Board Term, 2011]

Ans. Double displacement Reaction:
$Na_2SO_4(aq) + BaCl_2(aq) \longrightarrow BaSO_4(s) + 2NaCl(aq)$ **1**

COMMONLY MADE ERROR
- Students sometimes commit errors in writing the reactants and the products.

ANSWERING TIP
- Practice writing the balanced equation with correct reactants and products.

Q. 10. In the double displacement reaction between aqueous potassium iodide and aqueous lead nitrate, a yellow precipitate of lead iodide is formed. While performing the activity if lead nitrate is not available, name other salt of lead which can be used? AE

Ans. Lead acetate can be used in place of lead nitrate.

Short Answer Type Questions-I — 2 marks each

Q. 1. When Hydrogen gas is passed over heated copper (II) oxide, copper and steam are formed. Write the balanced chemical equation with physical states for this reaction. State what kind of chemical reaction is this? U

Ans. (i) $Cu O (s) + H_2 (g) \xrightarrow{\text{Heat}} Cu(s) + H_2O (g)$
(ii) Redox reaction
[CBSE Marking Scheme, 2015]

Q. 2. What is a combination reaction? State one example giving balanced chemical equation for the reaction. R

Ans. A reaction in which two or more simpler substances combine to form a single product.

Example: $C + O_2 \xrightarrow{\text{burn}} CO_2$

$2H_2 + O_2 \rightarrow 2H_2O$

Q. 3. List four observations that help us to determine whether a chemical reaction has taken place. U

Ans. (i) Evolution of a gas.
(ii) Change in temperature.
(iii) Change in state.
(iv) Change in colour.

@PROCBSE

Short Answer Type Questions-II — 3 marks each

Q. 1. What is 'rusting'? Describe with a labelled diagram an activity to investigate the conditions under which iron rusts. R [Delhi Set -II-2020]

Ans. Rusting: The process of acquiring a coating of a brown flaky substance called rust on iron when it is exposed to moist air for a long time.

Activity:

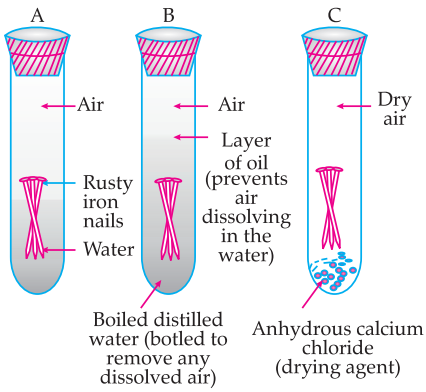
- Take three test tubes and label them as A, B and C.
- In each tube, place clean iron nails.
- Pour some water in test tube A and cork it.
- Pour distilled water in test tube B, add about 1 ml of oil and cork it.
- Put some anhydrous calcium chloride in test tube C and cork it.
- Leave the test tube for few days.

Observation:

Iron nails rusts in test tube A but they do not rust in test tubes B and C.

Explanation:

- It is because, in the test tube A, the nails are exposed to both air and water.



- In test tube B, the nails are exposed to only water because the oil prevents the air from dissolving in water.
- In test tube C, the nails are exposed to dry air because $CaCl_2$ will absorb the moisture from the air.

Conclusion: Air and water both are essential conditions for rusting.

Q. 2. You might have noted that when copper powder is heated in a china dish, the reddish brown surface of copper powder becomes coated with a black substance.

(a) Why has this black substance formed ?

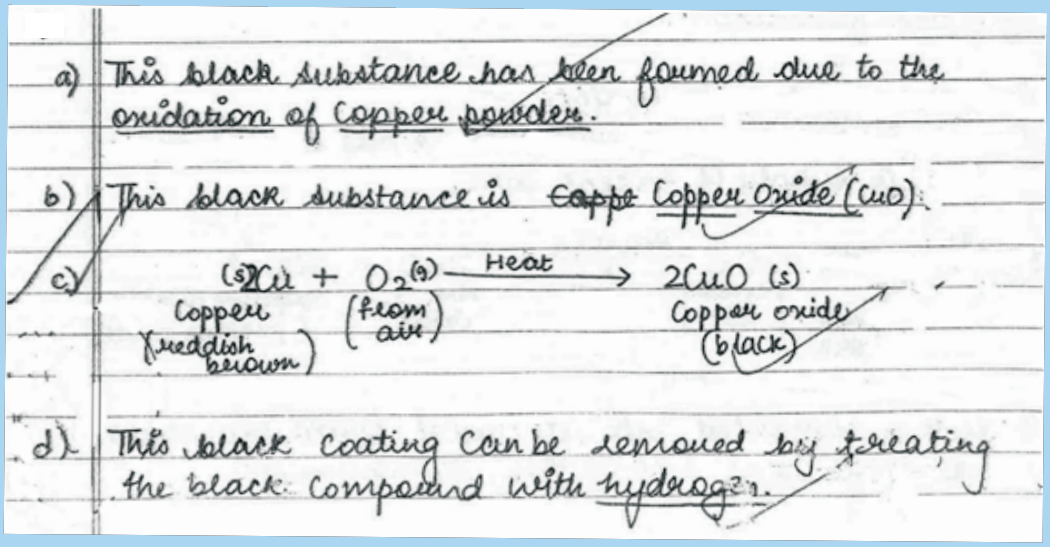
(b) What is this black substance ?

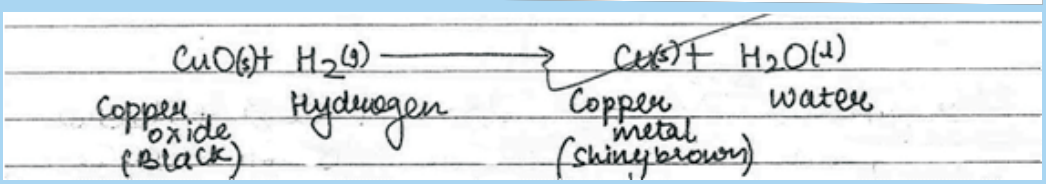
(c) Write the chemical equation of the reaction that takes place.

(d) How can the black coating on the surface be turned reddish? brown ? [2019- Topper's answer]

Topper Answer, 2019

Ans.



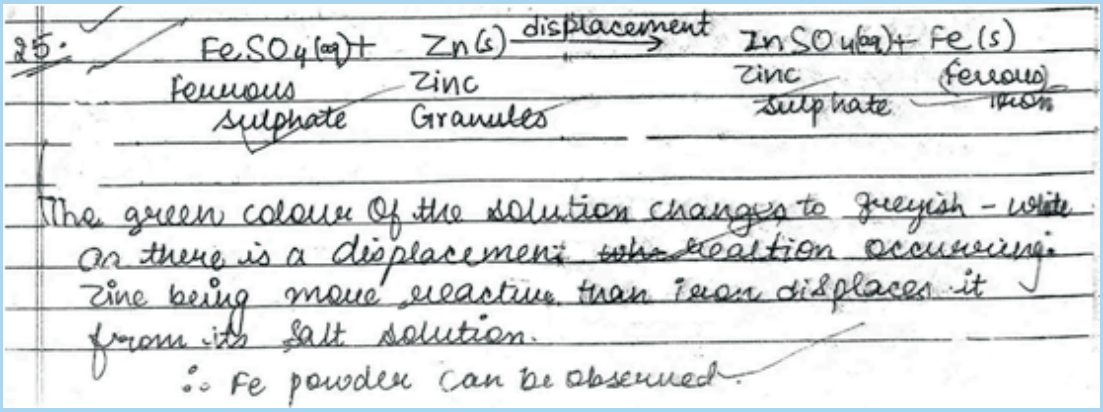


@PROCBSE

Q. 3. What would you observe on adding zinc granules to freshly prepared ferrous sulphate solution ? Give reason for your answer. U [2019 Topper's Answer]

Topper Answer, 2019

Ans.



Q. 4. 2 g of silver chloride is taken in a china dish and the china dish is placed in sunlight for sometime. What will be your observation in this case ? Write the chemical reaction involved in the form of a balanced chemical equation. Identify the type of chemical reaction.

U [Board Delhi, Set- I, 2019]

Ans.
- White silver chloride turns grey in sunlight **1**
- $2AgCl \xrightarrow{\text{Sunlight}} 2Ag + Cl_2$ **1**
- Decomposition reaction/Photolytic decomposition **1**

[CBSE Marking Scheme, 2019] **1+1+1**

COMMONLY MADE ERROR

- Many students write unbalanced equation which leads to deduction of marks.

ANSWERING TIP

- Ensure every equation written is balanced.

Q. 5. Identify the type of reactions taking place in each of the following cases and write the balanced chemical equation for the reactions.

(a) Zinc reacts with silver nitrate to produce zinc nitrate and silver.

(b) Potassium iodide reacts with lead nitrate to produce potassium nitrate and lead iodide.

U [CBSE Board Delhi, Set- I, 2019]

Ans. (a) Displacement reaction

$Zn + 2AgNO_3 \longrightarrow Zn(NO_3)_2 + 2Ag$

(b) Double displacement reaction

$2KI + Pb(NO_3)_2 \longrightarrow PbI_2 + 2KNO_3$

[CBSE Marking Scheme, 2019] **1 ½ + 1 ½**

COMMONLY MADE ERROR

- Students forget to balance the chemical equation and lose marks.

ANSWERING TIP

- Practice writing the balanced chemical equations.

Q. 6. On heating blue coloured powder of copper (II) nitrate in a boiling tube, black copper oxide, O_2 and a brown gas X is formed.

(a) Identify the type of reaction and the gas X.

(b) Write balanced chemical equation of the reaction.

R [CBSE Board Outside Delhi, Set-I, 2019]

Ans. (a) Decomposition / Thermal decomposition, ½

The gas X is NO_2 or (nitrogen dioxide) ½

(b) $2Cu(NO_3)_2 \xrightarrow{\text{Heat}} 2CuO + 4NO_2 + O_2$ **1**

Note: For (b) ½ mark for equation and ½ mark for balancing the equation **1**

[CBSE Marking Scheme, 2019]

Detailed Answer:

(a) Type of reaction: Thermal decomposition reaction. The gas X is nitrogen dioxide.

(b) $2Cu(NO_3)_2(s) \rightarrow 2CuO(s) + 4NO_2(g) + O_2(g)$

Copper nitrate(II) — Black — Brown

1+1+1

Q. 7. Define the term decomposition reaction. Give one example each of thermal decomposition and electrolytic decomposition.

U [Board Term-I, 2016]

@PROCBSE

Ans. Reaction in which a single reactant breaks down to give simpler products by heating.

Thermal decomposition:

$$CaCO_3 \xrightarrow{\Delta} CaO + CO_2$$ **(Or any other)**

Electrolytic decomposition:

$$2\,H_2O \xrightarrow{\text{Electric current}} 2H_2 + O_2$$

[CBSE Marking Scheme, 2016] **1 + 1 + 1**

Q. 8. Decomposition reactions require energy either in the form of heat or light or electricity for breaking down the reactants. Write one equation each for decomposition reactions where energy is supplied in the form of heat, light and electricity.

R [Delhi/Outside Delhi, 2018]

Ans.

$$CaCO_3 \xrightarrow{\text{heat}} CaO + CO_2$$

$$2FeSO_4 \xrightarrow{\text{heat}} Fe_2O_3 + SO_2 + SO_3$$

$$2Pb(NO_3)_2 \xrightarrow{\text{heat}} 2PbO + 4NO_2 + O_2$$

} Any one

$$2AgCl \xrightarrow{\text{Sunlight}} 2Ag + Cl_2$$

$$2AgBr \xrightarrow{\text{Sunlight}} 2Ag + Br_2$$

} Any one

$$2H_2O \xrightarrow{\text{electricity}} 2H_2 + O_2$$

(or any other equation for above decomposition reaction.)

Note: No marks to be deducted if equations are not balanced. **1+1+1**

[CBSE Marking Scheme, 2018]

COMMONLY MADE ERROR

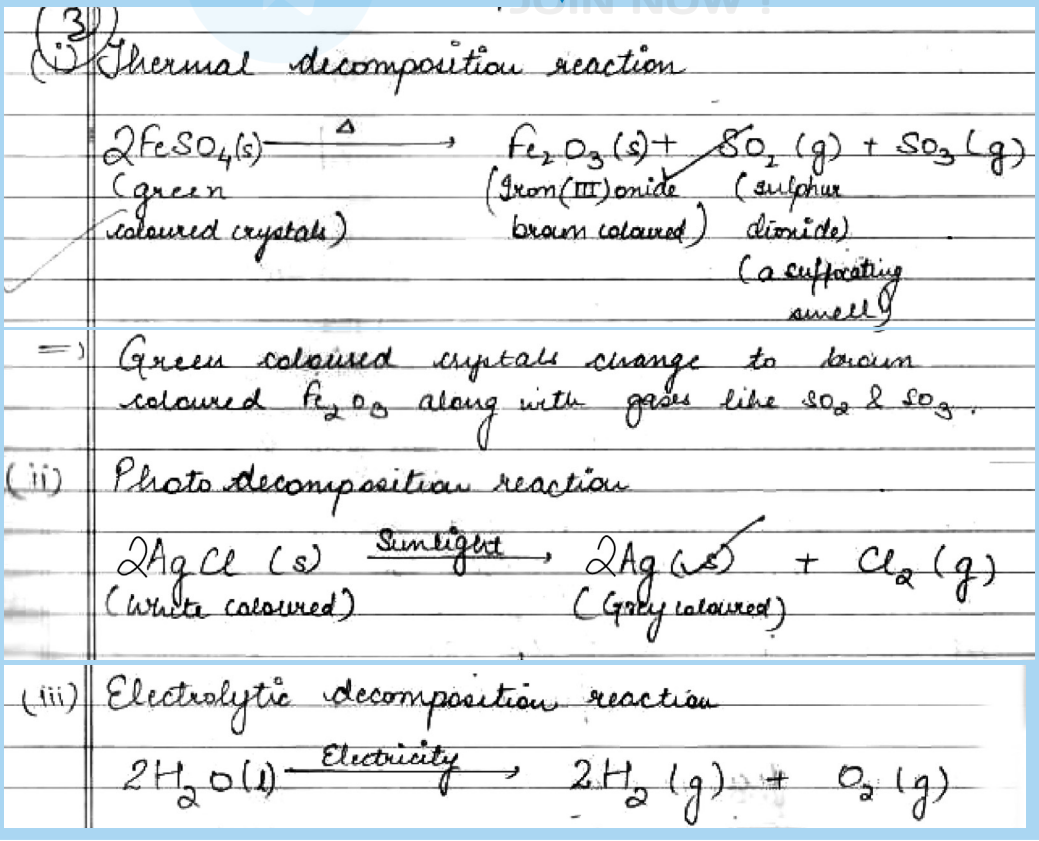
- Usually students get confused in the necessary conditions and liberation of gases in the reaction.

ANSWERING TIP

- Keenly observe the necessary conditions for the reactions during practical, prepare a list of type of decomposition reactions, its necessary conditions and gases released and practise it.

Topper Answer, 2018

Ans.



@PROCBSE

Q. 9. In the reaction:

$MnO_2 + 4HCl \rightarrow MnCl_2 + 2H_2O + Cl_2$

(a) Name the compound (i) oxidised, (ii) reduced.

(b) Define oxidation and reduction on its basis.

U+R [Compartment Set 1, 2,3 , 2018]

Ans. (a) (i) HCl is oxidized. ½

(ii) MnO_2 is reduced. ½

(b) (i) Oxidation: Gain of Oxygen or loss of Hydrogen. **1**

(ii) Reduction: Gain of Hydrogen or loss of Oxygen. [CBSE Marking Scheme, 2018] **1**

COMMONLY MADE ERROR

➲ Usually students get confused with the oxidised and reduced substances in the reaction.

ANSWERING TIP

➲ Students must remember that oxidation, a process in which oxygen or an electronegative element is added, while reduction is a process in which addition of hydrogen or an electropositive element takes place.

Q. 10. Balance the following chemical equations and state whether they are exothermic or endothermic:

(i) $Na + H_2O \longrightarrow NaOH + H_2$

(ii) $FeSO_4 \longrightarrow Fe_2O_3 + SO_2 + SO_3$

A [Board Term-I, 2016]

Ans. (i) $2Na + 2H_2O \longrightarrow 2NaOH + H_2$

It is an exothermic reaction.

(ii) $2FeSO_4(s) \xrightarrow{\Delta} Fe_2O_{3\,(s)} + SO_2(g) + SO_3(g)$

It is an endothermic reaction. **1½ + 1½**

AI **Q. 11. Name the term used to indicate the development of unpleasant smell and taste in fats and oils containing food due to oxidation. What are anti-oxidants ? Why are they added to fat and oil containing food ?** R [Board Term-I, 2016]

Ans. Rancidity.

Anti-oxidants are substances which prevent oxidation, actually are reducing agents. When added to food, the fats and oils present in the food do not get oxidized easily, hence do not turn rancid and remain good to eat for longer time.

1 + 1 + 1

[CBSE Marking Scheme, 2016]

Q. 12. Name two metals which do not corrode easily. Give an example in each of the following case to support that:

(i) Corrosion of some metals is an advantage.

(ii) Corrosion of a metal is a serious problem.

U [Board Term-I, 2016]

Ans. Gold and platinum.

(i) Corrosion of aluminium is useful. A protective layer of aluminium oxide is formed on the surface of the metal which renders the metal passive and prevents its further corrosion.

(ii) Corrosion of iron is a serious problem. Every year large amount of money is spent to replace damaged iron and steel structures. So, here, corrosion is a serious problem. **1 + 1 + 1**

[CBSE Marking Scheme, 2016]

Q. 13. During the reaction of some metals with dilute hydrochloric acid, the following observations were made by a student.

(a) Silver does not show any change.

(b) Some bubbles of a gas are seen when lead is reacted with the acid.

(c) The reaction of sodium is found to be highly explosive.

(d) The temperature of the reaction mixture rises when aluminium is added to the acid.

Explain these observations giving appropriate reason.

R [CBSE Outside Delhi, Set- III, 2019]

Ans. (a) Silver is placed below hydrogen in reactivity series / among least reactive metal / Silver does not react with dil. hydrochloric acid. ½

(b) Rate of reaction is slow / bubbles of hydrogen gas are formed / lead lies above hydrogen in reactivity series. **1**

(c) Sodium is highly reactive / reaction is highly exothermic, evolving hydrogen gas, which catches fire. **1**

(d) Reaction is exothermic. ½

[CBSE Marking Scheme, 2019]

Detailed Answer:

(a) As silver is placed below hydrogen in reactivity series thus is less reactive it does not react with dilute hydrochloric acid.

(b) Bubbles are seen due to the evolution of hydrogen gas.

$Pb(s) + 2HCl\,(aq) \rightarrow PbCl_2(aq) + H_2(g)$

(c) As sodium is highly reactive metal, it reacts with dilute hydrochloric acid vigorously with evolution of heat.

(d) The reaction between aluminium with dilute hydrochloric acid is exothermic thus, the temperature of the mixture rises on the addition of aluminium. **½+½+1+1**

@PROCBSE

Long Answer Type Questions — 5 marks each

Q. 1. (i) Define corrosion.
(ii) What is corrosion of iron called ?
(iii) How will you recognise the corrosion of silver ?
(iv) Why corrosion of iron is a serious problem ?
(v) How can we prevent corrosion of iron ?

R [Board Term-I, 2016]
[NCERT 2017]

Ans. (i) Corrosion is a process in which metals are deteriorated by action of air, moisture, chemicals etc.
(ii) Rusting.
(iii) Silver - black, copper green.
(iv) It causes destruction of car bodies, bridges, railing etc. **(Any two)**
(v) By Painting, alloying, greasing etc. **(Any two)**
[CBSE Marking Scheme, 2016] **5**

Detailed Answer:
(i) Corrosion is a process in which metals are deteriorated by action of air, moisture, chemicals etc.
(ii) Corrosion of iron is called rusting.
(iii) Silver turns black as it reacts with H_2S present in air and forms a layer of Ag_2S.
(iv) Corrosion of iron is a serious problem because it leads to wastage of tonnes of iron every year and lot of money is spent to repair or replace it.
(v) The iron articles should be painted to prevent them from corrosion. **1 + 1 + 1 + 1 + 1**

COMMONLY MADE ERROR

- Some students write improper definition of corrosion.
- They often give wrong ways to control corrosion.

ANSWERING TIP

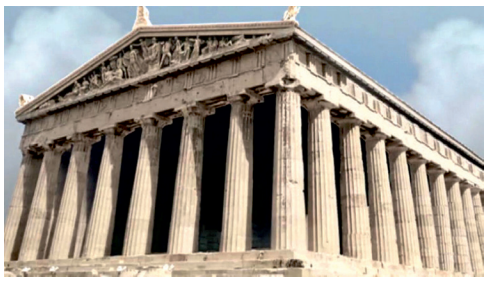
- Carefully learn the concept of corrosion with examples.

Q. 2. Identify the type of chemical reaction in the following statements and define each of them:
(i) Digestion of food in our body
(ii) Rusting of iron
(iii) Heating of manganese dioxide with aluminium powder.
(iv) Blue colour of copper sulphate solution disappears when iron filings are added to it.
(v) Dilute hydrochloric acid is added to sodium hydroxide solution to form sodium chloride and water. A [Board Term-I, 2016]

Ans. (i) Decomposition Reaction: Carbohydrates are broken down to form glucose.
(ii) Oxidation Reaction: When an iron object is left in moist air for a considerable time, it gets covered with a red brown flaky substance called rust.
(iii) Displacement reaction: More reactive metal displaces less reactive metal from its salt solution.
(iv) Displacement reaction: More reactive metal displaces less reactive metal from its salt solution.
(v) Double displacement reaction: Reaction in which two compounds react by an exchange of ions to form two new compounds. **1 × 5**
[CBSE Marking Scheme, 2016]

Visual Case-based Questions — 4 marks each

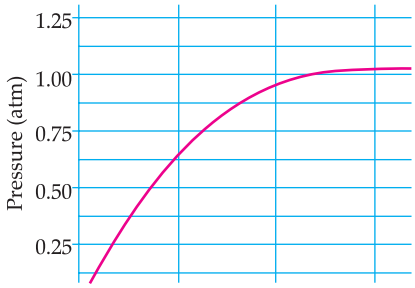
Q. 1. Read the following and answer any four questions from (a) to (e): [CBSE–QB 2021]
Marble's popularity began in ancient Rome and Greece, where white and off-white marble were used to construct a variety of structures, from hand-held sculptures to massive pillars and buildings.



(a) The substance not likely to contain $CaCO_3$ is
(i) Dolomite
(ii) A marble statue
(iii) Calcined gypsum
(iv) Sea shells.

(b) A student added 10g of calcium carbonate in a rigid container, secured it tightly and started to heat it. After some time, an increase in pressure was observed, the pressure reading was then noted at intervals of 5 minutes and plotted against time, in a graph as shown below. During which time interval did maximum decomposition took place?

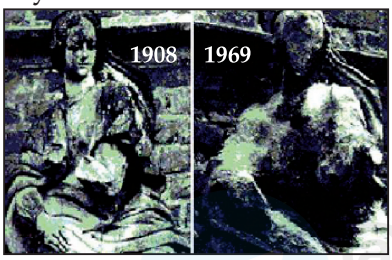
@PROCBSE



(i) 15-20 min **(ii)** 10-15 min
(iii) 5-10 min **(iv)** 0-5 min

(c) Gas A, obtained above is a reactant for a very important biochemical process which occurs in the presence of sunlight. Identify the name of the process -
(i) Respiration **(ii)** Photosynthesis
(iii) Transpiration **(iv)** Photolysis

(d) Marble statues are corroded or stained rain water. Identify the main reason



(i) decomposition of calcium carbonate to calcium oxide
(ii) polluted water is basic in nature hence it reacts with calcium carbonate
(iii) polluted water is acidic in nature he
(iv) calcium carbonate dissolves in water to give calcium hydroxide.

(e) Calcium oxide can be reduced to calcium, by heating with sodium metal. Which compound would act as an oxidizing agent in the above process?
(i) sodium **(ii)** sodium oxide
(iii) calcium **(iv)** calcium oxide

Ans. (a) calcined gypsum contains $CaSO_4$. $1/2H_2O$
(b) 0-5 min
(c) photosynthesis
(d) polluted water is acidic in nature, hence it reacts with calcium carbonate
(e) calcium oxide

Q. 2. Read the following and answer any four questions from (a) to (e): **[CBSE–QB 2021]**

Chemistry in Automobiles:

For an internal combustion engine to move a vehicle down the road, it must convert the energy stored in the fuel into mechanical energy to drive the wheels. In your car,the distributor and battery provide this starting energy by creating an electrical "spark",which helps in combustion of fuels like gasoline. Below is the reaction depicting complete combustion of gasoline in full supply of air:

$$2C_8H_{18}(l) + 25O_2(g) \longrightarrow 16\ 'X' + Y$$

(a) Which of the following are the products obtained from the reaction mentioned in the above case?

	Product 'X'	Product 'Y'
(i)	CO_2	H_2O_2
(ii)	H_2O	CO
(iii)	CH_3OH	H_2O
(iv)	CO_2	H_2O

(b) Identify the types of chemical reaction occurring during the combustion of fuel:
(i) Oxidation & Endothermic reaction
(ii) Decomposition & Exothermic reaction
(iii) Oxidation & Exothermic reaction
(iv) Combination & Endothermic reaction

(c) On the basis of evolution/absorption of energy, which of the following processes are similar to combustion of fuel?
(i) Photosynthesis in plants
(ii) Respiration in the human body
(iii) Decomposition of vegetable matter
(iv) Decomposition of ferrous sulphate.
(1) (ii) & (iii) **(2)** (i) & (ii)
(4) (iii) & (iv) **(4)** (ii) & (i)

(d) 'A student while walking on the road observed that a cloud of black smoke belched out from the exhaust stack of moving trucks on the road.' Choose the correct reason for the production of black smoke:
(i) Limited supply of air leads to incomplete combustion of
(ii) Rich supply of air leads to complete combustion of fuel.
(iii) Rich supply of air leads to a combination reaction.
(iv) Limited supply of air leads to complete combustion of fuel.

(e) 'Although nitrogen is the most abundant gas in the atmosphere, it does not combustion'. Identify the correct reason for this statement.
(i) Nitrogen is a reactive gas
(ii) Nitrogen is an inert gas
(iii) Nitrogen is an explosive gas
(iv) Only hydrocarbons can take part in combustion

Ans. (a) (iv)
(b) (iii)
(c) (i)
(d) (i)
(e) (ii)

Q. 3. Read the given passage and answer any four questions from (a) to (e).

The physical states of the reactants and products can be represented by using the symbols (s) for solids, (l) for liquids, (g) for gases and (aq) for aqueous solution along with their respective formulae. The word aqueous is written if the reactant or product is present as a solution in water. Precipitate can also be represented by using an arrow pointing downwards (↓) instead of using symbol (s).

@PROCBSE JOIN NO

@PROCBSE

In the same way, the gaseous state of an evolved gas can be represented by using an arrow pointing upward direction (↑) instead of using symbol (g). The specific condition of the reaction like temperature, pressure, catalyst etc. is written above or below the arrow in the chemical equation.

(a) If the reactant or product is present as a solution of water , it is represented as:

(i) (s) **(ii)** (l) **(iii)** (aq) **(iv)** ↓

(b) The correct way to represent the evolution of gas, is to use which of the following symbol:

(i) ↓ **(ii)** → **(iii)** ↑ **(iv)** (g)

(c) Complete the missing variable given as X and Y in the following reaction:

$2Na\ (s) + 2H_2O\ (l) \rightarrow 2NaOH\ (X) + H_2\ (Y)$

(i) (aq) and (g) **(ii)** (s) and (g)

(iii) (g) and (l) **(iv)** (g) and (aq)

(c) Which of the following reaction is balanced?

(i) $NaCl + 2H_2O \rightarrow 2NaOH + 2Cl_2 + H_2$

(ii) $2NaCl + H_2O \rightarrow 2NaOH + 2Cl_2 + H_2$

(iii) $2NaCl + 2H_2O \rightarrow 2NaOH + Cl_2 + H_2$

(iv) $2NaCl + 2H_2O \rightarrow NaOH + Cl_2 + H_2$

(d) Which of the following reaction is balanced?

(i) $Mg\ (aq) + H_2SO_4\ (aq) \rightarrow MgSO_4\ (aq) + H_2 \uparrow$

(ii) $Mg\ (s) + H_2SO_4\ (aq) \rightarrow MgSO_4\ (aq) + H_2 \uparrow$

(iii) $Mg\ (s) + H_2SO_4\ (l) \rightarrow MgSO_4\ (l) + H_2(g)$

(iv) $Mg\ (s) + H_2SO_4\ (l) \rightarrow MgSO_4\ (s) + H_2$

Ans. (a) (iii) (aq)

(b) (iii) ↑

(c) (i) (aq) and (g)

(d) (iii) $2NaCl + 2H_2O \rightarrow 2NaOH + Cl_2 + H_2$

(d) (ii) $Mg\ (s) + H_2SO_4\ (aq) \rightarrow MgSO_4\ (aq) + H_2 \uparrow$

Q. 4. In the following chemical reaction ''zinc oxide reacts with carbon to produce zinc metal and carbon monoxide.'' Answer any four question from I to V.

$$ZnO + C \rightarrow Zn + CO$$

(a) Name the substance getting oxidised and reduced in the above reaction: R

(i) C and ZnO **(ii)** Zn and C

(iii) ZnO and CO **(iv)** CO and ZnO

(b) Name the type of reaction: U

(i) oxidation reaction

(ii) reduction reaction

(iii) redox reaction

(iv) decomposition reaction

(c) The reduction reaction involves: R

(i) gain of electrons

(ii) loss of electrons

(iii) increase in oxidation state

(iv) addition of oxygen

(d) Which of the following is the effect of oxidation reaction in everyday life:

(i) Precipitation

(ii) Fermentation

(iii) Corrosion

(iv) Hydrogenation of oil

(e) The reactions used in black and white photography: R

(i) Decomposition of silver bromide

(ii) Decomposition of silver chloride

(iii) Both

(iv) None of the above

Ans. (a) (i) C and ZnO

(b) (iii) redox reaction

(c) (i) gain of electrons

(d) (iii) Corrosion

(e) (iii) Both

Q. 5. P, Q and R are 3 elements which undergo chemical reactions according to the following equations Answer any four question from I to V :

(i) $P_2O_3 + 2Q \rightarrow Q_2O_3 + 2P$

(ii) $3RSO_4 + 2Q \rightarrow Q_2(SO_4)_3 + 3R$

(iii) $3RO + 2P \rightarrow P_2O_3 + 3R$

(a) The most reactive and the least reactive elements are: U

(i) Q and P **(ii)** Q and R

(iii) R and Q **(iv)** R and P

(b) The type of reaction is : R

(i) Displacement reaction

(ii) Combination reaction

(iii) Neutralisation reaction

(iv) Substitution reaction

(c) $3RSO_4 + 2Q \rightarrow Q_2(SO_4)_3 + 3R$

The given reaction shows: AE

(i) Q is more reactive than R

(ii) Q is less reactive than R

(iii) Q and R are equally reactive

(iv) none of the above

(d) Choose the correct statement: U

(i) Zinc and lead are more reactive elements than copper.

(ii) Zinc and lead are less reactive elements than copper.

(iii) Zinc and copper are more reactive elements than lead.

(iv) Copper and lead are more reactive elements than zinc.

(e) $Na_2SO_4\ (aq) + BaCl_2(aq) \rightarrow BaSO_4\ (s) + 2NaCl(aq)$

The above reaction is an example of: R

(i) Double displacement reaction.

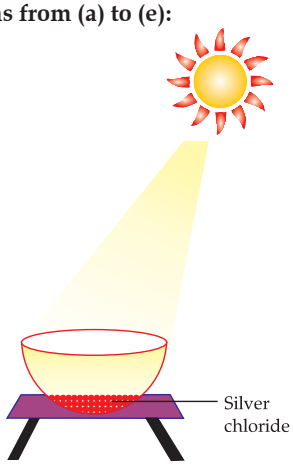
(ii) Displacement reaction.

@PROCBSE JOIN NOW!

(iii) Can be both.
(iv) None of the above.

Ans. (a) (ii) Q and R
(b) (i) Displacement reaction
(c) (i) Q is more reactive than R
(d) (i) Zinc and lead are more reactive elements than copper
(e) (i) Double displacement reaction

Q. 6. The following diagram displays a chemical reaction. Observe carefully and answer any four questions from (a) to (e):



(a) The type of chemical reaction that will take place is R
(i) Photochemical decomposition
(ii) Displacement reaction
(iii) Reduction reaction
(d) Combination reaction

(b) What colour change is observed in silver chloride? U
(i) Silver chloride turns white.
(ii) Silver chloride turns brown.
(iii) Silver chloride shows no colour change.
(iv) White silver chloride changes to grey.

(c) The correct balanced chemical equation involves: AE
(i) $2AgCl\ (s) \xrightarrow{sunlight} 2Ag\ (s) + Cl_2\ (g)$
(ii) $Ag + Cl \rightarrow AgCl$
(iii) $AgCl_2 \rightarrow Ag_2 + Cl_2$
(iv) $AgCl \xrightarrow{sunlight} 2Ag + Cl_2$

(d) When decomposition is carried out by heating, it is called as: R
(i) Heat decomposition
(ii) Photolytic decomposition
(iii) Electrolytic decomposition
(iv) Thermal decomposition

(e) The other silver salt which behaves like silver chloride in sunlight is: U
(i) silver hydride
(ii) silver bromide
(iii) silver iodide
(iv) silver nitrite

Ans. (a) (i) Photochemical decomposition
(b) (i) White silver chloride changes to grey.
(c) (i) $2AgCl\ (s) \xrightarrow{sunlight} 2Ag\ (s) + Cl_2\ (g)$
(d) (iv) Thermal decomposition
(e) (ii) silver bromide

@PROCBSE JOIN NOW !

Know the Terms

- **Chemical equation:** It is a complete symbolic representation of a chemical reaction involving reactants and products.
- **Electrolysis:** When a decomposition reaction is carried out with the help of electric current, the process is called electrolysis.
- **Redox reaction:** Those reactions in which oxidation and reduction take place simultaneously are called **redox reactions**.
- **Oxidising agent:** It is a substance which can add oxygen or an electronegative element to other materials. It can also remove hydrogen or an electropositive element from other materials.
- **Reducing agent**: It is a substance which can add hydrogen or an electropositive element to other materials. It can also remove oxygen or an electronegative element from other materials.

OSWAAL LEARNING TOOL
To learn from Oswaal Concept Video
Visit: http:qrgo.page.link OR Scan this code

❑❑❑

@PROCBSE

Acids, Bases and Salts

Physical Properties of Acids

Sour in taste

Turns blue litmus red

Give H^+ ions in aqueous solution

Aqueous solution conduct electricity

Physical Properties of Bases

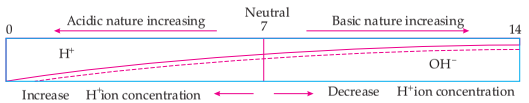
Bitter in taste

Turns red litmus blue

Give OH^- ions in aqueous solution

Aqueous solution conduct electricity

Classification of Acid, Base and Neutral solutions based on pH scale



pH scale: It is the H^+ ion Concentration of the solutions, denoted by pH

Chemical Properties of Acids

Reacts with metals to liberate hydrogen.

Acid + Metal → Salt + Hydrogen Gas

$2HCl + Zn \rightarrow ZnCl_2 + H_2\uparrow$

Reacts with metal carbonates/metal hydrogen carbonate to liberate CO_2

- $2HCl + Na_2CO_3 \rightarrow 2NaCl + CO_2 + H_2O$
- $HCl + NaHCO_3 \rightarrow NaCl + CO_2 + H_2O$

Reacts with certain metal oxides to form salt and water.

Metal oxide + Acid → Salt + Water

Chemical Properties of Bases

Alkali reacts with metal to liberate hydrogen gas.

$2NaOH + Zn \rightarrow Na_2ZnO_2 + H_2\uparrow$

Bases reacts with acidic oxides to form salts.

$2NaOH + CO_2 \rightarrow Na_2CO_3 + H_2O$

Salts

When acid and base are combined under the given condition, Salt is obtained

Types of salts

Common salt: $NaOH + HCl \rightarrow NaCl + H_2O$

Bleaching Powder: $Ca(OH)_2 + Cl_2 \rightarrow CaOCl_2 + H_2O$

Baking Soda: $NaCl + H_2O + CO_2 + NH_3 \rightarrow NH_4Cl + NaHCO_3$

Washing Soda: $Na_2CO_3 + 10H_2O \rightarrow Na_2CO_3 \cdot 10H_2O$

Plaster of Paris: $CaSO_4.2H_2O \rightarrow CaSO_4 \cdot \frac{1}{2}H_2O + 1\frac{1}{2}H_2O$

Gypsum: $CaSO_4.\frac{1}{2}H_2O + 1\frac{1}{2}H_2O \rightarrow CaSO_4.2H_2O$

Trace the Mind Map

First Level · Second Level · Third Level

@PROCBSE

CHAPTER

2 ACIDS, BASES AND SALTS

Syllabus

Their definitions in terms of furnishing of H^+ and OH^- ions, general properties, examples and uses, concept of pH scale (Definition relating to logarithm not required), importance of pH in everyday life; preparation and uses of Sodium Hydroxide, Bleaching powder, Baking soda, Washing soda and Plaster of Paris.

Trend Analysis

List of Concept	2018	2019		2020	
	OD/D	OD	D	OD	D
Acids, bases and salts and their definitions	1 Q (3 M)	1 Q (3 M)	1 Q (3 M)	1 Q (1 M)	1 Q (1 M)
Concept of pH scale and its importance in everyday life.	Or 1 Q (3 M)	1 Q (3 M)	—	—	1 Q (1 M)
Chemical Salts, Preparations, Properties and Uses		Or 1 Q (3 M)	1 Q (3 M)	Or 1 Q (3 M)	1 Q (3 M)

@PROCBSE JOIN NOW !

TOPIC - 1
Acids and Bases

Revision Notes

Introduction

- Acids are sour in taste. They turn blue litmus red. Acids are the substances that furnish H^+ ions in aqueous solution.
- If in an aqueous solution, concentration of acid is low, it is called **dilute solution** and if concentration of acid is high, it is called **concentrated solution**.
- Hydrochloric acid is released in stomach to make medium acidic in nature. It leads to coagulation of protein and helps in their digestion. HCl kills bacteria coming in the stomach along with the food.
- When a burning matchstick is brought near the hydrogen gas, it burns with a pop sound.
- When CO_2 gas is passed through lime water, it turns milky. If CO_2 is passed in excess, milkiness disappears.

TOPIC - 1
Acids and Bases
Page No. 20
TOPIC - 2
Salts, Their Properties and Uses
Page No. 30

@PROCBSE

- There are many natural substances like red onion peels, red cabbage leaves, beetroot extract, coloured petals of some flowers, which are called indicators because they indicate the presence of acid or base by showing the change in colour.
- Acids react with certain metal oxides to form salt and water. Acids react with metal carbonates and hydrogen carbonates to produce carbon dioxide gas.
- Strong bases react with active metals to produce hydrogen gas. Bases react with non-metallic oxides to produce salt and water.
- Both acids and bases conduct free electric current in their aqueous solution due to the presence of free ions.
- Strength of an acid or base depends on the number of H^+ ions or OH^- ions produced by them respectively. More the H^+ ions produced by an acid, stronger is the acid. More the OH^- ions produced by a base, stronger is the base.
- **Indicators:** These are the substances which change their colour / smell in different types of substances.
- **Types of Indicators:**

	S. No.	Indicator	Smell/Colour In Acid Solution	Smell/Colour In Basic Solution
Natural Indicator	1.	Litmus	Red	Blue
	2.	Red cabbage leaf extract	Red	Green
	3.	Flowers of hydrangea plant	Blue	Pink
	4.	Turmeric	No change	Red
Synthetic Indicator	1.	Phenolphthalein	Colourless	Pink
	2.	Methyl orange	Red	Yellow
Olfactory Indicator	1.	Onion	Characteristic smell	No smell
	2.	Vanilla essence	Retains smell	No smell
	3.	Clove oil	Retains smell	Loses smell

- **Chemical Properties of Acids and Bases:**

1. Reaction of Metals with:

Acids	Bases
Acid + Metal → Salt + Hydrogen gas	Base + Metal → Salt + Hydrogen gas
e.g., $2HCl + Zn \rightarrow ZnCl_2 + H_2\uparrow$ (Zinc chloride)	e.g., $2NaOH + Zn \rightarrow Na_2ZnO_2 + H_2\uparrow$ (Sodium zincate)

Test for H_2 gas: Hydrogen gas released can be tested by bringing a burning candle near gas bubbles, it bursts with pop sound.

2. Reaction of Metal Carbonates / Metal Hydrogen Carbonates with:

Acids	Bases
Acid + Metal Carbonate / Metal hydrogen Carbonate ↓ Salt + CO_2 + H_2O	Base + Metal Carbonate / Metal Hydrogen Carbonate ↓ No Reaction

e.g., $2HCl + Na_2CO_3 \rightarrow 2NaCl + CO_2 + H_2O$

$HCl + NaHCO_3 \rightarrow NaCl + CO_2 + H_2O$

Test for CO_2: CO_2 can be tested by passing it through lime water. Lime water turns milky.

$Ca(OH)_2 + CO_2 \rightarrow CaCO_3 + H_2O$

When excess CO_2 is passed, milkiness disappears.

$CaCO_3 + CO_2 + H_2O \rightarrow Ca(HCO_3)_2$

3. Reaction of Acids and Bases With Each Other

Neutralization Reaction: Reaction of acid with base is called neutralization reaction.

e.g., $HCl + NaOH \rightarrow NaCl + H_2O$

- **If:**

Strong Acid + Weak Base → Acidic salt + H_2O

Scan to know more about this topic — Acid

Scan to know more about this topic — Base

Scan to know more about this topic — Acid-Base Conductivity

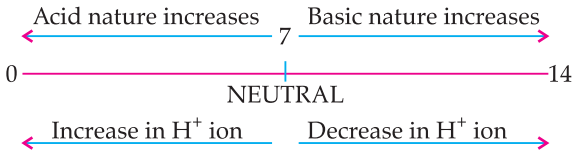
Scan to know more about this topic — Dilution

@PROCBSE JOIN NOW !

@PROCBSE

Weak Acid + Strong Base → Basic salt + H_2O
Strong Acid + Strong Base → Neutral salt + H_2O
Weak Acid + Weak Base → Neutral salt + H_2O

- pH of stomach is 1.5-3.0 due to secretion of HCl. In case of indigestion, acidity increases, which can be neutralised by antacids like milk of magnesia.
- Cold drinks, chocolates and sweets are harmful to tooth. They produce acids in mouth which are responsible for tooth decay.
- Salts of a strong acid and a strong base are neutral with pH value of 7.
- Salts have various uses in everyday life and in industries.
- A salt is soluble if it dissolves in water to give a solution with a concentration of at least 0.1 moles per litre at room temperature.
- **pH Scale:** A scale for measuring H^+ ion concentration in a solution. p in pH stands for 'potentz' a German word which means power.
  - pH = 7 → neutral solution
  - pH < 7 → acidic solution
  - pH > 7 → basic solution
  - On diluting an acid: pH increases ↑
  - On diluting a base: pH decreases ↓



- **Importance of pH in everyday life:**

1. Plants and animals are pH sensitive.
- Our body works within the pH range of 7 – 7.8.
- When pH of rain water is less than 5.6, it is called acid rain.
- Plants require a specific pH range for their healthy growth.

@PROCBSE KNOW !

Mnemonics

Concept: Natural indicators	Concept: pH scale
Mnemonics: **PG.RCT**	Mnemonics: **Ph**one **l**ao **7A** mein
Interpretation: **P**etunia **G**eranium **R**ed cabbage **T**urmeric	**Interpretation:** **pH** **l**ess than **7** --- **A**cid

Objective Type Questions — 1 mark each

A Multiple Choice Questions

1. An aqueous solution 'A' turns phenolphthalein solution pink. On addition of an aqueous solution 'B' to 'A', the pink colour disappears. The following statement is true for solution 'A' and 'B'.
[Outside Delhi 2020]

(a) A is strongly basic and B is a weak base.
(b) A is strongly acidic and B is a weak acid.
(c) A has pH greater than 7 and B has pH less than 7.
(d) A has pH less than 7 and B has pH greater than 7.

Ans. (c) A has pH greater than 7 and B has pH less than 7.

Q. 2. Identify the basic salt from the following salts:
(a) Na_2CO_3 **(b)** NH_4Cl
(c) $NaNO_3$ **(d)** KCl
[Board SQP, 2020]

Ans. Correct option: (a)
Explanation: Na_2CO_3 is a basic salt.

Q. 3. Which one of the following can be used as an acid–base indicator by a visually impaired student?
(a) Litmus **(b) Turmeric**
(c) Vanilla essence **(d) Petunia leaves**
[NCERT Exemp.]

Ans. Correct option: (c)
Explanation: Vanilla essence can be used as an acid-base indicator by visually impaired students as it is an olfactory indicator whose odour changes in acidic or basic media.

@PROCBSE

Q. 4. Which of the following is acidic in nature?

(a) Lime juice **(b) Human blood**
(c) Lime water **(d) Antacid**

[NCERT Exemp.]

Ans. Correct option: (a)

Explanation: Lime juice is acidic in nature as the juice is obtained from lime, a citrus fruit. This contains citric acid, and is therefore sour in taste.

Q. 5. During the preparation of hydrogen chloride gas on a humid day, the gas is usually passed through the guard tube containing calcium chloride. The role of calcium chloride taken in the guard tube is to

(a) absorb the evolved gas.
(b) moisten the gas.
(c) absorb moisture from the gas.
(d) absorb Cl^- ions from the evolved gas.

[NCERT Exemp.]

Ans. Correct option: (c)

Explanation: The role of calcium chloride taken in the guard tube is to absorb moisture from the gas. This is because calcium chloride is used as a drying agent which absorbs moisture from the hydrogen chloride (HCl) gas.

Q. 6. Which of the following are present in a dilute aqueous solution of hydrochloric acid?

(a) $H_3O^+ + Cl^-$ **(b) $H_3O^+ + OH^-$**
(c) $Cl^- + OH^-$ **(d) Unionized HCl**

[NCERT Exemp.]

Ans. Correct option: (a)

Explanation: In a dilute aqueous solution of hydrochloric acid, $H_3O^+ + Cl^-$ ions are present.

B Assertions and Reasons Type Questions

Directions: In the following questions, a statement of assertion (A) is followed by a statement of reason (R). Mark the correct choice as:

(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).
(b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).
(c) Assertion (A) is true but reason (R) is false.
(d) Assertion (A) is false but reason (R) is true.

1. Assertion: After white washing the walls, a shiny white finish on walls is obtained after two to three days.

Reason: Calcium Oxide reacts with Carbon dioxide to form Calcium Hydrogen Carbonate which gives shiny white finish. [SQP 2020-2021]

Ans. Correct option: (c)

[CBSE Marking Scheme, 2020]

Explanation: Calcium hydroxide is obtained by reaction of calcium oxide and water.

2. Assertion (A): When zinc is added to dilute hydrochloric acid, hydrogen is given off.

Reason (R): Hydrogen chloride molecules contain hydrochloric acid and hydrogen atoms.

Ans. Correct option: (b)

Explanation: The metal zinc readily reacts with hydrochloric acid to produce hydrogen gas (H_2) and zinc chloride ($ZnCl_2$).

3. Assertion (A): Gas bubbles are observed when sodium carbonate is added to dilute hydrochloric acid.

Reason (R): Carbon dioxide is given off in the reaction.

Ans. Correct option: (a)

Explanation: Sodium carbonate reacts with excess hydrochloric acid to form sodium chloride, water and carbon dioxide. In this reaction, bubbles of carbon dioxide are observed.

4. Assertion (A): Ammonia solution is an alkali.

Reason (R): Ammonia solution turns blue litmus paper red.

Ans. Correct option: (c)

Explanation: Ammonia solution, which is alkaline, turn the red litmus paper blue.

C Very Short Answer Type Questions

Q. 1. Which is the basic salt from the following salts:
Na_2CO_3 and NH_4Cl R [Modified ,SQP-2020]

Ans. Na_2CO_3 **1**

Q. 2. Name both the phenomenon occurring when a small amount of acid is added to water: AE [2020 Delhi]

Ans. Formation of H_3O^+ ions and Dilution.

Q. 3. Two solutions X and Y are tested with universal indicator. Solution X turns orange whereas solution Y turns red. Which of the solutions is a stronger acid ? A [SQP-4]

Ans. Solution Y is a stronger acid. **1**

Q. 4. What happens to pH when milk changes to curd? Why? U [Board Term-I Set-C2, 2010]

Ans. When milk changes into curd, its pH will decrease. Because curd contains lactic acid, so H^+ ion concentration increases and thus pH will decrease. **1**

Q. 5. Name the gas liberated when an acid reacts with a metal ? U

Ans. Hydrogen gas. **1**

Q. 6. If two solutions of different pH 2 and 5 are given, which will be stronger acid and why? R [Board Term-I Set-A1, 2010]

Ans. pH = 2 as lower the pH, stronger the acid. **1**

AI **Q. 7. Why 1 M HCl has higher concentration of H^+ ions than 1 M CH_3COOH ?** A [Board Term-I, Outside Delhi Set II, 2009]

Ans. 1 M HCl has a higher concentration of H^+ ions because when HCl dissolves in water it dissociates completely into ions while CH_3COOH is a weak acid and does not dissociate into ions completely. **1**

@PROCBSE JOIN NOW !

@PROCBSE

Short Answer Type Questions-I — 2 marks each

Q. 1. A teacher provided acetic acid, water, lemon juice, aqueous solution of sodium hydrogen carbonate and sodium hydroxide to students in the school laboratory to determine the pH values of these substances using pH papers. One of the students reported the pH values of the given substances as 3, 12, 4, 8 and 14 respectively. Which one of these values is not correct ? Write its correct value stating the reason. AE [Outside Delhi 2019]

Ans. The pH value of water given is incorrect.
Its correct value is 7 since it is neutral in nature.
[CBSE Marking Scheme, 2019] **1 + 1 = 2**

Q. 2. Blue litmus solutions is added to two test tubes A and B containing dilute HCl and NaOH solution respectively. In which test tube a colour change will be observed? State the colour change and give its reason. C

OR

What is observed when 2 mL of dilute hydrochloric acid is added to 1 g of sodium carbonate taken in a clean and dry test tube ? Write chemical equation for the reaction involved. AE [Delhi, 2019]

Ans. Test Tube A
It changes the colour from blue to red
Hydrochloric acid turns blue litmus red.

OR

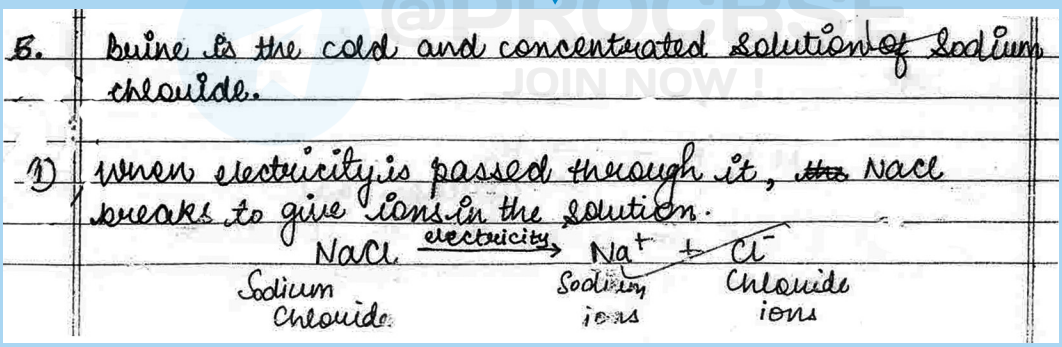
Brisk effervescence is produced.
$Na_2CO_3 + 2HCl \longrightarrow 2\,NaCl + H_2O + CO_2$
[CBSE Marking Scheme, 2019]

Detailed Answer:
Dilute HCl (Tube A) being acidic in nature will change the colour of blue litmus solution to red. There will be no change in the Tube B containing NaOH solution as NaOH is basic in nature. **1+1=2**

Q. 3. What is brine? What happens when an electric current is passed through it ? Write chemical equation for it.
[CBSE Outside Delhi, 2019]

Topper Answer, 2019

Ans.



Detailed Answer:
The cold and concentrated aqueous solution of sodium chloride is known as brine.
When an electric current passed through brine, hydrogen gas is evolved at the anode, chlorine gas is evolved at the cathode, and sodium hydroxide is formed in the electrolysing solution.
Sodium chloride + water → sodium hydroxide + Chlorine + hydrogen
$2NaCl\,(aq) + 2H_2O\,(l) \rightarrow 2NaOH\,(aq) + Cl_2\,(g) + H_2\,(g)$

AI **Q. 4. A liquid has a pH less than 7 which represents an acidic solution.**
(i) State the nature of solution, if its pH increases from 7 to 14.
(ii) Mention the ion whose concentration increases with the increase in pH value. U

Ans. (i) The nature of solution is basic . As the pH increases from 7 to 14, the strength of alkali also increases. So the nature of solution will be basic. **1**
(ii) Hydroxide ion or hydroxyl ion or OH^- ion. **1**

COMMONLY MADE ERROR

- Students usually get confused with the pH values.

ANSWERING TIP

- Understand the concept of pH with proper examples.

Q. 5. How is the presence of an acid tested with a strip of red litmus paper ? [CBSE 2019]

OR

A student is performing an experiment to study the properties of acetic acid. Answer the following questions:
(i) Name the substance he must add to acetic acid to produce carbon dioxide.

@PROCBSE

(ii) Give the relevant chemical equation for the reaction.

(iii) How would he test CO_2 gas in the laboratory ?

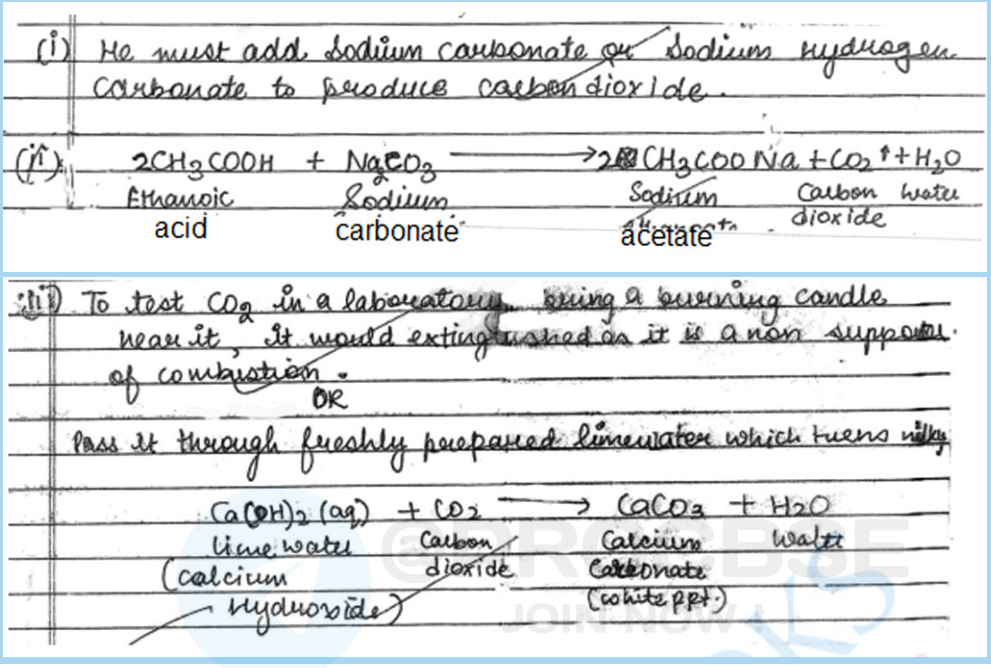
[CBSE, 2018]

Ans. Red litmus do not show any colour change with acid. So it must be changed to blue litmus by dipping the strip in alkaline solution .Then dip the blue litmus in acidic solution (it will turn red).

OR

Topper Answer, 2019

Ans.



Short Answer Type Questions-II — 3 marks each

Q. 1. A compound 'X' of sodium is used as an antacid and it decomposes on strong heating.

(i) Name the compound 'X' and give its chemical formula.

(ii) Write a balanced chemical equation to represent the decomposition of 'X'.

(iii) Give one use of compound 'X' besides an antacid.

R **[CBSE SQP, 2020]**

Ans.(i) Sodium bicarbonate / Sodium hydrogen carbonate / baking soda and its formula is $NaHCO_3$

(ii) $2NaHCO_3 \xrightarrow{heat} Na_2CO_3 + CO_2 + H_2O$

(iii) It is used in fire extinguisher and for baking. **(Any one)** **1 + 1 + 1**

[CBSE Marking Scheme, 2020]

Q. 2. You are provided with 90 mL of distilled water and 10 mL of concentrated sulphuric acid to prepare dilute sulphuric acid.

(a) What is the correct way of preparing dilute sulphuric acid? Give reason.

(b) How will the concentration of H_3O^+ ions change on dilution? R **[CBSE SQP, 2020]**

Ans.(a) Add 10 mL of concentrated sulphuric acid slowly to 90 mL of water with constant stirring.

Dilution of acid is a highly exothermic process. If water is added to concentrated sulphuric acid, heat generated causes the mixture to splash leading to burns and the glass container can break.

(b) Decreases per unit volume. **1 + 1 + 1**

[CBSE Marking Scheme, 2020]

AI **Q. 3. (a) While diluting an acid, why is it recommended that the acid should be added to water and not water to the acid ?**

(b) Dry hydrogen chloride gas does not change the colour of dry litmus paper. Why ?

R **[CBSE Board Outside Delhi, 2019]**

Ans. (a) The process of diluting an acid is highly exothermic, and on the addition of acid to the water the excess heat is absorbed by water. **1 + 1**

(b) Because HCl does not form H^+/H_3O^+ ions in dry condition. **[CBSE Marking Scheme, 2019] 1**

@PROCBSE

Detailed Answer:

(a) Diluting an acid is an exothermic process. When water is added to an acid, the heat generated may cause the mixture to splash out and may cause serious burns. Therefore, it is recommended that acid should be added to water carefully with constant stirring.

(b) Presence of ions like hydrogen (H^+) ions or hydronium (H_3O^+) ions changes the colour of litmus paper. HCl is able to produce these ions only in the form of aqueous solution. Hence, dry hydrogen chloride gas does not change the colour of dry litmus paper. **1½+1½**

AI **Q. 4. On heating blue coloured powder of copper (II) nitrate in a boiling tube, black copper oxide, O_2 and a brown gas X is formed.**

(a) Identify the type of reaction and the gas X.

(b) Write balanced chemical equation of the reaction.

(c) Write the pH range of aqueous solution of the gas X. U

Ans. (a) Decomposition / Thermal decomposition ½

The gas X is NO_2 or (nitrogen dioxide) ½

(b) $2Cu(NO_3)_2 \xrightarrow{heat} 2CuO + 4NO_2 + O_2$ **1**

(c) Range less than 7 (or 0 – 6.9 pH) **1**

Note:

For (b) ½ mark for equation and ½ mark for balancing the equation

[CBSE Marking Scheme, 2019] 1 + 1 + 1

Q. 5. A white powder is added while baking cakes to make it soft and spongy. Name its main ingredients. Explain the function of each ingredient. Write the chemical reaction taking place when the powder is heated during baking. C **[CBSE, 2019]**

Topper Answer, 2019

Ans.

10. The white powder added to cakes is baking powder.

Baking powder is prepared with Baking Soda i.e. Sodium Hydrogen Carbonate along with a mild acid like Tartaric acid.

(1) Baking soda being a base is bitter and tartaric acid is sour.

(2) When their mixture is added, neutralisation takes place nullifying the bitter and sour effects.

Baking Soda + Tartaric acid → Baking Powder.

~~Baking Soda is used~~

Baking soda is mainly for producing effervescence and tartaric acid is used for nullifying the bitter effect of sodium bicarbonate.

$2NaHCO_3 \xrightarrow{\Delta} Na_2CO_3 + CO_2\uparrow + H_2O(g)$

Baking Soda in form of Baking powder. — Sodium Carbonate — Carbon dioxide — Water (vapours)

The carbon dioxide released gets trapped in the cake layers and makes it soft and spongy.

AI **Q. 6. 2 ml of sodium hydroxide solution is added to a few pieces of granulated zinc metal taken in a test tube. When the contents are warmed, a gas evolves which is bubbled through a soap solution before**

@PROCBSE

testing. Write the equation of the chemical reaction involved and the test to detect the gas. Name the gas which will be evolved when the same metal reacts with dilute solution of a strong acid.

A + R + U **[Delhi/Outside Delhi, 2018]**

Ans. $Zn + 2NaOH \rightarrow Na_2ZnO_2 + H_2$

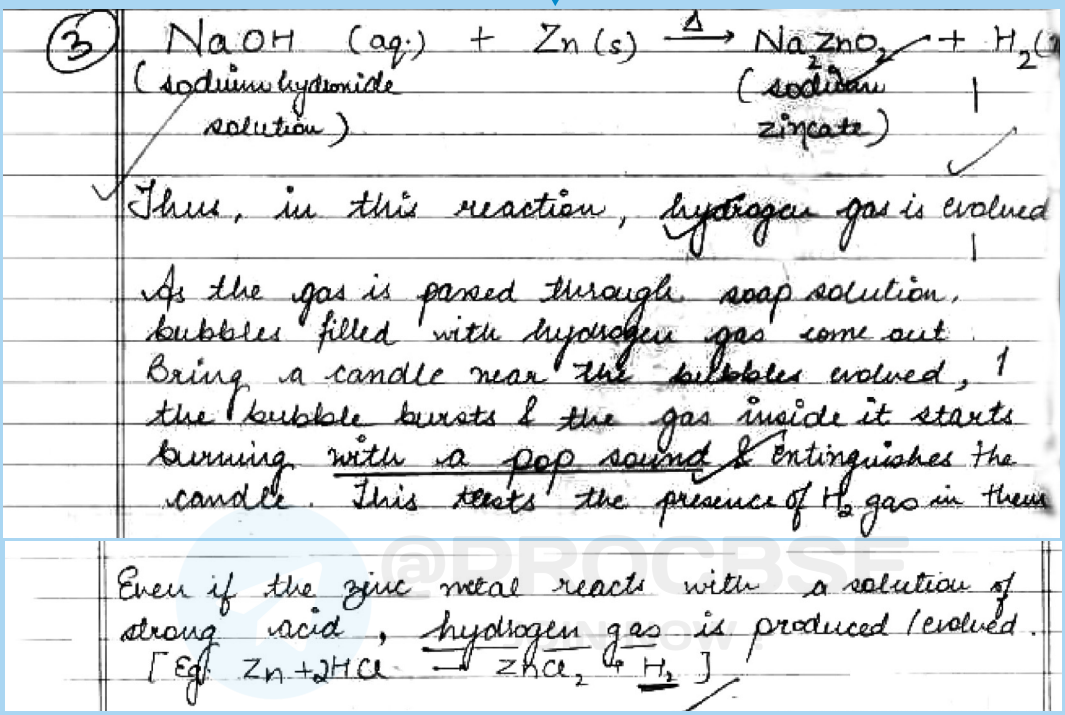
When a burning splinter is brought near the gas, it burns with a Pop Sound.

Gas – Hydrogen / H_2

[CBSE Marking Scheme, 2018] **1 + 1 + 1**

Topper Answer, 2018

Ans.



COMMONLY MADE ERROR

- Usually students get confused with the liberation of gas during the reaction of zinc with acids and bases.

ANSWERING TIP

- Keenly observe the reactions during practicals, zinc reacts with both acids and bases to give out hydrogen gas but remember the above said reactions are not possible with all metals.

Q. 7. 1 g of solid sodium chloride is taken in a clean and dry test tube and 2mL of conc. sulphuric acid is added to it. If the gas evolved is tested first with dry and then with wet blue litmus paper, in which case will the litmus paper change colour ? Give reason for your answer. What inference can be drawn about the nature of the evolved gas ? Support your answer with chemical equation for the reaction. U + A **[Comptt. Set-I, II & III, 2018]**

Ans. Wet blue litmus paper. ½

When the gas is tested with dry litmus paper, it shows no change in colour .This is because ions are not formed in the absence of water.

But with wet litmus paper hydrogen ions are produced and thus change in colour is observed. **1**

It has acidic nature.

Due to presence of H_3O^+ ions ½

$HCl + H_2O \rightarrow H_3O^+ + Cl^-$ **1**

[CBSE Marking Scheme, 2018]

COMMONLY MADE ERROR

- Students usually get confused with the action of wet or dry litmus paper and reason for the same.

ANSWERING TIP

- The concept of ionization of acids in aqueous medium to give hydrogen or hydronium ions should be kept in mind.

@PROCBSE

Q. 8. 'Sweet tooth may lead to tooth decay'. Explain why? What is the role of tooth paste in preventing cavities ? AE [SQP, 2018]

Ans. Sweet tooth leads to tooth decay, which is caused by the action of bacteria on food particles remaining in the mouth and acid is formed. As a result, the pH of the mouth falls below 5.5 and the tooth enamel dissolves resulting in cavities. Toothpastes are generally basic, they neutralize the excess acid produced in the mouth and prevent tooth decay.
[CBSE Marking Scheme, 2018] 3

Q. 9. Explain the action of dilute hydrochloric acid on the following with chemical equation:
(i) Magnesium ribbon
(ii) Sodium hydroxide
(iii) Crushed egg shells A [Board Term-I, 2016]

Ans. (i) $Mg + 2HCl \longrightarrow MgCl_2 + H_2$
Hydrogen gas is produced.
(ii) $HCl + NaOH \longrightarrow NaCl + H_2O$
Neutralization reaction
(iii) $2HCl(aq) + CaCO_3(s) \longrightarrow CaCl_2(aq) + H_2O + CO_2$
Calcium chloride is formed.
[CBSE Marking Scheme, 2016] 1 + 1 + 1

Detailed Answer:
(i) Dilute hydrochloric acid reacts with magnesium to form magnesium chloride and H_2 gas is liberated.
$Mg(s) + 2HCl(aq) \longrightarrow MgCl_2(aq) + H_2(g)$
(ii) Reaction between dilute hydrochloric acid and sodium hydroxide is a neutralization reaction. Sodium chloride salt and water are formed.
$NaOH(aq) + HCl(aq) \longrightarrow NaCl(aq) + H_2O(l)$
(iii) Egg shells are made of calcium carbonate, $CaCO_3$. Dilute hydrochloric acid dissolves the $CaCO_3$ and makes the shell soft.
$CaCO_3(s) + 2HCl(aq) \rightarrow CaCl_2(aq) + CO_2(g) + H_2O(l)$
(Crushed egg shell) **1 + 1 + 1**

Long Answer Type Questions — 5 marks each

Q. 1. Match the following pH values 1, 7, 10, 13 to the solutions given below:
- **Milk of magnesia**
- **Gastric juices**
- **Brine**
- **Aqueous Sodium hydroxide.**

Amit and Rita decided to bake a cake and added baking soda to the cake batter. Explain with a balanced reaction, the role of the baking soda. Mention any other use of baking soda. C

OR

Four samples A, B, C and D change the colour of pH paper or solution to Green, Reddish-pink, Blue and Orange. Their pH was recorded as 7, 2, 10.5 &6 respectively.
(i) Which of the samples has the highest amount of Hydrogen ion concentration? Arrange the four samples in the decreasing order of their pH.
(ii) Rahul found that the Plaster of Paris, which he stored in a container, has become very hard and lost its binding nature. What is the reason for this? Also, write a chemical equation to represent the reaction taking place.
(iii) Give any one use of Plaster of Paris other than for plastering or smoothening of walls.
C & AE [CBSE SQP-2020-21]

Ans. Milk of magnesia 10
Gastric juices 1
Brine 7
Aqueous Sodium hydroxide 13
Baking soda undergoes thermal decomposition to form Na_2CO_3, CO_2 and H_2O;
CO_2 makes the cake fluffy & soft

$$NaHCO_3 \xrightarrow{heat} Na_2CO_3 + CO_2 + H_2O$$

Uses:
Used in fire extinguishers/ antacid to neutralize excess acid in stomach / to neutralize the effect of acid in insect sting. **(Any 1)**

OR

(i) B (reason: low pH , high H^+ ion concentration) decreasing order: C, A, D, B
(ii) Due to moisture in the atmosphere it is converted into Gypsum
$CaSO_4 + 1½\ H_2O \rightarrow CaSO_4.2H_2O$
(iii) Making toys/dolls or statues /fixing broken limbs/ making decorative materials.
[CBSE SQP Marking Scheme, 2020]

Q. 2. Write the main difference between an acid and a base. With the help of suitable examples explain the term neutralization and the formation of:
(i) acidic **(ii) basic and**
(iii) neutral salts.
R [CBSE Board Delhi Set- III, 2019]

Ans.

Acid	Base
1. An acid produces H^+ ions in aqueous solution.	A base produces OH^- ions in aqueous solution.
2. Acids are sour in taste.	Bases are bitter in taste.
3. Acids change the colour of blue litmus to red.	Bases change the colour of red litmus to blue.

1(Any one)

@PROCBSE JOIN NOW

Neutralization – A reaction of an acid with a base to produce salt and water. **1**

(i) Acidic – $NH_4OH + HCl \longrightarrow NH_4Cl + H_2O$ **1**

(ii) Basic – $NaOH + H_2CO_3 \longrightarrow Na_2CO_3 + H_2O$ **1**

(iii) Neutral – $KOH + HNO_3 \longrightarrow KNO_3 + H_2O$ **(or any other example) 1**

[CBSE Marking Scheme, 2019]

Q. 3. (i) Define pH scale. Draw a figure showing variation of pH with the change in concentration of $H^+(aq)$ and $OH^-(aq)$ ions.

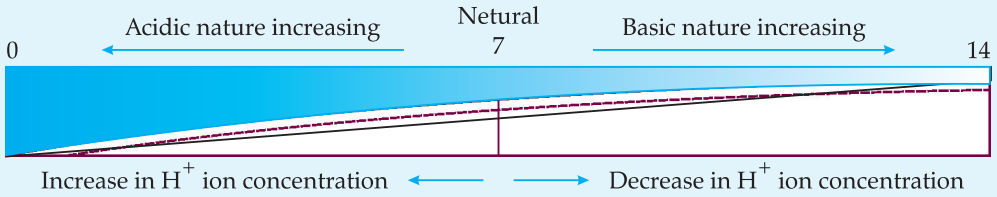
(ii) Mention the range of pH of acidic solution, basic solution and neutral solution respectively.

R **[Board Term-I, 2016]**

[NCERT Exemplar]

Ans. (i) Scale for measuring $[H^+]$ concentration in a solution is called pH scale.

Refer to below figure:



(ii) pH of Neutral solution is 7.

pH of Acidic solution is 0 to below 7.

pH of Basic solution is above 7 to 14 .

[CBSE Marking Scheme, 2016] 1 + 2 + 2

Q. 4. (i) Define universal indicator. For what purpose it is used ?

(ii) Two solutions A and B have pH values of 3.0 and 9.5 respectively. Which of these will turn litmus solution from blue to red and which will turn phenolphthalein from colourless to pink ?

(iii) Water is a neutral substance. What colour will you get when you add a few drops of universal indicator to a test tube containing distilled water ?

R **[Board Term-I, 2016]**

Ans. (i) Universal indicator is a mixture of many different indication (or dyes) which give different colours at different pH values of the entire pH scale. The colour produced by universal indicator is used to find the pH value of acid or base by matching the colour with the colours on pH colour chart.

(ii) Solution A is acidic and will turn litmus solution from blue to red.

Solution B is basic and will turn phenolphthalein from colourless to pink.

(iii) Green colour will be obtained.

[CBSE Marking Scheme, 2016] 2 + 2 + 1

Q. 5. Account for the following:

(i) State the relation between hydrogen ion concentration of an aqueous solution and its pH.

(ii) An aqueous solution has a pH value of 7.0. Is this solution acidic, basic or neutral ?

(iii) Which has a higher pH value, 1 M HCl or 1 M NaOH solution ?

(iv) Tooth enamel is one of the hardest substances in our body. How does it undergo damage due to eating chocolates and sweets ? What should we do to prevent it ?

(v) How do $[H^+]$ ions exist in water ?

U **[Board Term-I 2016]**

Ans. (i) If H^+ ion concentration is more, pH will be less and vice versa or pH of a solution is inversely proportional to H^+ ion concentration or pH = –log $[H^+]$.

(ii) This solution is neutral.

(iii) 1M NaOH solution.

(iv) When the pH in the mouth is below 5.5, bacteria present in the mouth produce acids by degradation of sugar and corrode the tooth enamel. It can be prevented by using toothpastes which are generally basic.

(v) As hydronium $[H_3O]^+$ ion.

[CBSE Marking Scheme, 2016] 1 + 1 + 1 + 1 + 1

@PROCBSE JOIN NOW !

@PROCBSE

TOPIC - 2
Salts, their Properties and Uses

Revision Notes

Scan to know more about this topic
Salt

- **Salts:** Salts are formed when an acid and base reacts with each other.
- **Types of Salts:**

1. **Common Salt (NaCl):**
   Preparation: $NaOH + HCl \rightarrow NaCl + H_2O$
   Properties: $2NaCl(aq) + 2H_2O(l) \rightarrow 2NaOH(aq) + Cl_2(g) + H_2(g)$
   Users of common salt:
   1. Used it daily food
   2. Used as preservative
   3. Used in manufacture of metal (Na) & gas (cl2) in molten state by electrolysis.

Scan to know more about this topic
More about salts

2. **Bleaching Powder ($CaOCl_2$):**
   Preparation: It is produced by the action of chlorine on dry slaked lime.
   $$Cl_2 + Ca(OH)_2 \rightarrow CaOCl_2 + H_2O$$
   Properties:
   (a) It has a strong smell of Chlorine.
   (b) Soluble in water.
   (c) It loses Chlorine by the action of carbon di oxide.
   Uses:
   (a) Bleaching cotton and linen in textile industry.
   (b) Bleaching wood pulp in paper factories.
   (c) Oxidizing agent in chemical industries.
   (d) Disinfecting drinking water.

@PROCBSE JOIN NOW !

Scan to know more about this topic
Are crystals dry

3. **Baking Soda (** Sodium hydrogen carbonate) ($NaHCO_3$):
   Preparation: $NaCl + H_2O + CO_2 + NH_3 \rightarrow NH_4Cl + NaHCO_3$
   Baking soda
   Properties: $2NaHCO_3 \xrightarrow{\text{Heat}} Na_2CO_3 + H_2O + CO_2$
   It is mild non-corrosive base.
   When it is heated during cooking:
   $2NaHCO_3 \xrightarrow{\Delta} Na_2CO_3 + H_2O + CO_2$
   Uses:
   (a) For making baking powder (mixture of baking soda and tartaric acid). When baking powder is heated or mixed with water, CO_2 is produced which causes bread and cake to rise making them soft and spongy.
   $NaHCO_3 + H^+ \rightarrow CO_2 + H_2O +$ Sodium Salt of an Acid
   (b) An ingredient in antacid.
   (c) Used in soda acids, fire extinguishers.
4. **Washing Soda ($Na_2CO_3.10H_2O$):**
   Preparation: Recrystallization of sodium carbonate gives washing soda. It is a basic salt.
   $$Na_2CO_3 + 10H_2O \rightarrow Na_2CO_3.10H_2O$$
   Properties:
   (a) Transparent crystalline solid.
   (b) It has 10 molecules of water of crystallization.
   (c) It dissolves in water and the aqueous solution is alkaline.
   (d) It liberates Carbon di oxide when treated with Hydrochloric acid and Sulphuric acid
   Uses:
   (a) In glass, soap and paper industry.
   (b) Manufacture of borax.

@PROCBSE

(c) It can be used as cleaning agent

(d) It can be used for removing permanent hardness of water.

5. **Plaster of Paris (Calcium sulphate hemihydrates) ($CaSO_4.½H_2O$):**

Preparation: On heating gypsum $CaSO_4.2H_2O$ at 373K, it loses water molecules and becomes Plaster of Paris (POP). It is white powder and on mixing with water it changes to gypsum.

$$CaSO_4.2H_2O \rightarrow CaSO_4.\frac{1}{2}H_2O + 1\frac{1}{2}H_2O$$

Properties: $CaSO_4.\frac{1}{2}H_2O + 1\frac{1}{2}H_2O \rightarrow CaSO_4.2H_2O$

Uses:

(a) Doctors use POP for supporting fractured bones.

(b) For making toys and material for decoration.

Objective Type Questions — 1 mark each

A Multiple Choice Questions

Q. 1. Which of the following salts does not contain water of crystallisation?

(a) Blue vitriol **(b) Baking soda**

(c) Washing soda **(d) Gypsum**

[NCERT Exemp.]

Ans. Correct option: (b)

Explanation: Water of crystallisation is the fixed number of water molecules present in one formula unit of a salt. Potassium nitrate, barium sulphate, potassium chloride, sodium nitrate, baking soda, etc., are the salts that do not contain water of crystallisation.

Q. 2. Sodium carbonate is a basic salt because it is a salt of

(a) strong acid and strong base.

(b) weak acid and weak base.

(c) strong acid and weak base.

(d) weak acid and strong base. [NCERT Exemp.]

Ans. Correct option: (d)

Explanation: Sodium carbonate is a basic salt of weak acid *i.e.* carbonic acid and a strong base *i.e.* sodium hydroxide.

Q. 3. Common salt besides being used in kitchen can also be used as the raw material for making

(i) washing soda. **(ii) bleaching powder.**

(iii) baking soda. **(iv) slaked lime.**

(a) (i) and (ii) **(b) (i), (ii) and (iv)**

(c) (i) and (iii) **(d) (i), (iii) and (iv)**

[NCERT Exemp.]

Ans. Correct option: (c)

Explanation: The common salt obtained is an important raw material for various materials of daily use, such as sodium hydroxide, baking soda, washing soda and many more.

Q. 4. One of the constituents of baking powder is sodium hydrogen carbonate, the other constituent is

(a) hydrochloric acid. **(b) tartaric acid.**

(c) acetic acid. **(d) sulphuric acid.**

[NCERT Exemp.]

Ans. Correct option: (b)

Explanation: Baking powder is a mixture of baking soda (sodium hydrogen carbonate) and a mild edible acid such as tartaric acid.

B Assertions and Reasons Type Questions

Directions: In the following questions, a statement of assertion (A) is followed by a statement of reason (R). Mark the correct choice as:

(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

(b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).

(c) Assertion (A) is true but reason (R) is false.

(d) Assertion (A) is false but reason (R) is true.

Q. 1. Assertion (A): When common salt is kept open, it absorbs moisture from the air.

Reason (R): Common salt contains magnesium chloride.

Ans. Correct option: (a)

Explanation: Magnesium chloride present in common salt is deliquescent substance *i.e.*, it absorbs moisture from the air when kept in open.

Q. 2. Assertion (A): Baking soda creates acidity in the stomach.

Reason (R): Baking soda is alkaline.

Ans. Correct option: (d)

Explanation: Baking soda, being alkaline, neutralises the acidity in the stomach and removes it.

Q. 3. Assertion (A): Plaster of Paris is used by doctors for setting fractured bones.

Reason (R): When Plaster of Paris is mixed with water and applied around the fractured limbs, it sets into a hard mass.

Ans. Correct option: (a)

Explanation: Plaster of Paris when mixed with water and applied around the fractured limbs, it sets in to a hard mass and keeps the bone joints in a fixed position. So, it is commonly used for setting fractured bones.

@PROCBSE

C Very Short Answer Type Questions

Q. 1. Name two main constituent of baking powder? R [CBSE Delhi 2020]

Ans. Sodium hydrogen carbonate (Sodium bicarbonate) and tartaric acid. [CBSE Marking Scheme, 2010]

AI **Q. 2. Name a salt which does not contain water of crystallization.** R

Ans. Baking soda 1

COMMONLY MADE ERROR

- Some students write wrong examples such as copper sulphate.

ANSWERING TIP

- Understand the concept of water of crystallisation with proper examples.

Q. 3. Which colour the solution of sodium carbonate will show in litmus? R

Ans. The colour of litmus in a solution of sodium carbonate is blue. 1

Q. 4. Write the chemical name for $Na_2CO_3.10H_2O$. R

Ans. Sodium carbonate decarbohydrate.

Q. 5. Give one word for water soluble base. AE

Ans. Alkali.

Q. 6. Give one word for substance which dissociates on dissolving in water to produce hydrogen ions. $[H]^+$ (*aq*) ions. R

Ans. Acid. 1

Short Answer Type Questions-I — 2 marks each

Q. 1. List two main sources of common salt in nature? Name any two compounds where common salt is used as a raw material? R

Ans. Sea water and rock salt

Sodium hydroxide and sodium bicarbonate.

AI **Q. 2. (a) What is the term used for $10H_2O$ attached in $Na_2SO_4.10\ H_2O$? What is its function?**

(b) Write the chemical equation to explain the preparation of $Na_2SO_4.10H_2O$? C

Ans. It is known as water of crystallization.

It imparts shape and colour to the crystal.

$NaCl + H_2O + CO_2 + NH_3 \rightarrow NH_4Cl + NaHCO_3$

AI **Q. 3. Bee-sting leaves a chemical substance that causes pain and irritation. Name the chemical substance. Identify the type of substance which may give relief on the sting area when applied on it.** C

Ans. Methanoic acid (HCOOH).

Use of Baking soda can give relief on the stung area when applied on it.

Short Answer Type Questions-II — 3 marks each

Q. 1. List the important products of the Chloro-alkali process. Write one important use of each.

OR

How is washing soda prepared from sodium carbonate? Give its chemical equation. State the type of this salt. Name the type of hardness of water which can be removed by it? R [Delhi 2020]

Ans. Products of chloro-alkali process are: Sodium hydroxide (NaOH), Chlorine gas (Cl_2) and Hydrogen gas (H_2).

Uses of sodium hydroxide: (Any 1)

(i) In the manufacture of paper.

(ii) In making soaps and detergents.

Uses of chlorine gas: (Any 1)

(i) In the production of bleaching powder

(ii) To make plastics (PVC), pesticides, chloroform, paints etc.

Uses of hydrogen gas: (Any 1)

(i) As fuel for rockets

(ii) In the hydrogenation of oils to obtain vegetable ghee. **1×3=3**

OR

Washing soda is prepared from sodium carbonate by recrystallisation.

$Na_2CO_3 + 10H_2O \longrightarrow Na_2CO_3.10H_2O$

Washing soda is a basic salt. It is used for removing permanent hardness of water.

Q. 2. Complete and balance the following chemical equations:

(i) $NaOH(aq) + Zn(s) \longrightarrow$

(ii) $CaCO_3(s) + H_2O(l) + CO_2(g) \longrightarrow$

(iii) $HCl(aq) + H_2O(l) \longrightarrow$

OR

During electrolysis of brine, a gas G is liberated at anode When this gas G′ is passed through slaked lime, a compound 'C' is formed, which is used for disinfecting drinking water.

(i) Write formula of 'G' and 'C'.

(ii) State the chemical equation involved.

(iii) What is common name of compound 'C'? Give its chemical name. [Outside Delhi, 2020]

@PROCBSE JOIN NOW !

@PROCBSE

Ans. (i) $Zn(s) + 2NaOH(aq) \xrightarrow{Heat}$

Zinc Sodium hydroxide

$Na_2ZnO_2(aq) + H_2(g)\uparrow$

Sodium zincate Hydrogen

(ii) $CaCO_3(aq) + H_2O(l) + CO_2(g) \longrightarrow Ca(HCO_3)_2(aq)$

(iii) $HCl + H_2O \longrightarrow H_3O^+ + Cl^-$ **1×3=3**

OR

Bleaching powder is produced by the action of chlorine on dry slaked lime $Ca(OH)_2$.

Chlorine is produced during the electrolysis of aqueous sodium chloride.

(i) G: Cl_2, C: $CaOCl_2$

(ii) $Ca(OH)_2 + Cl_2 \longrightarrow CaOCl_2 + H_2O$

(iii) Bleaching powder.

AI **Q. 3. Identify the acid and the base from which sodium chloride is obtained. Which type of salt is it ? When is it called rock salt ? How is rock salt formed ?** U **[CBSE Board Delhi, Set- I, 2019]**

Ans. • Acid – Hydrochloric acid/HCl
Base – Sodium hydroxide/NaOH
• Neutral Salt
• When it forms brown crystals combined with impurities.
• Drying up of seas. **1 + ½ + ½ + 1**
[CBSE Marking Scheme, 2019]

Q. 4. Identify the acid and base which form sodium hydrogen carbonate. Write chemical equation in support of your answer. State whether this compound is acidic, basic or neutral. Also write its pH value. U **[CBSE Board Delhi, Set- I, 2019]**

Ans. • Acid — H_2CO_3 ½
• Base — NaOH ½
• $NaOH + H_2CO_3 \rightarrow NaHCO_3 + H_2O$ **1**
[CBSE Marking Scheme, 2019]

Detailed Answer:

$NaCl + \underbrace{H_2O + CO_2}_{(Acid)} + NH_3 \rightarrow NH_4Cl + NaHCO_3$

Sodium chloride (Base); Ammonia; Ammonium chloride; Sodium hydrogen carbonate

The compound is basic (weak). Its pH is more than 7. **2+1**

AI **Q. 5. How is sodium hydroxide manufactured in industries? Name the process. In this process a gas X is formed as by product. This gas reacts with lime water to give a compound Y, which is used as a bleaching agent in the chemical industry. Identify X and Y and write the chemical equation of the reactions involved.**

R + A **[CBSE Board Outside Delhi, Set-I, 2019]**

Ans. • When electricity is passed through an aqueous solution of sodium chloride (brine). ½
• Chlor – alkali process ½
• X - Cl_2 ½
• Y = $CaOCl_2$ ½
• $2NaCl_{(aq)} + 2H_2O_{(l)} \rightarrow 2NaOH_{(aq)} + Cl_{2(g)} + H_{2(g)}$ ½
• $Ca(OH)_2 + Cl_2 \longrightarrow CaOCl_2 + H_2O$ ½
[CBSE Marking Scheme, 2019]

Detailed Answer:

When electricity is passed through an aqueous solution of sodium chloride (brine), it decomposes to form sodium hydroxide.

$2NaCl(aq) + 2H_2O(l) \rightarrow$

Sodium chloride

$2NaOH(aq) + Cl_2(g) + H_2(g)$

Sodium hydroxide (X)

This process is called as chlor-alkali process.

In the manufacture of sodium hydroxide, hydrogen gas and chlorine gas (X) are formed as byproducts. When chlorine gas (X) reacts with lime water, it forms calcium oxychloride (bleaching powder) Y.

The reaction is:

$Ca(OH)_2(aq) + Cl_2(g) \rightarrow CaOCl_2(aq) + H_2O(l)$

Lime water (Slaked lime); Calcium hypochlorite (Y)

Y is Calcium oxychloride, which is used as bleaching agent in the chemical industry. **1+1+1**

Q. 6. The pH of salt used to make tasty and crispy pakoras is 14. Identify the salt and write a chemical equation for its formation. List its two uses.

U + A **[Delhi, Outside Delhi, 2018]**

Ans. $NaHCO_3$ (Sodium Hydrogen Carbonate/ Sodium bicarbonate)

$NaCl + H_2O + CO_2 + NH_3 \rightarrow NH_4Cl + NaHCO_3$

Uses:

(i) For making baking powder

(ii) As ingredient of antacid.

(iii) Soda-acid fire extinguishers **(Any two)**

Note: As no salt can have pH = 14, give full credit for any attempt of the candidates.

[CBSE Marking Scheme, 2018] 1 + 1 + 1

COMMONLY MADE ERROR

➲ Students usually get confused with the formula and preparation of sodium bicarbonate.

ANSWERING TIP

➲ Learn the chemical formulae and practice all the preparation reactions.

@PROCBSE

Q. 7. (a) For the preparation of cakes, baking powder is used. If at home your mother uses baking soda instead of baking powder, how will it affect the taste of the cake and why ?
(b) How is baking soda be converted into baking powder ?
(c) What makes the cake soft and spongy ?
U + A [Comptt. Set-I, II & III-2018]

Ans. (a) The cake will have a bitter taste because of the formation of Na_2CO_3/sodium carbonate while baking/heating.
(b) By adding tartaric acid
(c) The liberated CO_2 gas.
[CBSE Marking Scheme, 2018] **1 + 1 + 1**

COMMONLY MADE ERROR

- Usually students get confused with baking powder and baking soda.

ANSWERING TIP

- Baking soda is sodium hydrogen carbonate from which baking powder is prepared.

Q. 8. Identify the compound of calcium which is used for plastering of fractured bones. With the help of chemical equation show how is it prepared and what special precautions should be taken during the preparation of this compound.
U + A [CBSE SQP, 2018]

Ans. Plaster of Paris: $CaSO_4.\frac{1}{2}H_2O$
Calcium Sulphate Hemihydrate

Preparation:

$$CaSO_4.2H_2O \xrightarrow{373K} CaSO_4.\frac{1}{2}H_2O + 1\frac{1}{2}H_2O$$

Precaution:
Gypsum should not be heated above 373 K other wise it will form $CaSO_4$.
[CBSE Marking Scheme, 2018] **3**

COMMONLY MADE ERROR

- Students usually get confused with the formula of plaster of paris and gypsum.

ANSWERING TIP

- Learn and practice the molecular formula for POP and Gypsum, its preparation and the condition for the reaction.

Q. 9. A sanitary worker uses a white chemical having strong smell of chlorine gas to disinfect the water tank.
(i) Identify the chemical compound, write its chemical formula.
(ii) Give chemical equation for its preparation.
(iii) Write its two uses other than disinfection.
A [Board Term-I, 2016]

Ans. (i) Bleaching powder: $CaOCl_2$
(ii) $Ca(OH)_2 + Cl_2 \longrightarrow CaOCl_2 + H_2O$
(iii) Two uses other than disinfection are:
(a) Paper industries **(b)** Chemical Industries.
[CBSE Marking Scheme, 2016] **1 + 1 + 1**

Q. 10. (i) A white powder is an active ingredient of antacids and is used in preparation of baking powder. Name the compound and explain that how it is manufactured. Give chemical equation.
(ii) Write a chemical equation to show the effect of heat on this compound. A [Board Term-I, 2016]

Ans. (i) Compound is $NaHCO_3$/baking soda/sodium hydrogen carbonate

Manufacture: $NH_3 + NaCl + H_2O + CO_2 \longrightarrow NH_4Cl + NaHCO_3$

(ii) $2\,NaHCO_3 \xrightarrow{Heat} Na_2CO_3 + H_2O + CO_2$
[CBSE Marking Scheme, 2016] **1 + 1 + 1**

Q. 11. In one of the industrial processes, used for manufacture of sodium hydroxide, a gas X is formed as by-product. The gas 'X' reacts with dry slaked lime to give a compound 'Y' which is used as bleaching agent in textile industry. Identify X and Y. AE [Board Term-I, 2015]

Ans. (i) X = Chlorine gas, Y = Calcium oxychloride

(ii) $Ca(OH)_2 + Cl_2 \longrightarrow CaOCl_2 + H_2O$
(Dry slaked lime) (Chlorine) (Calcium oxy-chloride) (Bleaching agent) (Water)
1+1+1

COMMONLY MADE ERROR

- Many students do not write the correct name of gas and compound.

ANSWERING TIP

- Practice such questions in which identification of compounds is based on chemical reactions.

@PROCBSE JOIN NOW !

@PROCBSE

Long Answer Type Questions — 5 marks each

Q. 1. A metal 'M' is stored under kerosene. It vigorously catches fire, if a small piece of this metal is kept open in air. Dissolution of this metal in water releases great amount of energy and the metal catches fire. The solution so formed turns red litmus blue.

(a) Name the metal 'M'.

(b) Write formula of the compound formed when this metal is exposed to air.

(c) Why is metal 'M' stored under kerosene ?

(d) If oxide of this metal is treated with hydrochloric acid, what would be the products?

(e) Write balanced equations for:

(i) Reaction of 'M' with air.

(ii) Reaction of 'M' with water.

(iii) Reaction of metal oxide with hydrochloric acid.

AE **[Outside Delhi 2020]**

Ans. (a) Name of the metal M: sodium (Na).

(b) Formula of the compound formed is Na_2O.

(c) Metals like sodium and potassium react with oxygen so fast that they can catch fire if kept open. Since, they are most reactive metals; they are always kept immersed in kerosene oil to prevent accidental fire.

(d) Sodium oxide reacts with hydrochloric acid to produce sodium chloride and water.

(e) (i) Reaction with air: $4Na + O_2 \longrightarrow 2Na_2O$

(ii) Reaction with water:

$2Na(s) + 2H_2O(l) \longrightarrow 2NaOH(aq) + H_2(g)$ + heat energy

(iii) Reaction of sodium oxide with HCl:

$Na_2O(s) + 2HCl(aq) \longrightarrow 2NaCl(aq) + H_2O(l)$

Q. 2. Write balanced chemical equations for the following statements:

(i) Bleaching powder is kept open in air.

(ii) Blue crystals of copper sulphate are heated.

(iii) Chlorine gas is passed through dry slaked lime.

(iv) Carbon dioxide gas is passed through lime water.

(v) NaOH solution is heated with zinc granules.

A **[Board Term-I, 2016]**

Ans. (i) $CaOCl_2(s) + CO_2(g) \longrightarrow CaCO_3(s) + Cl_2(g)$

(Bleaching powder) (Carbon dioxide) (Calcium carbonate) (Chlorine)

(ii) $CuSO_4 . 5H_2O \xrightarrow{Heat} CuSO_4 + 5H_2O$

(Blue) (White)

(iii) $Ca(OH)_2 + Cl_2 \longrightarrow CaOCl_2 + H_2O$

(Dry slaked lime) (Chlorine) (Bleaching powder)

(iv) $Ca(OH)_2 + CO_2 \longrightarrow CaCO_3 + H_2O$

(Lime water) (Calcium carbonate) (Milky)

(v) $2NaOH + Zn \xrightarrow{Heat} Na_2ZnO_2 + H_2$

(Sodium zincate) (Hydrogen)

[CBSE Marking Scheme, 2016] 1 × 5

AI **Q. 3. Give suitable reasons for the following statements:**

(i) Rain water conducts electricity but distilled water does not.

(ii) We feel burning sensation in the stomach when we overeat.

(iii) A tarnished copper vessel regains its shine when rubbed with lemon.

(iv) The crystals of washing soda change to white powder on exposure to air.

(v) An aqueous solution of sodium chloride is neutral but an aqueous solution of sodium carbonate is basic. U **[Board Term-I, 2016, 2015, 2014]**

Ans. (i) Distilled water does not conduct electricity because it does not contain any ionic compound like acids, bases or salts dissolved in it.

(ii) When we overeat, excess of acid is produced in the stomach which causes burning sensation.

(iii) Copper vessels tarnish due to formation of basic copper carbonate which gets neutralized when rubbed with lemon and the copper vessel regains its shine.

(iv) Washing soda is sodium carbonate decahydrate which when exposed to air loses 10 molecules of water and changes to white powder.

(v) Sodium chloride is a salt of strong acid HCl and strong base NaOH, so it is neutral.

Sodium carbonate is a salt of weak acid H_2CO_3 and strong base NaOH, so it is basic. **1 + 1 + 1 + 1 +1**

[CBSE Marking Scheme, 2014]

Q. 4. (a) Write the chemical formula of hydrated copper sulphate and anhydrous copper sulphate. Give an activity to illustrate how these two are inter convertible.

(b) Write chemical names and formulae of Plaster of Paris and gypsum. C **[Board Term-I, 2015]**

Ans. (a) Hydrated copper sulphate – $CuSO_4.5H_2O$

Anhydrous copper sulphate – $CuSO_4$.

Activity: (i) Heat a few crystals of copper sulphate in a dry boiling tube.

(ii) Add 2-3 drops of water on the sample of copper sulphate obtained after heating.

After heating, water is removed and salt turns white.

@PROCBSE JOIN NOW

If crystals are moistened again with water, blue colour reappears. Water of crystallization is fixed number of water molecules present in one formulae unit of a salt. Five water molecules are present in one formula unit of copper sulphate.

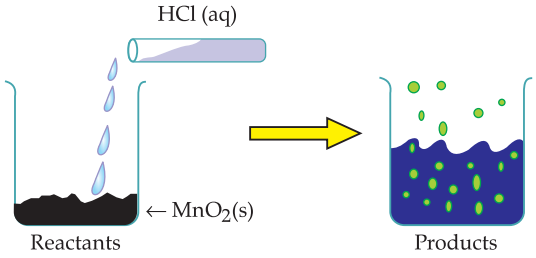
(b) Calcium sulphate hemihydrate – $CaSO_4.½H_2O$
Calcium sulphate dihydrate – $CaSO_4.2H_2O$.

[CBSE Marking Scheme, 2015] **3+2**

Visual Case-based Questions — 4 marks each

Q. 1. Read the following and answer any four questions from (a) to (e): [CBSE–QB 2021]

The reaction between MnO_2 with HCl is depicted in the following diagram. It was observed that a gas with bleaching abilities was released.



(a) The chemical reaction between MnO_2 and HCl is an example of:
(i) displacement reaction
(ii) combination reaction
(iii) redox reaction
(iv) decomposition reaction.

(b) Chlorine gas reacts with _____ to form bleaching powder.
(i) dry $Ca(OH)_2$
(ii) dil. solution of $Ca(OH)_2$
(iii) conc. solution of $Ca(OH)_2$
(iv) dry CaO

(c) Identify the correct statement from the following:
(i) MnO_2 is getting reduced whereas HCl is getting oxidized
(ii) MnO_2 is getting oxidized whereas HCl is getting reduced.
(iii) MnO_2 and HCl both are getting reduced.
(iv) MnO_2 and HCl both are getting oxidized.

(d) In the above discussed reaction, what is the nature of MnO_2 ?
(i) Acidic oxide **(ii)** Basic oxide
(iii) Neutral oxide **(iv)** Amphoteric oxide

(e) What will happen if we take dry HCl gas instead of aqueous solution of HCl?
(i) Reaction will occur faster.
(ii) Reaction will not occur.
(iii) Reaction rate will be slow
(iv) Reaction rate will remain the same.

Ans. (a) (iii) redox reaction
(b) (i) dry $Ca(OH)_2$
(c) (i) MnO_2 is getting reduced whereas HCl is getting oxidized
(d) (ii) Basic oxide
(e) (ii) Reaction will not occur

Q. 2. Read the following and answer any four questions from (a) to (e): [CBSE–QB 2021]

Frothing in Yamuna:

The primary reason behind the formation of the toxic foam is high phosphate content in the wastewater because of detergents used in dyeing industries, dhobi ghat Yamuna's pollution level is so bad that parts of it have been labelled 'dead' as there is no oxygen in it for aquatic life to survive.



(a) Predict the pH value of the water of river Yamuna if the reason for froth is high content of detergents dissolved in it.
(i) 10-11 **(ii)** 5-7
(iii) 2-5 **(iv)** 7

(b) Which of the following statements is correct for the water with detergents dissolved in it?
(i) low concentration of hydroxide ion (OH^-)and high concentration of hydronium ion (H_3O^+).
(ii) high concentration of hydroxide ion (OH^-) and low concentration of hydronium ion (H_3O^+).
(iii) high concentration of hydroxide ion (OH^-) as well as hydronium ion (H_3O^+).
(iv) equal concentration of both hydroxide ion (OH^-) and hydronium ion (H_3O^+).

(c) The table provides the pH value of four solutions P, Q, R and S

Solution	pH value
P	2
Q	9
R	5
S	11

Which of the following correctly represents the solutions in increasing order of their hydronium ion concentration?
(i) P>Q>R>S **(ii)** P>S>Q>R
(iii) S<Q<R<P **(iv)** S<P<Q<R

@PROCBSE

(d) High content of phosphate ion in river Yamuna may lead to:

(i) decreased level of dissolved oxygen and increased growth of algae

(ii) decreased level of dissolved oxygen and no effect of growth of algae

(iii) increased level of dissolved oxygen and increased growth of algae

(iv) decreased level of dissolved oxygen and decreased growth of algae

(e) If a sample of water containing detergents is provided to you, which of the following methods will you adopt to neutralize it?

(i) Treating the water with baking soda

(ii) Treating the water with vinegar

(iii) Treating the water with caustic soda

(iv) Treating the water with washing soda

Ans. (a) (i)

(b) (ii)

(c) (iii)

(d) (i)

(e) (ii)

Q. 3. Study the given table and answer the following questions. It shows the pH value of the plaque (which collects around teeth) surrounding the teeth of a child over 3 hrs.

Time/h	pH
0.00	7.0
1.0	7.0
2.0	7.1
3.0	7.2
4.0	4.1

(a) The three constituents of plaque are

(i) Acid **(ii) Saliva**

(iii) Bacteria **(iv) All of these**

(b) The pH which leads to tooth decay?

(i) above 7 **(ii) at 7**

(iii) below 5.5 **(iv) above 5.5**

(c) State the time during the day when condition is most favourable for process of tooth decay.

(i) 1.0 **(ii) 2.0**

(iii) 3.0 **(iv) 4.0**

(d) The nature of toothpastes commonly used to protect tooth decay is:

(i) acidic **(ii) basic**

(iii) neutral **(iv) none of the above**

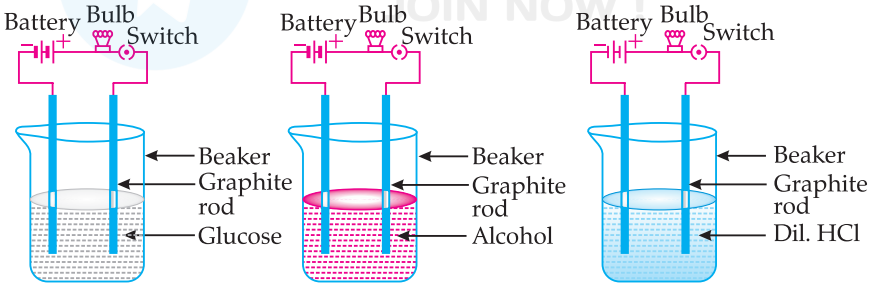
Ans. (a) (iv) The constituents of plaque are acid, saliva, bacteria and food.

(b) (iii) below 5.5

(c) (iv) Time 4.0, lowest pH indicates the highest amount of acid produced by the bacteria.

(d) (ii) basic **1+1+1+1**

Q. 4. Suhana takes three beakers *A*, *B* and *C* filled with aqueous solutions of glucose, alcohol and hydrochloric acid respectively as shown in the following figure:



(a) Which of the following statement is correct in terms of glowing of bulb when the switch is ON?

(i) Bulb A and B do not glow but bulb C glows.

(ii) Bulb A and C do not glow but bulb B glows.

(iii) Bulb B and C do not glow but bulb A glows.

(iv) All the bulbs glow.

(b) The bulb glows in a solution depending on whether the solution is:

(i) acidic **(ii) an electrolyte**

(iii) basic **(iv) a non electrolyte**

(c) Which of the following are present in a dilute aqueous solution of hydrochloric acid?

(i) $H_3O^+ + Cl^-$ **(ii)** $H_3O^+ + OH^-$

(iii) $Cl^- + OH^-$ **(iv) Unionized HCl**

(d) Which of the following statement is true if alcohol is replaced with NaOH solution:

(i) bulb glows in alcohol but not in NaOH solution.

(ii) bulb will glow in NaOH solution but not in alcohol

(iii) bulb does not glow in alcohol and neither will it glow in NaOH solution.

(iv) bulb glows in NaOH solution as well as in alcohol.

Ans. (a) Bulb *A* and *B* do not glow but bulb *C* glows.

(b) (ii) an electrolyte

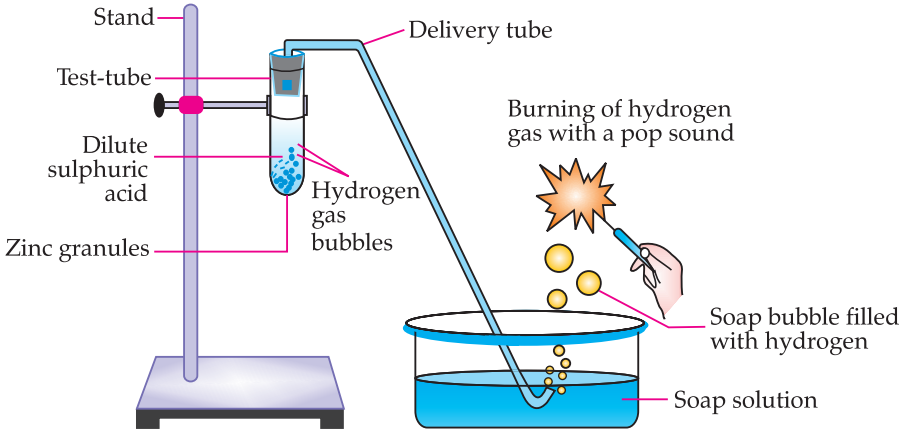
(c) (i) In a dilute aqueous solution of hydrochloric acid, $H_3O^+ + Cl^-$ ions are present.

(d) (ii) bulb will glow in NaOH solution but not in alcohol. **1+1+1+1**

@PROCBSE JOIN NOW !

@PROCBSE

Q. 5. Study the given experimental set-up and answer the following questions.



(a) The above experimental set up shows reaction between metal and
- **(i) Acid**
- **(ii) Metal carbonate**
- **(iii) Metal hydrogen carbonate**
- **(iv) Metal oxide**

(b) Which gas is liberated during the process?
- **(i) Hydrogen gas**
- **(ii) Carbon dioxide gas**
- **(iii) Nitrogen gas**
- **(iv) Hydrogen sulphide gas**

(c) Write the products formed in the above process:
- **(i) Zinc sulphate only**
- **(ii) Only hydrogen gas**
- **(iii) Zinc sulphate and hydrogen gas**
- **(iv) Zinc sulphide and hydrogen gas**

(d) A new product sodium zincate is formed if sulphuric acid is replaced with:
- **(i) Sodium hydroxide**
- **(ii) Sodium oxide**
- **(iii) Zinc oxide**
- **(iv) water**

Ans. (a) (i) It is a reaction between a metal (Zn) and an acid (H_2SO_4)

(b) (i) During the reaction between a metal and an acid, hydrogen gas is released.

(c) (iii) Zinc sulphate and hydrogen gas

(d) (i) Sodium hydroxide **1+1+1+1**

Q. 6. P, Q, R are different colourless solids, while S is a colourless solution. They are (in random order) Sodium chloride (NaCl), Calcium Carbonate ($CaCO_3$), Acetic acid (CH_3COOH) and Phenolphthalein indicator. Small amount of the above substances were added in pairs (e.g. P with Q; Q with R etc.) to a small amount of water in a test tube. They give the following results as shown in the observation table.

Observation Table:

	P	Q	R
Q	No reaction	-	No reaction
R	Dark Pink Colour	No reaction	-
S	No reaction	No reaction	Effervescence

(a) The chemicals are:

	P	Q	R	S
(i)	NaCl	$CaCO_3$	CH_3COOH	Phenolphthalein
(ii)	Phenolphthalein	NaCl	$CaCO_3$	CH_3COOH
(iii)	CH_3COOH	Phenolphthalein	NaCl	$CaCO_3$
(iv)	$CaCO_3$	CH_3COOH	Phenolphthalein	NaCl

(b) Which of the following reaction is incorrect:

(i) Phenolphthalein (P) + NaCl (Q) $\longrightarrow$ No reaction

(ii) Phenolphthalein + $CaCO_3$ (R) $\longrightarrow$ Alkaline medium (Dark Pink Colour)

(iii) Phenolphthalein + NaCl $\longrightarrow$ Acidic medium (Blue colour)

(iv) $CaCO_3$ (R) + $2CH_3COOH$ (S) $\longrightarrow$ $(CH_3COO)_2Ca + CO_2$ (effervescence) + $2H_2O$

(c) The chemicals that can be used as an acid– base indicator by a visually impaired student is _____. (*Petunia* leaves/ Vanilla essence).

(d) If acetic acid and hydrochloric acid of same concentration are taken, HCl is a stronger acid because it contains:

(i) more of Cl^- ions.

@PROCBSE JOIN NOW !

@PROCBSE

(ii) more of H^+ ions.
(iii) less of H^+ ions
(iv) more of CH_3COO^- ions.

Ans. (a) P- Phenophthalein, Q – NaCl, R – $CaCO_3$, S – CH_3COOH.

(b) (i) Phenophthalein (P) + NaCl (Q) → No reaction

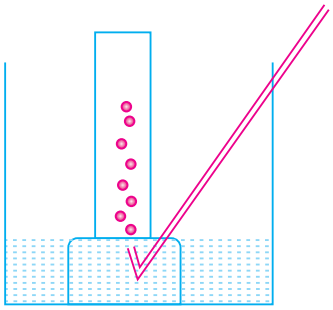
(ii) Phenolphthalein + $CaCO_3$ (R) → Alkaline medium (Dark Pink Colour)

(iii) $CaCO_3$ (R) + $2CH_3COOH$ (S) → $(CH_3COO)_2Ca + CO_2$ (effervescence) + $2H_2O$

(c) Vanilla essence can be used as an acid-base indicator by visually impaired students as it is an olfactory indicator whose odour changes in acidic or basic media.

(d) HCl is stronger because it gives rise to more H^+ ions than acetic acid. **1+1+1+1**

Q. 7. A metal is treated with dilute sulphuric acid. The gas evolved is collected by the method shown in the figure:



(a) Name the gas evolved:
(i) Hydrogen (ii) Oxygen
(iii) Sulphur dioxide gas (iv) Carbon dioxide

(b) Is the gas lighter or heavier than air? How will you test the gas?

(c) If the metal used above is zinc then write the chemical equation for the evolution of gas.

(d) What nature of hydrogen is used as a fuel in rocket:
(i) solid (ii) liquid
(iii) gaseous (iv) all of the above

Ans. (a) (i) Hydrogen gas. It is soluble in water.

(b) (i) Lighter than air . When a burning splinter is brought near the gas it burns with a pop sound.

(c) (ii) $Zn(s) + H_2SO_4(dil) \rightarrow ZnSO_4(aq) + H_2(g)\uparrow$

(d) (ii) Liquid **1+1+1+1**

Q. 8. Read the passage and answer the following questions.

Suhana wanted her house to be white washed. She bought 10 kg of quicklime from the market and dissolved it in 30 L of water. On adding lime to water, she observed that the water started boiling even when it was not being heated.

(a) Name the product when water is added to quicklime.
(i) Calcium oxide (ii) Calcium hydroxide
(iii) Calcium dioxide (iv) Calcium carbonate

(b) The common name for quick lime is:
(i) Calcium hydroxide (ii) Calcium oxide
(iii) Calcium dioxide (iv) Calcium carbonate

(c) The correct formula for calcium hydroxide is:
(i) Ca(OH) (ii) $Ca(OH_2)$
(iii) $Ca(OH)_2$ (iv) Ca_2OH_2

(d) Which of the following statements is correct about the above reaction based on your observations?
(i) It is an endothermic reaction.
(ii) It is an exothermic reaction
(iii) The pH of the resulting solution will be more than seven.
(iv) The pH of the resulting solution will be less than seven.
(i) I and II (ii) II and III
(iii) I and IV (iv) III and IV

Ans. (a) (ii) Calcium hydroxide

(b) (ii) Calcium oxide

(c) (iii) $Ca(OH)_2$

(d) (ii) It is an exothermic reaction because heat is given out. The resulting compound is $Ca(OH)_2$ which is basic in nature. So the pH of the resulting solution will be more than seven. **1 + 1+1+1**

Q. 9. Read the passage and answer the following questions:

Sanjana while preparing cake used baking soda in small amounts. It helps to make the cake soft and spongy. An aqueous solution of baking soda also turns red litmus blue. It is also used in soda acid extinguisher.

(a) Name the gas produced by the reaction of baking soda and acid which helps as fire extinguisher:
(i) Carbon monoxide (ii) Carbon dioxide
(iii) Hydrogen (iv) oxygen

(b) Name the products formed when baking soda is heated:
(i) sodium sulphate and carbon dioxide gas
(ii) sodium carbonate and water
(iii) sodium carbonate, carbon dioxide and water.
(iv) Sodium oxide carbon dioxide and water.

(c) The pH of baking soda solution is :
(i) more than 7
(ii) less than 7
(iii) equal to 7
(iv) less than 7 but more than 3.

@PROCBSE

(d) What is the chemical name for baking soda?
(i) Sodium carbonate
(ii) sodium bicarbonate
(iii) calcium carbonate
(iv) calcium bicarbonate.

Ans. (a) (ii) Carbon dioxide
(b) (iii) sodium carbonate, carbon dioxide and water.
(c) (i) more than 7
(d) (ii) sodium bicarbonate

Q. 10. Read the passage and answer the following questions.
A dry pellet of a common base B when kept in open absorbs moisture and turns sticky. The compound is also a by-product of chloro-alkali process.

(a) Identify B:
(i) Sodium chloride **(ii) Sodium hydroxide**
(iii) Carbon dioxide **(iv) Sodium carbonate**

(b) What type of reaction occurs when B is treated with an acidic oxide?
(i) Neutralisation
(ii) Double decomposition
(iii) Combination
(iv) Displacement

(c) What is the raw material used in chloro-alkali?
(i) aqueous solution of sodium chloride
(ii) sodium chloride in dry form
(iii) sodium hydroxide
(iv) sodium carbonate

(d) When aqueous sodium carbonate (Na_2CO_3) reacts with HCl (aq), it gives
(i) NaOH, H_2 and CO_2
(ii) NaCl, H_2O and CO_2
(iii) $NaHCO_3$, H_2 and CO_2
(iv) $NaHCO_3$, H_2O and CO_2

Ans. (a) (ii) Sodium hydroxide
(b) (i) Neutralisation
(c) (i) aqueous solution of sodium chloride
(d) (ii) NaCl, H_2O and CO_2

$$Na_2CO_3(aq) + 2HCl(aq) \rightarrow 2NaCl + H_2O + CO_2$$
1+1+1+1

Know the Terms

- **Mineral acids:** The acids which are obtained from minerals are called **mineral acids**.
- **Organic acids:** Acids which are obtained from plants and animals are called organic acids.
- **Strong acids:** The acids which ionise almost completely are called **strong acids**, *e.g.*, mineral acids.
- **Weak acids:** The acids which ionise only partially or to a lesser extent are called **weak acids**, *e.g.*, organic acids.
- **Strong bases:** The substances / bases which ionise completely to furnish OH^- ions are called **strong bases**, *e.g.*, KOH, NaOH etc.
- **Weak bases:** The bases which ionize partially are called **weak bases**, *e.g.*, $Mg(OH)_2$, $Cu(OH)_2$ etc.
- **Alkalies:** Water soluble bases are called **alkalies**, *e.g.*, NaOH, KOH. Thus, all alkalies are bases but all bases are not alkali.

OSWAAL LEARNING TOOL
To learn from Oswaal Concept Video
Visit: http:qrgo.page.link OR Scan this code

❑❑❑

@PROCBSE

Metals and Non-metals

Metals

Physical Properties

They are solids

High M. P. and B.P.

High density

Malleable and ductile

Good conductors of heat and electricity

Chemical Properties

$Metal + O_2 \rightarrow Metal\ Oxide$

$2Mg + O_2 \rightarrow 2MgO$

$Metal + Water \rightarrow Metal\ oxide + Hydrogen\ gas$

$Metal\ oxide + water \rightarrow Metal\ hydroxide$

$2Na(s) + 2H_2O(l) \rightarrow 2NaOH(aq) + H_2(g) + Heat\ energy$

$Metal + dilute\ acid \rightarrow Salt + H_2$

$Mg + 2HCl \rightarrow MgCl_2 + H_2$

$Metal + Cl_2 \rightarrow Metal\ Chloride$

$Metal + H_2 \rightarrow Metal\ Hydride$

Non-metals

Physical Properties

Can be solids, liquids or gases

Low M.P and B.P

Brittle

Non-malleable and non-ductile

Poor conductors of heat and electricity

Chemical Properties

$Non\text{-}metal + O_2 \rightarrow Non\text{-}metal\ oxide$

$C(s) + O_2(g) \rightarrow CO_2(g)$

$Non\text{-}metal + steam \rightarrow H_2 + non\text{-}metal\ oxide$

$C(s) + 2H_2O(g) \rightarrow CO_2(g) + 2H_2$

$Non\text{-}metal + acid \rightarrow No\text{-}reaction$

$Non\text{-}metal + Cl_2 \rightarrow Non\text{-}metal\ chloride$

Corrosion

A process in which metal reacts with substance present in the atmosphere to form surface compounds, called rust

Reactivity series of metals

The series of metals in decreasing order of reactivity.

K > Na > Ca > Mg > Al > Zn > Fe > Sn > Pb > H > Cu > Hg > Ag > Au > Pt.

Extraction of metals

Ore

Concentration of ore

- Metals of high reactivity → Electrolysis of molten ore → Pure metal
- Metals of medium reactivity → Carbonate ores → Calcination; Sulphide ores → Roasting
- Metals of low reactivity → Sulphide ores → Roasting → Metal → Refining

Oxide of metal

Reduction to metal

Purification of metal

Formation of ionic compound

When metals react with non-metals, electrons are transferred from the metal atoms to the non-metal atoms, forming ionic compounds.

eg. Formation of Sodium Chloride

$Na \rightarrow Na^+ + e^-$

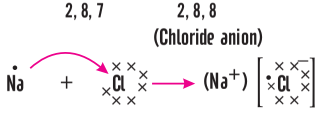
2, 8, 1 — 2, 8

(Sodium cation)

$Cl + e^- \rightarrow Cl^-$

2, 8, 7 — 2, 8, 8

(Chloride anion)



Trace the Mind Map

First Level · Second Level · Third Level

@PROCBSE

CHAPTER

3

METALS AND NON-METALS

Syllabus

Properties of metals and non-metals; Reactivity series; Formation and properties of ionic compounds; Basic metallurgical processes; Corrosion and its prevention.

Trend Analysis

List of Concept names	2018	2019		2020	
	OD/D	OD	D	OD	D
Properties of metals and Non-metals; Reactivity series, amphoteric oxides		1 Q (2 M) 1 Q (3 M)	1 Q (5 M)	1 Q (5 M)	1 Q (5 M)
Formation and properties of ionic compounds; Basic metallurgical processes; Corrosion and its prevention	1 Q (5 M)	Or 1 Q (2 M)			

@PROCBSE JOIN NOW !

TOPIC - 1

Properties of Metals and Non-Metals

Revision Notes

Introduction

- Metals are mostly solids, possessing high density. They have high melting and boiling points. They are lustrous and sonorous. They are good conductors of heat and electricity.
- Most of the metals are hard. However, some of the metals like sodium, potassium are soft metals and can be easily cut with knife.
- All metals are solids except Mercury, Caesium, Francium, Germanium and Gallium which are solids with low melting point. Gallium becomes liquid if kept on palm but Gallium has very high boiling point which makes it useful for high temperature thermometers.

TOPIC - 1

Properties of Metals and Non-Metals
Page No. 42

TOPIC - 2

Ionic compounds, Metallurgy and Corrosion
Page No. 48

@PROCBSE

➢ **Physical Properties:**

Property	Metals	Non-Metals
1. Lustre	Metals have shining surface.	They do not have shining surface. • Except Iodine.
2. Hardness	They are generally hard. • Except Sodium, Lithium and Potassium which are soft and can be easily cut with knife.	Generally soft. • Except Diamond, a form of carbon which is the hardest natural substance.
3. State	Exist as solids. • Except Mercury that exists in liquid.	Exist as solids or gases • Except Bromine that exists in liquid.
4. Malleability	Metals can be beaten into thin sheets. • Gold, Silver and Aluminium are the most malleable metals.	Non-metals are non-malleable. • They are brittle.
5. Ductility	Metals can be drawn into thin wires.	They are non-ductile.
6. Conductor of heat & electricity	Metals are good conductors of heat and electricity.	Non-metals are poor conductors of heat and electricity. • Except Graphite.
7. Density and Melting point	Generally metals have high density and high melting point. • Except Sodium and Potassium	Non metals have low density and low melting point.
8. Sonorous	Metals produce a sound on striking a hard surface.	They are not sonorous.
9. Oxides	Metallic oxides are basic in nature.	Non-metallic oxides are acidic in nature.

➢ **Chemical Properties:**

(A) Reaction with Air:

Metals combine with oxygen to form metal oxide.

Metals + O_2 → Metal oxide

Examples:

(i) $2Cu + O_2 \rightarrow 2CuO$
Copper (II) oxide (black)

(ii) $4Al + 3O_2 \rightarrow 2Al_2O_3$
Aluminium oxide

(iii) $2Mg + O_2 \rightarrow 2MgO$
Magnesium oxide

@PROCBSE
JOIN NOW !

Scan to know more about this topic
Metals and non metals

➢ Different metals show different reactivity towards O_2.

- Na and K react so vigorously with oxygen that they catch fire if kept in open. So they are kept immersed in kerosene.
- Surfaces of Mg, Al, Zn and Pb are covered with a thin layer of oxide which prevent them from further oxidation.
- Fe does not burn on heating but iron fillings burn vigorously.
- Cu does not burn but is coated with black copper (II) oxide.
- Au and Ag do not react with oxygen.

➢ **Amphoteric Oxides:** Metal oxides which react with both acids as well as bases to produce salt and water are called amphoteric oxides.

Examples: $Al_2O_3 + 6HCl \rightarrow 2AlCl_3 + 3H_2O$
Aluminium chloride

$Al_2O_3 + 2NaOH \rightarrow 2NaAlO_2 + H_2O$
Sodium aluminate

(B) Reaction of Metals with Water:

Metal + Water → Metal oxide + Hydrogen

Metal oxide + Water → Metal hydroxide

Examples: $2Mg + 2H_2O \rightarrow 2MgO + 2H_2$
Magnesium oxide

@PROCBSE

$$MgO + H_2O \rightarrow Mg(OH)_2$$
Magnesium hydroxide

(C) Reaction of Metals with Solutions of other Metal Salts:

Metal A + Salt solution B → Salt solution A + Metal B

- Reactive metals can displace less reactive metals from their compounds in solution form.

$$Fe + CuSO_4 \longrightarrow FeSO_4 + Cu$$

- All the metals do not react with the same rate. Some react very fast, some react moderately whereas others react very slowly. The series of metals in decreasing order of reactivity is called **reactivity** or **activity series of metals.** The metals at the top (K at the top most) are most reactive whereas metals at the bottom (Pt at the extreme bottom) least reactive.

K > Na>Ca>Mg,> Al > Zn > Fe>Sn> Pb,>H > Cu > Hg > Ag > Au > Pt.

- Metals react with dilute acids to form salt and hydrogen gas. The metal replaces hydrogen of the acid to form salt.
- **Aqua Regia** is a mixture of conc. HCl and conc. HNO_3 in the ratio of 3: 1. It can dissolve gold and platinum. Aqua Regia is a strong oxidizing agent due to the formation of NOCl (Nitrosyl chloride) and chlorine produced by reaction of two acids.
- **Alloys** are homogeneous mixtures of two or more metals. One of them can be non-metal also, *e.g.,* Brass is an alloy of copper and zinc. When a metal is alloyed with mercury, it is called an **amalgam**.
- Metals in reactivity series, if placed above hydrogen, can displace hydrogen from dilute acids (HCl and H_2SO_4).

Mnemonics

Concept: Activity series of metals

Mnemonics:
Popular **S**cientists **C**an **M**ake **A** **Z**oo **I**n**T**he **L**ow **H**umid **C**ountry **M**ore **S**atisfactorily

Interpretation:

P - Potassium
C – Calcium
A - Aluminium
I - Iron
L - Lead
C - Copper
S - Silver
S – Sodium
M – Magnesium
Z – Zinc
T - Tin
H – Hydrogen
M - Mercury

@PROCBSE JOIN NOW !

Objective Type Questions — 1 mark each

A Multiple Choice Questions

Q. 1. Which one of the following metals does not react with cold as well as hot water?

(a) Na **(b) Ca**
(c) Mg **(d) Fe** [NCERT Exemp.]

Ans. Correct option : (d)

Explanation: Metals like aluminium, zinc, iron do not react with hot/cold water. They react with water only when water is in the form of steam.

$3Fe + 4H_2O \rightarrow Fe_3O_4 + 4H_2$. **1**

Q. 2. What happens when calcium is treated with water?

(i) It does not react with water.
(ii) It reacts violently with water.
(iii) It reacts less violently with water.
(iv) Bubbles of hydrogen gas formed stick to the surface of calcium.

(a) (i) and (iv) **(b) (ii) and (iii)**
(c) (i) and (ii) **(d) (iii) and (iv)**
[NCERT Exemp.]

Ans. Correct option : (d)

Explanation: Calcium reacts slowly with water. The reaction forms calcium hydroxide, $Ca(OH)_2$ and hydrogen gas (H_2). The calcium metal sinks in water and after an hour or so bubbles of hydrogen are observed, stuck to the surface of the metal. **1**

Q. 3. Generally, non-metals are not lustrous. Which of the following non-metal is lustrous?

(a) Sulphur **(b) Oxygen**
(c) Nitrogen **(d) Iodine**
[NCERT Exemp.]

@PROCBSE

Ans. Correct option : (d)
Explanation: Iodine is a non-metal but it is lustrous. **1**

Q. 4. An element A is soft and can be cut with a knife. This is very reactive to air and cannot be kept open in air. It reacts vigorously with water. Identify the element from the following:
(a) Mg **(b) Na**
(c) P **(d) Ca** [NCERT Exemp.]

Ans. Correct option : (b)
Explanation: Sodium is so soft that can be cut using a knife. It reacts with oxygen or moisture present in air readily and reacts with water vigorously. Because of this sodium is stored in kerosene oil to prevent any reaction or accident. **1**

B Assertions and Reasons Type Questions

Directions: In the following questions, a statement of assertion (A) is followed by a statement of reason (R). Mark the correct choice as:
(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).
(b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).
(c) Assertion (A) is true but reason (R) is false.
(d) Assertion (A) is false but reason (R) is true.

Q. 1. Assertion (A): When a piece of copper metal is added to dilute sulphuric acid, the solution turns blue.
Reason (R): Copper reacts with dilute sulphuric acid to form blue copper (II) sulphate solution.

Ans. Correct option : (a)
Explanation: When a piece of copper metal is added to dilute sulphuric acid, the solution turns blue. It is because, copper reacts with dilute sulphuric acid to form blue copper (II) sulphate solution. **1**

Q. 2. Assertion (A): Metals are sonorous.
Reason (R): They are generally brittle in the solid state; they break into pieces when hammered.

Ans. Correct option :(c)
Explanation: Metals are sonorous, malleable and ductile while non-metals are brittle. **1**

Q. 3. Assertion (A): Gas bubbles are observed when sodium carbonate is added to dilute hydrochloric acid.
Reason (R): Carbon dioxide is given off in the reaction.

Ans. Correct option : (a)
Explanation: Gas bubbles are observed when sodium carbonate is added to dilute hydrochloric acid as CO_2 gas is released. **1**

C Very Short Answer Type Questions

Q. 1. The compound obtained on reaction of iron with steam is/are: R [CBSE Delhi 2020]

Ans. Fe_3O_4
$3Fe(s) + 4H_2O(g) \rightarrow Fe_3O_4(s) + 4H_2(g)$ **1**

Q. 2. An element 'X' reacts with O_2 to give a compound with a high melting point. This compound is also soluble in water. The element 'X' is likely to be: U [Delhi 2020]

Ans. Calcium reacts with oxygen and form CaO which has high melting point and is water soluble. **1**

Q. 3. Name a non-metal which is lustrous and a metal which is non-lustrous. AE [DDE 2017]

Ans. Non-metal (lustrous) = Iodine (I)
Metal (non-lustrous) = Sodium (Na) ½+½

Q. 4. Why is gold a preferred metal for making jwellery? (Any two reasons) R

Ans. Due to the property of malleability, ductility and it is lustrous **(Any two)** ½+½

Q. 5. Which of the two, metal or non metal will form an oxide which is basic in nature? U

Ans. Metal, because metal oxides are basic in nature. **1**

AI **Q. 6. How are oxides of metal different from oxides of non metals in terms of their nature?** U

Ans. Metallic oxides are basic, few are amphoteric.
Non-metallic oxides are acidic, few are neutral.
½+½

Short Answer Type Questions-I — 2 marks each

Q. 1. The following observations were made by a student on treating four metals P, Q, R and S with the given salt solutions: C [CBSE 2020]

Sample	$MgSO_4$ (aq)	$Zn(NO_3)_2$ (aq)	$CaSO_4$ (aq)	Na_2SO_4 (aq)
P	No reaction	Reaction occurs	Reaction occurs	No reaction
Q	Reaction occurs	Reaction occurs	Reaction occurs	Reaction occurs
R	No reaction	Reaction occurs	No reaction	No reaction
S	No reaction	No reaction	No reaction	No reaction

Based on the above observations:
(a) Arrange the given samples in the increasing order of reactivity
(b) Write the chemical formulae of products formed when Q reacts with $CuSO_4$ solution.

Ans. (a) S>R>P>Q
(b) Cu and QSO_4 **2**

@PROCBSE

Q. 2. Give reasons:

(a) Platinum, gold and silver are used to make jewellery.

(b) Metals like sodium and potassium are stored under oil. AE **[CBSE Outside delhi 2019]**

Ans. (a) Lustre, ductile, malleable, least reactive

(Any two) ½ + ½

(b) Na & K are highly reactive (in air & moisture).

[CBSE Marking Scheme, 2019] 2

Q. 3. Silver articles become black when kept in open for some time, whereas copper vessels lose their shiny brown surfaces and gain a green coat when kept in open. Name the substances present in air with which these metals react and write the name of the products formed. A **[Outside Delhi 2019]**

Ans.

Silver	Sulphur in air	Silver sulphide ½+½
Copper	Moisture an carbon dioxide	Copper carbonate ½×4½=2

[CBSE Marking Scheme, 2019] 2

Q. 4. Give reasons:

(a) Carbonate and sulphide ores are usually converted into oxides during the process of extraction.

(b) Aluminium is a highly reactive metal; still it is widely used in making cooking utensils.

U **[Outside Delhi 2019]**

Ans. (a) It is easier to obtain a metal from its oxide as compared to sulphide and carbonate ore.

(b) Aluminium forms a thicker protective oxide layer.

[CBSE Marking Scheme, 2019] 2

Q. 5. Give reasons for the following:

(i) Most metals conduct electricity well.

(ii) The reaction of iron (III) oxide [Fe_2O_3] with heated aluminium is used to join cracked machine parts.

AE **[CBSE Delhi 2019]**

Ans. (i) Metals have loosely bound electrons / Loose electrons easily / free electrons.

(ii) Molten iron produced during reaction joins the cracked machine parts.

[CBSE Marking Scheme, 2019] 2

Short Answer Type Questions-II — 3 marks each

AI **Q. 1. What are amphoteric oxides? Give an example. Write balanced chemical equations to justify your answer.**

R **[CBSE Board Outside Delhi, Set-I, 2019]**

Ans. Amphoteric oxides: Metal oxides showing both acidic and basic nature.

Example: Al_2O_3 / ZnO **(or any other)**

$Al_2O_3 + 6HCl \longrightarrow 2AlCl_3 + 3H_2O$

$Al_2O_3 + 2NaOH \longrightarrow 2NaAlO_2 + H_2O$

½ + ½ + 1 + 1

[CBSE Marking Scheme, 2019]

Detailed Answer:

Oxides of metals which have both acidic as well as basic behaviour are known as amphoteric oxides. Examples are aluminium oxide and zinc oxide. Amphoteric oxides react with acids as well as base to form salt and water. ZnO reacts with hydrochloric acid (acid) to form zinc chloride (salt) and water thus acting as basic oxide.

$$\underset{\text{Zinc oxide}}{ZnO(s)} + \underset{\text{Hydrochloric acid (Acid)}}{2HCl(aq)} \rightarrow \underset{\text{Zinc chloride (Salt)}}{ZnCl_2(aq)} + \underset{\text{Water}}{H_2O(l)}$$

ZnO reacts with sodium hydroxide (base) to form sodium zincate (salt) and water thus, acting as acidic oxide.

$$\underset{\text{Zinc oxide}}{ZnO(S)} + \underset{\text{Sodium hydroxide (Base)}}{2NaOH(aq)} \rightarrow \underset{\text{Sodium zincate (Salt)}}{Na_2ZnO_2(aq)} + \underset{\text{Water}}{H_2O(l)}$$

1 + 1 + 1

Q. 2. You are given samples of three metals: Sodium, magnesium and copper. Suggest any two activities to arrange them in order to their decreasing reactivity. U **[Board Term-I, 2016]**

Ans. Different metals react with oxygen at different rates. *e.g.*, Sodium (Na) and potassium (K) catch fire, if left in open. Hence, these are the most reactive metals. To prevent accidental fires, these metals are kept immersed in kerosene oil. Magnesium burns in air only by heating. So, it is less reactive than sodium and potassium. Copper (Cu) does not burn on heating but blister copper burns. Hence the order of reactivity of these metals with oxygen is:

Na > Mg > Cu.

Metals react with water to produce a metal oxide and hydrogen gas. Sodium (Na) and potassium (K) react violently with cold water. So the reaction is violent and exothermic. Magnesium (Mg) does not react with cold water. It reacts with hot water. Metals like lead, copper, silver do not react with water at all. The reactivity series of metals towards water is:

Na > Mg > Cu. **1½ + 1½**

@PROCBSE JOIN NOW

COMMONLY MADE ERROR

- Students usually get confused with the order of reactivity of metals.

ANSWERING TIP

- Understand the concept of reactivity of metals and how to arrange them in increasing or decreasing order.

AI **Q. 3. State reason for the following:**

(i) Non-metals cannot displace hydrogen from the acids.

(ii) Hydrogen is not a metal, yet it is placed in the activity series of metals.

(iii) Aluminium is more reactive than iron, yet its corrosion is less than that of iron.

U **[Board Term-I, 2015]**

Ans. (i) Non-metals are electron acceptors, they cannot supply electrons so as to convert H^+ ion to $H_2(g)$.

(ii) Like metals, hydrogen can lose an electron to form positive H^+ ion.

(iii) Aluminium reacts with oxygen in atmosphere and forms a strong protective layer of oxide which protects the metal from further corrosion. **1+1 + 1**

Long Answer Type Questions — 5 marks each

Q. 1. A metal 'M' is stored under kerosene. It vigorously catches fire, if a small piece of this metal is kept open in air. Dissolution of this metal in water releases great amount of energy and the metal catches fire. The solution so formed turns red litmus blue. C **[CBSE Outside Delhi 2020]**

(a) Name the metal 'M'.

(b) Write formula of the compound formed when this metal is exposed to air.

(c) Why is metal 'M' stored under kerosene ?

(d) If oxide of this metal in treated with hydrochloric acid, what would be the products?

(e) Write balanced equations for:

(i) Reaction of 'M' with air.

(ii) Reaction of 'M' with water.

(iii) Reaction of metal oxide with hydrochloric acid.

Ans. (a) Metal M is sodium (Na).

(b) Formula of the compound formed is Na_2O.

(c) Metals like sodium and potassium react with oxygen so fast that they can catch fire if kept open. Since, they are most reactive metals; they are always kept immersed in kerosene oil to prevent accidental fire.

(d) Sodium oxide reacts with hydrochloric acid to produce sodium chloride and water.

(e) (i) Reaction with air:

$4Na + O_2 \rightarrow 2Na_2O$

(ii) Reaction with water:

$2Na(s) + 2H_2O(l) \rightarrow 2NaOH(aq) + H_2(g) + \text{heat energy}$

(iii) Reaction of sodium oxide with HCl:

$Na_2O(s) + 2HCl(aq) \rightarrow 2NaCl(aq) + H_2O(l)$

1 × 5 = 5

Q. 2. (a) List in tabular form any three chemical properties on the basis of which metals and non-metals are differentiated.

(b) State two ways to prevent the rusting of iron.

R+U **[Compartment Set 1, 2,3 , 2018]**

Ans. (a)

S. No.	Metals	Non-Metals
1.	Lose electrons to form positive ions/ are electropositive in nature.	Gain electrons to form negative ions/ are electronegative in nature.
2.	React with dilute acids to liberate hydrogen gas.	Do not react with dilute acids .
3.	Generally metal oxides are basic in nature.	Generally non-metal oxides are acidic in nature.

(b) (i) Painting

(ii) Oiling

(iii) Galvanization

(vi) Alloying **(or any other)**

[CBSE Marking Scheme, 2018] 5

COMMONLY MADE ERROR

- Students get confused and interchange the properties of metals and non metals.

ANSWERING TIP

- Don't get confused between acceptor and gainer of electron concept.
- Learn and understand the properties of both metals and non metals with examples.

@PROCBSE

TOPIC - 2
Ionic compounds, Metallurgy and Corrosion

Revision Notes

- **Ionic Compounds**
  The compounds formed by the transfer of electrons from a metal to a non-metal are called ionic compounds or electrovalent compounds.
- **Properties of Ionic Compounds**
  (i) **Physical nature:** They are solid and hard, generally brittle.
  (ii) **Melting and Boiling Point:** They have high melting and boiling points.
  (iii) **Solubility:** Generally soluble in water and insoluble in solvents such as kerosene, petrol etc.
  (iv) **Conduction of electricity:** Ionic compounds conduct electricity in molten and solution form but not in solid state.
- **Occurrence of Metals**
  - **Minerals:** The elements or compounds which occur naturally in the earth's crust are called minerals.
  - **Ores:** Minerals that contain very high percentage of particular metal and the metal can be profitably extracted from it, such minerals are called ores.
- **Extraction of metals**
  - It is the process of obtaining pure metal from its ore.
  - Extraction of metal can be classified into three steps:
    1. Enrichment of ores or concentration of ores
    2. Extraction of metal from the concentrated ores.
    3. Refining of metal

@PROCBSE JOIN NOW !

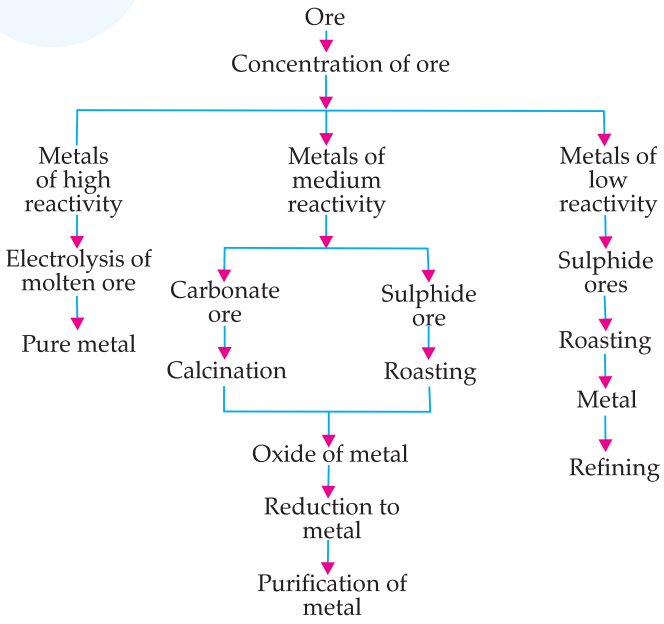


Fig: Steps involved in the extraction of metals from ores.

Scan to know more about this topic

Difference between metals and non-metals

- **Alloys**
  - An alloy is a homogeneous mixture of two or more metals or a metal and non-metal. It is prepared by mixing the molten metals in definite proportions and then cooling the mixture at the room temperature.

@PROCBSE

- Examples include:

Alloys	Constituents
Stainless steel	Iron, carbon, nickel, chromium
Brass	Copper and zinc
Bronze	Copper and tin
Solder	Lead and tin

➢ **Amalgam:** An alloy in which mercury is present as one of the constituents is known as amalgam. e.g. Sodium amalgam and Silver amalgam

Mnemonics

Concept:	Concept:
Mnemonics: Long Route, Short Route, Medium Route	**Mnemonics : Cold Coffee Should Rearranged**
Interpretation: **L**ow **R**eactivity **S**ulphide **O**res **R**oasting **M**etal **R**efining	**Interpretation:** **C**arbonate Ores **C**alcination **S**ulphide ores **R**oasting

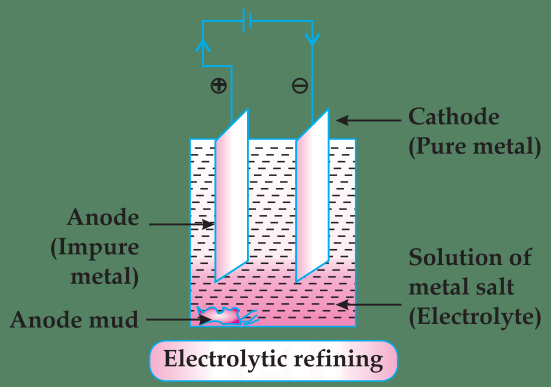
How is it done on the GREENBOARD?

Q. Describe electrolytic refining of copper with chemical equations. Draw a well labelled diagram for it.

Ans. Step I: Electrolytic Refining: This method is widely used as purification of metals like zinc (Zn), copper (Cu), aluminium (Al), chromium (Cr), tin (Sn), lead (Pb), nickel (Ni) and gold (Au).

Step II: In this process, impure metal is used as anode, a strip of pure metal is used as cathode and soluble salt of metal is used as electrolyte. On passing electric current through the electrolyte, cations move towards cathode, gain electrons and pure metal gets deposited on cathode.

Step III: In electrolytic refining of copper, the impurities left behind at anode called anode mud contains valuable metals such as gold and silver which can be recovered in the native state.



3

@PROCBSE

Objective Type Questions — 1 mark each

A Multiple Choice Questions

Q. 1. Which of the following metals exist in their native state in nature?

(i) Cu **(ii) Au**
(iii) Zn **(iv) Ag**
(a) (i) and (ii) **(b) (ii) and (iii)**
(c) (ii) and (iv) **(d) (iii) and (iv)**

[NCERT Exemp.]

Ans. Correct option : (c)
Explanation: Metals such as gold and silver are found as native metals.

Q. 2. Galvanization is a method of protecting iron from rusting by coating with a thin layer of

(a) Gallium **(b) Aluminium**
(c) Zinc **(d) Silver**

[NCERT Exemp.]

Ans. Correct option : (c)
Explanation: In the process of galvanization, iron is covered by a coat of zinc. This layer of zinc prevents iron from getting rusted.

Q. 3. Which of the following metals are obtained by electrolysis of their chlorides in molten state?

(i) Na **(ii) Ca**
(iii) Fe **(iv) Cu**
(a) (i) and (iv) **(b) (iii) and (iv)**
(c) (i) and (iii) **(d) (i) and (ii)**

[NCERT Exemp.]

Ans. Correct option : (d)
Explanation: Sodium and calcium fall towards the top of reactivity series. Since, sodium and calcium are very reactive these metals cannot be reduced to pure form from their oxides or carbonates.
Thus, sodium and calcium are obtained by the process of electrolysis of their chlorides.

Q. 4. An electrolytic cell consists of

(i) positively charged cathode
(ii) negatively charged anode
(iii) positively charged anode
(iv) negatively charged cathode
(a) (i) and (ii) **(b) (iii) and (iv)**
(c) (i) and (iii) **(d) (ii) and (iv)**

[NCERT Exemp.]

Ans. Correct option: (b)
Explanation: Positively charged ions are called cations as they are deposited at negatively charged pole. Negatively charged ions are called anions as these are deposited at positively charged pole. That's why the negatively charged pole is called cathode and positively charged pole is called anode.

Q. 5. Alloys are homogeneous mixtures of a metal with a metal or non-metal. Which among the following alloys contain non-metal as one of its constituents?

(a) Brass **(b) Bronze**
(c) Amalgam **(d) Steel**

[NCERT Exemp.]

Ans. Correct option: (d)
Explanation: Steel is an alloy of iron and carbon. Mixing of carbon gives strength to iron.

B Assertions and Reasons Type Questions

Directions: In the following questions, a statement of assertion (A) is followed by a statement of reason (R). Mark the correct choice as:

(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).
(b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).
(c) Assertion (A) is true but reason (R) is false.
(d) Assertion (A) is false but reason (R) is true.

Q. 1. Assertion (A): A mineral is called ore, when metal is extracted from it conveniently and economically.
Reason (R): All ores are minerals but all minerals are not ores.

Ans. Correct option : (b)
Explanation: Minerals are naturally occurring chemical substances in the earth's crust obtained by mining. But a mineral is called an ore only when the metal can be extracted from it conveniently and economically. Thus, all ores are minerals but all minerals are not ores.

Q. 2. Assertion (A): In the metallurgy of Al, purified Al_2O_3 is mixed with Na_3AlF_6 or CaF_2.
Reason (R): It lowers the melting point of the mixture and brings conductivity.

Ans. Correct option: (a)
Explanation: In the metallurgy of aluminium, purified Al_2O_3 is mixed with Na_3AlF_6 or CaF_2 which lowers the melting point of the mixture and brings conductivity.

Q. 3. Assertion (A): Usually the sulphide ore is converted to oxide before reduction.
Reason (R): Reduction of oxides occurs easier.

Ans. Correct option: (a)
Explanation: Usually the sulphide ore is converted to oxide before reduction as oxides are easier to reduce.

Q. 4. Assertion (A): While the extraction of copper, one of the steps involved is
$Cu_2S + 2Cu_2O \longrightarrow 6Cu + SO_2$

@PROCBSE

Reason (R): In this reaction Cu_2S is the reducing agent whereas Cu_2O is the oxidising agent.

Ans. Correct option : (c)

Explanation: The Cu^{2+} ion in both the compounds gets reduced while sulphur gets oxidised.

Q. 5. Assertion (A): In alumino thermite process, the metals like iron melts due to the heat evolved in the reaction.

Reason (R): The reaction is:

$Fe_2O_3 + 2Al \longrightarrow Al_2O_3 + 2Fe$

Ans. Correct option: (a)

Explanation: Large amount of heat is evolved which melts iron and can be used for welding.

C Very Short Answer Type Questions

Q. 1. Why do ionic compounds not conduct electricity in solid state but conduct electricity in molten and aqueous state? U [CBSE SQP-2020]

Ans. Ionic compound do not conduct electricity in solid state due to absence of free ions but they conduct electricity in molten and aqueous state due to presence of free ions. **1**

Q. 2. State thermite reaction giving the reaction involved. R [Board Term-1] [Set (B1), 2010]

Ans. Reduction of iron oxide to iron by aluminium is called thermite reaction. **1**

$Fe_2O_3 + 2Al \longrightarrow 2Fe + Al_2O_3 + Heat.$

AI **Q. 3. Why is painting on iron articles necessary?** AE

Ans. Paint forms a protective coating on the surface of iron. So, oxygen and moisture present in the air cannot have a direct contact with the metal. Therefore, surface gets protected against rusting. **1**

Q. 4. Why carbon is not considered as a good reducing agent while reducing alumina? U

Ans. Because aluminium has greater affinity for oxygen than for carbon, therefore carbon cannot reduce alumina (Al_2O_3) to aluminium. **1**

Q. 5. Show by equation, the product formed when zinc carbonate is heated in absence of oxygen. U

Ans. ZnO(*s*) and CO_2(*g*) are formed.

$ZnCO_3 \xrightarrow{\Delta} ZnO + CO_2$ **1**

Short Answer Type Questions-I — 2 marks each

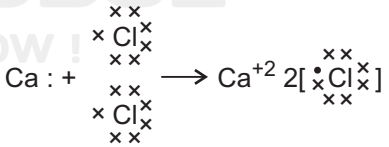
Q. 1. Name a metal of medium reactivity and write three main steps in the extraction of this metal from its sulphide ore. [CBSE Outside Delhi 2019]

Ans. **(i)** Iron / Zinc / Lead (any one) ½
(ii) Concentration of ore Enrichment of ore ½
(iii) Roasting / conversion of sulphide into oxide on heating in air ½
(iv) Reduction of metallic oxide to metal ½
[CBSE Marking Scheme, 2019]

Q. 2. Explain the formation of Calcium Chloride with the help of electron dot structure. (At numbers: Ca = 20; Cl = 17) [CBSE SQP-2020]

Ans.

	Z	E.C.
Ca	20	2, 8, 8, 1
Cl	17	2, 8, 7,



Ca^{+2} $2Cl^-$
$CaCl_2$

Q. 3. (a) Where does the metal aluminium, used in the process, occurs in the reactivity series of metals?

(b) Name the substances that are getting oxidised and reduced in the process. [CBSE Delhi 2020]

Ans. **(a)** As aluminium is more reactive than iron, so it is placed above iron in the reactivity series.

(b) Aluminium is getting oxidised to aluminium oxide and iron oxide is getting reduced to iron.

Short Answer Type Questions-II — 3 marks each

Q. 1. What is thermit process? Where is this process used? Write balanced chemical equation for the reaction involved. [CBSE Delhi 2020]

Ans. Thermite reaction: Reaction in which iron oxide reacts with aluminium to produce molten iron.

The thermite reaction is used to join railway tracks or cracked machine parts.

This process is called thermite welding.

It is an exothermic process.

$Fe_2O_3(s) + 2Al(s) \rightarrow 2Fe(l) + Al_2O_3(s) + Heat$

@PROCBSE

Q. 2. An ore on treatment with dil. HCl gives the smell of rotten egg. Name the type of this ore. How can the metal be obtained from its concentrated ore? [CBSE OD 2019]

Topper Answer, 2019

Ans.

Smell of rotten eggs is usually produced by Sulphur.

∴ It must be a sulphide ore.

let us suppose that the ore is Zinc blende (ZnS).

Concentration of ore

First of all, the ore is concentrated by the method of Froth floatation.

Conversion into metal oxide

Then it is ~~roasted~~ converted into its metal oxide via Roasting in supply of excess air.

for eg. $ZnS + O_2 \xrightarrow[\Delta]{\text{Roasting}} ZnO + SO_2 \uparrow$

Zinc Sulphide ore (excess air) → Zinc Oxide + Sulphur dioxide (pungent smell)

Conversion into metal

It is then converted into its metal form by using a reducing agent like Carbon, Aluminium etc.

for eg. $ZnO + C \xrightarrow{\text{reduction}} Zn + CO$

Zinc oxide + (reducing agent) Carbon → Zinc metal (contaminated) + Carbon monoxide

It is further refined to get it in its pure form.

Q. 3. Explain the following:

(a) Sodium chloride is an ionic compound which does not conduct electricity in solid state, whereas it conducts electricity in molten state as well as in its aqueous solution.

(b) Reactivity of aluminium decreases if it is dipped in nitric acid.

(c) Metals like calcium and magnesium are never found in their free state in nature.

A [CBSE Board Delhi, Set- III, 2019]

Ans. (a) In molten state, due to heat the electrostatic forces of attraction between the oppositely charged ions are overcome. So ions move freely and conduct electricity. In aqueous solutions ions are free and conduct electricity.

(b) Due to the formation of a coating of aluminium oxide / Al_2O_3.

(c) Reactive metals like calcium and magnesium react easily with different elements and occur in the form of ores. **1 + 1 + 1**

[CBSE Marking Scheme, 2019]

@PROCBSE

Detailed Answer:

(a) Sodium chloride is an ionic compound formed by ions of sodium (Na^+) and chlorine (Cl^-). In solid state, ions are fixed in position so no free electrons are available to conduct electricity. Whereas in molten state and aqueous solution of sodium chloride, free electrons are available to conduct electricity.

(b) On dipping aluminium in nitric acid, a layer of aluminium oxide is formed as nitric acid is a strong oxidizing agent. The layer of aluminium oxide prevents further reaction of aluminium due to which the reactivity of aluminium decreases.

(c) Because these metals are highly reactive and readily react with atmospheric oxygen and other gas. **1+1+1**

Q. 4. Given below are the steps for the extraction of copper from its ore. Write the chemical equation of the reactions involved in each case.

(i) Roasting of copper (I) sulphide

(ii) Reduction of copper (I) oxide with copper (I) sulphide

(iii) Electrolytic refining

R [CBSE Board Outside Delhi, Set- III, 2019]

Ans. (i) $2\,Cu_2S + 3O_2 \xrightarrow{Heat} 2\,Cu_2O + 2SO_2$

(ii) $2Cu_2O + Cu_2S \xrightarrow{Heat} 6\,Cu + SO_2$

(iii) At anode: $Cu \rightarrow Cu^{2+} + 2e^-$

At Cathode: $Cu^{2+} + 2e^- \rightarrow Cu$

(1 + 1+ (½ + ½)) [CBSE Marking Scheme, 2019]

Detailed Answer:

(i) Roasting of copper (I) sulphide:

$$\underset{\text{Copper sulphide}}{2Cu_2S(s)} + 3O_2(g) \xrightarrow{Heat} \underset{\text{Copper oxide}}{2Cu_2O(s)} + 2SO_2(g)$$

(ii) Reduction of copper (I) oxide from copper (I) sulphide:

$$\underset{\text{Copper oxide}}{2Cu_2O(s)} + \underset{\text{Copper sulphide}}{Cu_2S(s)} \xrightarrow{Heat} 6Cu(s) + SO_2(g)$$

(iii) Electrolytic refining:

At anode: $Cu(s) \rightarrow Cu^{2+}(aq) + 2e^-$

At cathode: $Cu^{2+}(aq) + 2e^- \rightarrow Cu(s)$ **1+1+1**

Q. 5. What is Cinnabar ? How is a metal extracted from cinnabar ? Explain briefly.

R [CBSE Board Term-I, 2016]

Ans. Cinnabar (HgS) is an ore of mercury.

When Cinnabar, HgS is heated in air, it is first converted into HgO, HgO is then reduced to Hg on further heating.

$$2HgS + 3O_2 \xrightarrow{\Delta} 2HgO + 2SO_2$$

$$2HgO \xrightarrow{\Delta} 2Hg + O_2$$

[CBSE Marking Scheme, 2016]

Detailed Answer:

- Cinnabar (HgS) is an ore of Mercury.
- The metals being less reactive can be obtained by reducing their oxides to metals by heating alone.

So, when Cinnabar is heated in air, it first changes into its oxide and then into mercury metal.

$$\underset{\text{(Cinnabar)}}{2HgS(s)} + \underset{\text{(Air)}}{3O_2(g)} \xrightarrow{Heat} \underset{\text{Mercury oxide}}{2HgO(s)} + \underset{\text{Sulphur dioxide}}{2SO_2(g)}$$

$$\underset{\text{mercuric (II) oxide}}{2HgO(s)} \xrightarrow{\Delta} \underset{\text{mercury metal}}{2Hg(l)} + \underset{\text{oxygen}}{O_2(g)}$$

Long Answer Type Questions — 5 marks each

Q. 1. Carbon cannot reduce the oxides of sodium, magnesium and aluminium to their respective metals. Why? Where are these metals placed in the reactivity series? How are these metals obtained from their ores? Take an example to explain the process of extraction along with chemical equations. U [CBSE Delhi 2020]

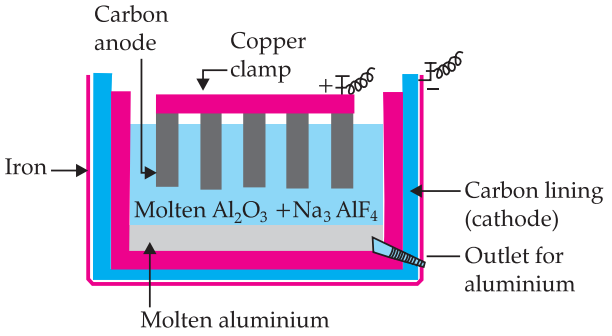
Ans. Metals which are placed high in the reactivity series such as sodium, calcium, magnesium, aluminium etc. are very reactive. These metals have high affinity for oxygen than carbon. Therefore, these metals cannot be obtained by reduction with carbon. For such metals, electrolytic reduction process is used for obtaining metal.

Electrolytic reduction of aluminium: Molten aluminium oxide is electrolysed to produce pure aluminium at the cathode while oxygen gas is produced at the anode.

$Al^{3+} + 3e^- \rightarrow Al$ (aluminium metal at the (–) cathode)

$2O^{2-} - 4e^- \rightarrow O_2$ (oxygen gas at the (+)anode)

1+1+1+2



Electrolytic reduction of aluminium

Q. 2. Write balanced chemical equations to explain what happens, when

@PROCBSE JOIN NOW !

@PROCBSE

(i) Mercuric oxide is heated.
(ii) Mixture of cuprous oxide and cuprous sulphide is heated.
(iii) Aluminium is reacted with manganese dioxide.
(iv) Ferric oxide is reduced with aluminium.
(v) Zinc carbonate undergoes calcination.

AE **[CBSE Outside Delhi 2020]**

Ans. (i) When mercury oxide is heated strongly, it reduces to mercury metal.

$2HgO \xrightarrow{heat} 2Hg + O_2$

(ii) When a mixture of copper oxide and copper sulphide is heated, pure copper is obtained.

$2Cu_2O + Cu_2S \rightarrow 6Cu + SO_2$

(iii) When aluminium powder is heated with manganese dioxide, the following reaction takes place:

$3MnO_2(s) + 4Al(s) \rightarrow 3Mn(l) + 2Al_2O_3(s) + heat$

(iv) Reaction of ferric oxide with aluminium: In this reaction, a lot of heat is produced along with molten iron. This process of metal oxide to form metal by using aluminium powder as a reducing agent is known as thermite reaction.

$Fe_2O_3(s) + 2Al(s) \rightarrow 2Fe(l) + Al_2O_3(s) + Heat:$

(v) Heating of carbonate ores in the limited supply of air is known as calcination. During the process, carbon dioxide gas is released and metal oxide is obtained.

$ZnCO_3 \xrightarrow{heat} ZnO + CO_2$ **1×5=5**

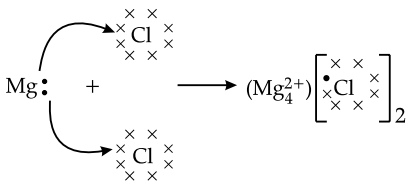
Q. 3. (i) By the transfer of electrons, illustrate the formation of bond in magnesium chloride and identify the ions present in this compound.
(ii) Ionic compounds are solids. Give reasons.
(iii) With the help of a labelled diagram show the experimental set up of action of steam on a metal.

U **[Outside Delhi 2020]**

Ans. (i) Formation of magnesium chloride:

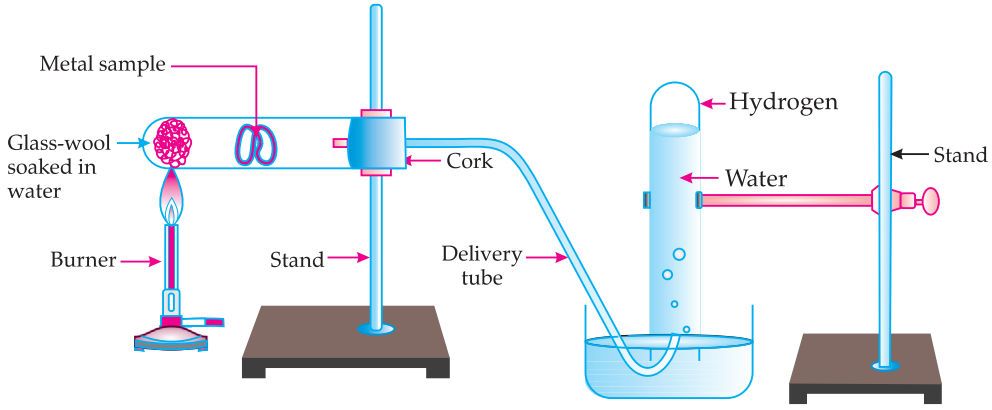
Here, magnesium is a metal and chlorine is a non-metal. Magnesium atom loses two electrons to attain noble gas configuration and results in the formation of magnesium cation Mg^{2+}. Similarly, chlorine atom gains electron to complete its octet and results in the formation of chloride anion Cl^-. When magnesium reacts with chlorine, two electrons lost by magnesium atom are gained by two chlorine atoms. Mg^{2+} and Cl^- being oppositely charged, attract each other and held by strong electrostatic forces of attraction to exist as $MgCl_2$.

$Mg \rightarrow Mg^{2+} + 2e^-$
2,8,2 2,8
(Magnesium cation)
$Cl \rightarrow Cl^-$
2,8,7 2,8,8
(Chloride anion)



(ii) Due to the strong force of attraction between the positive and negative ions, ionic compounds are solid.

(iii) Reaction with steam: Metals like iron, zinc and aluminium react with steam to form corresponding oxide and hydrogen gas.



Reaction of metal with steam **2 + 1 + 2**

@PROCBSE

Q. 4. (a) Write electron dot structures of Ca (Atomic no. 20) and O (Atomic no. 8).

(b) Show the formation of calcium oxide by transfer of electrons.

(c) Name the ions present in this compound.

(d) List four important characteristics of this compound. AE **[Outside Delhi 2020]**

Ans. (a) Ca = 2, 8, 8, 2 O = 2, 6

(b) Ca ⁘ + ⁙O: → Ca^{2+} [⁙O:]

(c) Calcium ions (Ca^{2+}) and oxygen ions (O^{2-})

(d) Characteristics of calcium oxide (CaO):

(i) Quick lime is an amorphous white solid with a high melting point of about.

(ii) It is a very stable compound and withstands high temperatures.

(iii) In the presence of water, it forms slaked lime. This process is called the slaking of lime.

$$CaO + H_2O \rightarrow Ca(OH)_2$$

(iv) It is an oxide that is basic in nature and forms salts when it comes in contact with an acid.

$$CaO + H_2SO_4 \rightarrow CaSO_4 + H_2O$$

AI **Q. 5. (a) Define the terms 'alloy' and 'amalgam'. Name the alloy used for welding electric wires together. What are its constituents ?**

(b) Name the constituents of the following alloys:

(i) Brass (ii) Stainless steel (iii) Bronze,

State one property in each of these alloys, which is different from its main constituents.

R **[DDE 2017]**

Ans. (a) An alloy is a homogeneous mixture of two or more metals or a metal and a non-metal, mixed in the molten state. Amalgam is an alloy of a metal with mercury.

Solder is the alloy used for the welding of electric wires. Tin and Lead are its constituents.

(b) (i) Brass – copper and zinc

(ii) Stainless steel – Iron, carbon, nickel, chromium

(iii) Bronze – copper and tin.

Brass and bronze have lower electrical conductivity than their constituents. Stainless steel does not corrode easily as iron does. **1 + 3 + 1**

COMMONLY MADE ERROR

➲ Students get confused with metals involved in forming alloys and their name.

ANSWERING TIP

➲ Make a list and learn the mixture of metals of alloys with their names.

Q. 6. Metal X is found in nature as its sulphide XS. It is used in the galvanisation of iron articles. Identify the metal X. How will you convert this sulphide ore into the metal? Explain with equations.

A **[CBSE SQP, 2020]**

Ans. Metal X is Zinc

The sulphide ore is first heated strongly in supply of oxygen and changed into its oxide. This process is called roasting.

$$2ZnS + 3O_2 \xrightarrow{heat} 2ZnO + 2SO_2$$

Zinc oxide is then reduced to zinc metal by heating it with carbon. This process is called reduction.

$$2ZnO + C \rightarrow 2Zn + CO_2$$

[CBSE Marking Scheme, 2020] 1 + 1 + 1 + 1 + 1

Q. 7. State the reason for the following:

(i) Aluminium oxide is called an amphoteric oxide.

(ii) An iron strip dipped in a blue copper sulphate solution turns blue pale green solution.

(iii) Hydrogen gas is not evolved when most metals react with nitric acid.

(iv) Calcium does not occur in free state in nature.

(v) Sodium and potassium metals are kept immersed under kerosene. A **[Board SQP, 2020]**

Ans. (i) As it reacts with both acids as well as bases to form salts.

(ii) Iron being more reactive than copper displaces copper from copper sulphate to form green ferrous sulphate solution.

(iii) Nitric acid is a strong oxidising agent. Hydrogen gas produced gets oxidised to H_2O.

(iv) Calcium is a very reactive metal. It reacts with the chemicals in surroundings and occurs in combined state.

(v) Sodium and potassium are highly reactive metals and react vigorously with oxygen in air and may even catch fire. They do not react with kerosene.

[CBSE Marking Scheme, 2020] 1 + 1 + 1 + 1 + 1

AI **Q. 8. (a) Write chemical equations for the following reactions:**

(i) Calcium metal reacts with water.

(ii) Cinnabar is heated in the presence of air.

(iii) Manganese dioxide is heated with aluminium powder.

(b) What are alloys ? List two properties of alloys.

R **[CBSE Board Delhi, Set- II, 2019]**

Ans. (a) (i) $Ca + 2H_2O \longrightarrow Ca(OH)_2 + H_2$

(ii) $2HgS + 3O_2 \xrightarrow{Heat} 2HgO + 2SO_2$

(iii) $3MnO_2 + 4Al \longrightarrow 2Al_2O_3 + 3Mn$

(b) Alloys are homogeneous mixture of two or more metals or a metal and a non metal.

Properties:

Alloys are stronger / harder / have low melting point / more resistant to corrosion / some are magnetic in nature. **(Any two)**

[CBSE Marking Scheme, 2019] 3 + 2

@PROCBSE JOIN NOW!

Q. 9. (i) How will you show experimentally that metals are good conductors of heat.

(ii) Describe the extraction of Mercury metal from its ore Cinnabar (HgS). R+U [SQP, 2018]

Ans. (i) Diagrams (consider from detailed answer)

Procedure

Observation: Heat is transferred from one end of metal wire to the free end of wire which melts the wax and pin falls shows metals conduct heat.

(ii) Ore: HgS – cinnabar

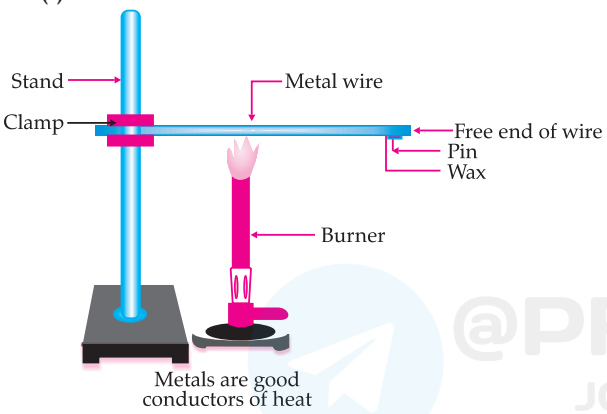
Roasting: $2HgS(s) + 3O_2(g) \rightarrow 2HgO(s) + 2SO_2(g)$

Reduction: $2HgO(s) \xrightarrow{\Delta} 2Hg(l) + O_2(g)$

[CBSE Marking Scheme, 2018] 5

Detailed Answer:

(i)



Procedure: Take an aluminium or copper wire and fix this wire on a stand as shown in the figure above. Attach pin to the free end of the wire with the help of wax. Heat the wire with the help of burner, candle or spirit lamp whatever available near the place where it is fixed.

Observation: Heat is transferred from one end of the metal wire to the free end of the wire, which melts the wax and the pin falls.

Inference: This experiment shows that metals are good conductors of heat and have high melting points.

(ii) Refer SAQ, Q5 Short Answer Type-II.

COMMONLY MADE ERROR

- Students often give incorrect experimental procedure and set-up.
  Students also get confused with the techniques and equations involved in the extraction of mercury metal.

ANSWERING TIP

- Practise the diagrams thoroughly and learn the extraction methods of mercury, copper and aluminium properly.

AI **Q. 10. (i) Write the steps involved in the extraction of pure metals in the middle of the activity series from their carbonate ores.**

(ii) How is copper extracted from its sulphide ore ? Explain the various steps supported by chemical equations. Draw labelled diagram for the electrolytic refining of copper.

R+U [Delhi/Outside Delhi, 2018]

Ans. (i) (a) Calcination, (b) Reduction, (c) Purification (in the given sequence only)

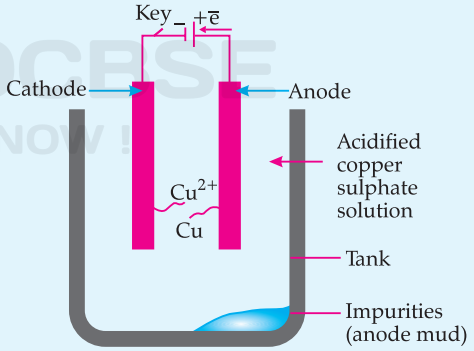
(ii) Sulphide ore of copper is heated in air.

$2Cu_2S + 3O_2 \rightarrow 2Cu_2O + 2SO_2$

$2Cu_2O + Cu_2S \rightarrow 6Cu + SO_2$

(Note: Full marks to be awarded even when only equations are written).

Labelled diagram of electrolytic refining of copper:



Electrolytic refining of copper

[CBSE Marking Scheme, 2018] 5

COMMONLY MADE ERROR

- Students usually write vague answers. It seems they are confused about the extraction methods involved.

ANSWERING TIP

- Understand the concept of ore extraction and the order of the steps involved in the extraction and the equation separately for sulphide and oxide ores. Diagrams are equally important.

@PROCBSE JOIN NOW !

Topper Answer, 2018

Ans.

(a) Extraction of pure metals from 'CO_3' ores :-

(i) Concentration of ore

↳ Gangue or matrix must be removed from ore by processes taking in mind differences in physical & chemical properties of gangue & ore.

(ii) Calcination :

The carbonate ores must be heated strongly in absence of air to convert them into metal ores.

$$ZnCO_3(s) \xrightarrow{\Delta} ZnO(s) + CO_2(\uparrow),$$

(iii) Reduction by a more reactive metal or Carbon :-

$$ZnO + C \longrightarrow Zn + Co$$

This will happen as Carbon has higher affinity for ~~for~~ oxygen than zinc.

(iv) Finally, the obtained metal ~~can~~ be refined by electrolysis of ~~their salt~~ salt solution.

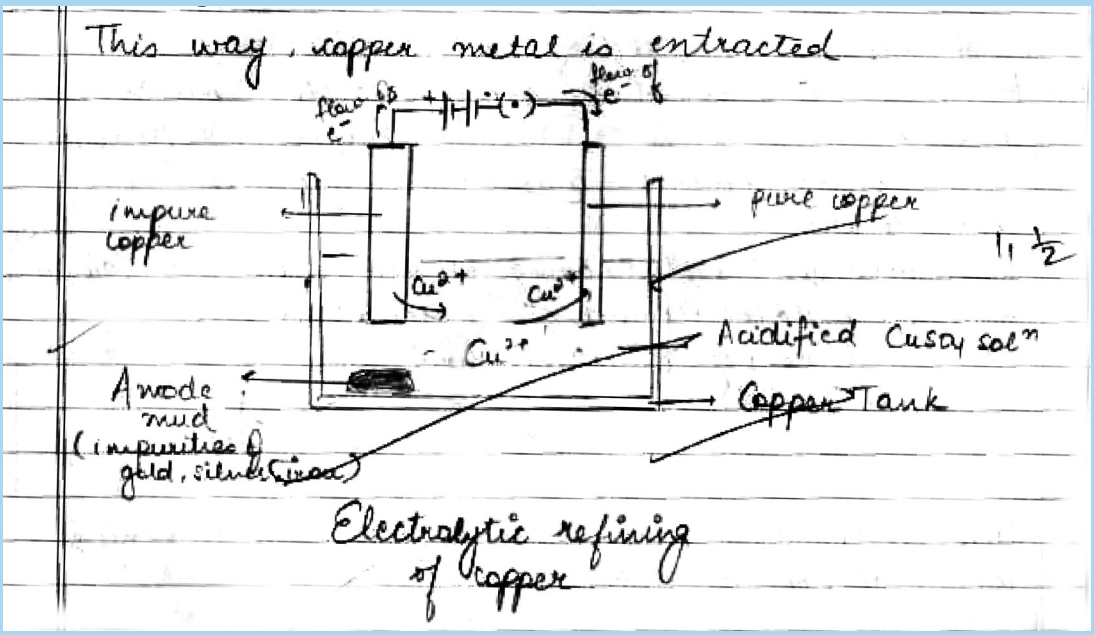
(b) Copper glance [Cu_2S] is copper's sulphide ore. It is first roasted & then reduced by the remaining Cu_2S in tank.

$$2Cu_2S(s) + 3O_2(g) \xrightarrow{\Delta} 2Cu_2O(s) + 2SO_2(g)$$

[Copper (I) sulphide] [Copper (I) oxide]

$$2Cu_2O(s) + Cu_2S(s) \xrightarrow{\Delta} 6Cu(s) + SO_2(g)$$ 2

@PROCBSE



Visual Case-based Questions — 4 marks each

Q. 1. Study the given table and answer any four questions from (a) to (e):
A student took the samples of four metals A, B, C and D and added following solutions one by one. The results obtained have been tabulated as follows:

Metal	Iron (II) Sulphate	Copper (II) Sulphate	Zinc Sulphate	Silver Nitrate
A	No reaction	Displacement	-	-
B	Displacement	-	No reaction	-
C	No reaction	No reaction	No reaction	Displacement
D	No reaction	No reaction	No reaction	No reaction

(a) Choose the most reactive metal:
(i) A **(ii) B**
(iii) C **(iv) D**

(b) Which of the following will displace Cu from its solution of sulphate:
(i) A only **(ii) B only**
(iii) Both A and B **(iv) None of the above**

(c) Which is the correct decreasing order of reactivity?
(i) B > A > C > D **(ii) A > B > D > C**
(iii) D > B > A > C **(iv) B > A > D > C**

(d) The gas produced when dil. HCl is added to a reactive metal:
(i) Oxygen **(ii) nitrogen**
(iii) hydrogen **(iv) none of the above**

(e) On the basis of sequence of reactions, identify the most and least reactive elements.
A + BX → AX + B
C + AY → CY + A
(i) Most reactive: C; Least reactive: B
(ii) Most reactive: B; Least reactive: C
(iii) Most reactive: A; Least reactive: B
(iv) Most reactive: B; Least reactive: A

Ans. (a) (i) B is the most reactive metal as it displaces iron from its salt solution.
(b) (ii) B only
B will displace Cu from $CuSO_4$ solution because B is more reactive than copper.
(c) (i) B > A > C > D
(d) (iv) Hydrogen
(e) (i) Most reactive: C; Least reactive: B **1+1+1+1**

Q. 2. When a silvery grey powder of a solid (A) is mixed with a powder of solid (B) no reaction occurs. But if the mixture is ignited and lighted using magnesium ribbon a reaction occurs with evolution of large amount of heat forming product (C) which settles down as liquid metal and the solid product (D) formed floats on the liquid (C). (C) in solid form reacts with moisture to form rust. The amount of heat generated during the reaction is so high that the reaction is used in welding of electric conductors, joints in railway tracks. Based on this information, answer any four questions from (a) to (e).

@PROCBSE

(a) Identify A and C?
(i) A – Al and C – Fe **(ii) A – Fe and C – Al**
(iii) A – Mg and C- Al **(iv) A – Al and C - Cu**
(b) Identify B and D which are oxides of:
(i) B – Fe , D – Al **(ii) B – Mg , D – Al**
(iii) B – Al D - Cu **(iv) B – Al D – Fe**
(c) Amphoteric oxides are:
(i) Metal oxides which do not react with acids but reacts with bases.
(ii) Metal oxides which reacts with both acids as well as bases.
(iii) Metal oxides which reacts with acids but do not react with bases.
(iv) Metal oxides which shows no reaction with either acids or bases.
(d) Which of the following is amphoteric in nature:
(i) Both aluminium oxide and zinc oxide
(ii) Only zinc oxide
(iii) Only aluminium oxide
(iv) Neither of them.
(e) The reaction in which heat is generated is called as:
(i) Exothermic reaction
(ii) Endothermic reaction
(iii) Decomposition reaction
(iv) Precipitation reaction

Ans. (a) (i) A - Al and C - Fe
(b) (i) B = oxide of iron D – oxide of Al
(c) (ii) Metal oxides which reacts with both acids as well as bases.
(d) (i) Both aluminium oxide and zinc oxide
(e) (i) Exothermic reaction **1+1+1+1**

Q. 3. Read the following passage and answer any four questions from (a) to (e).
Sohan went door to door posing as a goldsmith. He promised to bring back the glitter of old and dull gold ornaments. An unsuspecting lady gave a set of gold bangles to him which he dipped in a particular solution. The bangles sparkled like new but their weight was reduced drastically. The lady was sad but after a futile argument, the man beat a hasty retreat.
(a) Which of the following is used for dissolution of gold?
(i) Hydrochloric acid
(ii) Sulphuric acid
(iii) Nitric acid
(iv) Aqua regia
(b) The composition of aqua-regia is
(i) Dil. HCl: Conc. HNO_3 3: 1
(ii) Conc. HCl: Dil. HNO_3 3: 1
(iii) Conc. HCl: Conc. HNO_3 3: 1
(iv) Dil. HCl: Dil. HNO_3 3: 1
(c) Which of the following is incorrect?
(i) Aqua regia is a strong oxidising agent.
(ii) Aqua regia is a strong reducing agent.
(iii) Aqua regia dissolves gold in it.
(iv) Aqua regia is a mixture of hydrochloric acid and nitric acid.
(d) Aqua regia dissolves:
(i) Gold and platinum
(ii) Gold and silver
(iii) Platinum and silver
(iv) Only gold
(e) Examples of Noble metals are:
(i) Gold **(ii) Silver**
(iii) Platinum **(iv) All of the above**

Ans. (a) Correct option: (d)
Explanation: Aqua Regia is a mixture of concentrated HNO_3 and concentrated HCl. It is used for dissolution of gold.
(b) Correct option: (c)
Explanation: Aqua regia is a mixture of nitric acid and hydrochloric acid, that is 3 part conc. HCl and one part conc. HNO_3 (3: 1).
(c) (ii) Aqua regia is a strong reducing agent.
(d) (i) gold and platinum
(e) (iv) all of the above **1+1+1+1**

Q. 4. Read the passage and answer any four questions from (a) to (e).
During extraction of metals, electrolytic refining is used to obtain pure metals. During the process, the impure metal is made the anode and a thin strip of pure metal is made the cathode. The solution of the metal salt is used as an electrolyte. On passing the current through the electrolyte, the pure metal from the anode dissolves from the electrolyte. An equivalent of pure metal from the electrolyte is deposited on the cathode.
(a) The process of purification of the metal obtained after reduction, is called:
(i) Extraction **(ii) Refining**
(iii) Froth floatation **(iv) Electrolysis**
(b) Which of the metals are refined by electrolytic refining?
I. Au **II. Cu**
III. Na **IV. K**
(i) I and II **(ii) I and III**
(iii) II and III **(iv) II and IV**
(c) During electrolytic refining of zinc, it gets
(i) deposited on cathode.
(ii) deposited on anode.
(iii) deposited on cathode as well as anode.
(iv) remains in the solution.
(d) In electrolytic refining of copper, impure copper act as _____and pure copper as _____:
(i) cathode , anode
(ii)) cathode, electrolyte
(iii)) anode , cathode
(iv) electrolyte, cathode
(e) Anode is _____electrode while cathode is ---------electrode:
(i) negative, positive
(ii) reducing, oxidising
(iii) both a and b
(iv) neither a nor b

@PROCBSE

Ans. (a) (ii) Refining

(b) Correct option: (a)

Explanation: Metals like Cu, Zn, Ag and Au are refined by electrolytic refining.

(c) Correct option: (a)

Explanation: Ions of zinc are positively charged, thus while electrolytic refining of zinc, zinc is deposited at cathode (negatively charged pole).

(d) (iii) anode, cathode

(e) (iii) both a and b **1+1+1+1**

Q. 5. Read the given passage and answer any four questions from (a) to (e).

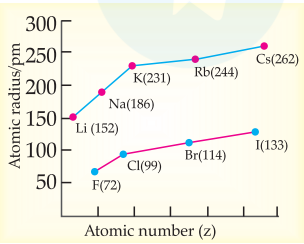
Metallic Character:

The ability of an atom to donate electrons and form positive ion (cation) is known as electro-positivity or metallic character. Down the group, metallic character increases due to increase in atomic size and across the period, from left to right electro-positivity decreases due to decrease in atomic size.

Non-Metallic Character:

The ability of an atom to accept electrons to form a negative ion (anion) is called non-metallic character or electronegativity. The elements having high electro-negativity have a higher tendency to gain electrons and form anion.

Down the group, electronegativity decreases due to increase in atomic size and across the period, from left to right electro -negativity increases due to decrease in atomic size.



(a) Which of the following correctly represents the decreasing order of metallic character of Alkali metals plotted in the graph? U

(i) Cs>Rb>Li>Na>K (ii) K>Rb>Li>Na>Cs

(iii) Cs>Rb>K>Na>Li (iv) Cs>K>Rb>Na>Li

(b) Hydrogen is placed along with Alkali metals in the modern periodic table though it shows non-metallic character: U

(i) as Hydrogen has one electron & readily loses electron to form negative ion.

(ii) as Hydrogen can easily lose one electron like alkali metals to form positive ion.

(iii) as Hydrogen can gain one electron easily like Halogens to form negative ion.

(iv) as Hydrogen shows the properties of non-metals.

(c) Which of the following has highest electronegativity? C

(i) F (ii) Cl

(iii) Br (iv) I

(d) Identify the reason for the gradual change in electronegativity in halogens down the group. C

(i) Electronegativity increases down the group due to decrease in atomic size.

(ii) Electronegativity decreases down the group due to decrease in tendency to lose electrons.

(iii) Electronegativity decreases down the group due to increase in atomic radius/ tendency to gain electron decreases.

(iv) Electronegativity increases down the group due to increase in forces of attractions between nucleus & valence electrons.

(e) Which of the following reason correctly justifies that "Fluorine (72pm) has smaller atomic radius than Lithium (152pm)"? R

(i) F and Li are in the same group. Atomic size increases down the group

(ii) F and Li are in the same period. Atomic size increases across the period due to increase in number of shells

(iii) F and Li are in the same group. Atomic size decreases down the group

(iv) F and Li are in the same period and across the period atomic size/radius decreases from left to right.

Ans. (a) (iii) Cs > Rb > K > Na > Li

(b) (ii) as Hydrogen can easily lose one electron like alkali metals to form positive ion

(c) (i) F

(d) (iii) Electronegativity decreases down the group due to increase in atomic radius/ tendency to gain electron decreases.

(e) (iv) F and Li are in the same period and across the period atomic size/radius decreases from left to right. **1+1+1+1**

Q. 6. In a thermite reaction, a compound of iron reacts with a metal.

(a) The metal used is: R

(i) Zinc (ii) Aluminium

(iii) Magnesium (iv) None of these.

(b) After completion of this reaction, a metal is obtained in the molten state. Identify the metal: C

(i) Zinc (ii) Aluminium

(iii) Iron (iv) Magnesium

(c) The correct equation to justify thermite reaction is: R

(i) $Fe_2O_3 + 2Al \rightarrow 2Fe + Al_2O_3$ – Heat.

(ii) $Fe_2O_3 + 2Al \rightarrow 2Fe + Al2O_3$ + Heat.

(iii) $Al_2O_3 + 2Fe \rightarrow 2Al + Fe_2O_3$ + Heat.

(iv) $Fe_2O_3 + 2Al \rightarrow 2Fe + Al_2O_3$.

(d) The correct name for Fe_2O_3 is: C

(i) Ferrous oxide (ii) Ferric oxide

(iii) Ferrous hydroxide (iv) Ferric hydroxide

Ans. (ii) Aluminium

(b) (iii) Iron

(c) (ii) $Fe_2O_3 + 2Al \rightarrow 2Fe + Al_2O_3$ + Heat.

(d) (ii) Ferric oxide **1+1+1+1**

@PROCBSE JOIN NOW!

@PROCBSE

Know the Terms

- **Malleability:** The ability of a metal due to which it can be beaten into large thin sheets is called **malleability**.
- **Ductility:** It is the ability of metal due to which it can be drawn into thin and long wires. Copper, aluminium and iron can be drawn into wires. Silver, gold and platinum are highly ductile metals.
- **Electrical conductance:** It is the property due to which electric current can pass through the metal. It is due to presence of free electrons or mobile electrons. Copper, silver, gold and aluminium are good conductors of electricity.
- **Thermal conductivity:** It is the property due to which metals can conduct heat. *e.g.*, Copper, silver, aluminium, gold and iron are good conductors of heat.
- **Metallic lustre:** Metals in their pure state have bright shining surfaces. This property is called **metallic lustre**.
- **Sonorous:** When metals are struck with a hard substance, they produce sound. This property is called **sonority** and the metals are said to be **sonorous**.
- **Neutral oxides:** The oxides which are neither acidic nor basic in nature, are known as **Neutral oxides**. They neither react with acids nor with bases. Some non-metals form neutral oxides. Example CO, NO, N_2O etc.
- **Metallurgy:** All the processes involved in the extraction of metals from their ores and refining them for use, is called metallurgy.
- **Ore-dressing:** It is a process of removing unwanted substances from the ore. This is also known as concentration of the ore or enrichment of ore. It is usually done by hydraulic washing, magnetic separation or froth floatation process.
- **Froth floatation process:** It is the process based on the principle that the mineral particles are more wetted by the oil, whereas the gangue particles are wetted by water. Compressed air is bubbled through the mixture. As a result of agitation, oil froth is formed which contains minerals which float on the top of water and can be separated easily.
- **Gangue:** The unwanted material present in the ores mined from earth is called **Gangue**. It needs to be removed prior to the extraction process.
- **Leaching:** It makes use of difference in the chemical properties of minerals and gangue. The ore is treated with suitable reagent which reacts with the ore, but not with the gangue. The purified ore is regenerated by sequence of reactions. An example of leaching is Bayer's method of obtaining pure aluminium oxide from Bauxite.
- **Roasting:** It is the process in which ore is heated in the presence of air so as to obtain metal oxides, which can be reduced easily to get free metal. Sulphide ores are converted into oxides by roasting.

$$2ZnS(s) + 3O_2(g) \xrightarrow{\text{Heat}} 2ZnO(s) + 2SO_2(g)$$

- **Calcination:** It is the process of heating ore in absence of air so as to remove moisture, volatile impurities and to convert carbonate ores into oxides.

$$ZnCO_3(s) \xrightarrow{\text{Heat}} ZnO(s) + CO_2(g)$$

- **Thermite process:** It is a process in which molten metal oxides are treated with aluminium powder. It is highly exothermic reaction. The molten metal obtained is used for welding of railway tracks or cracked machine parts.

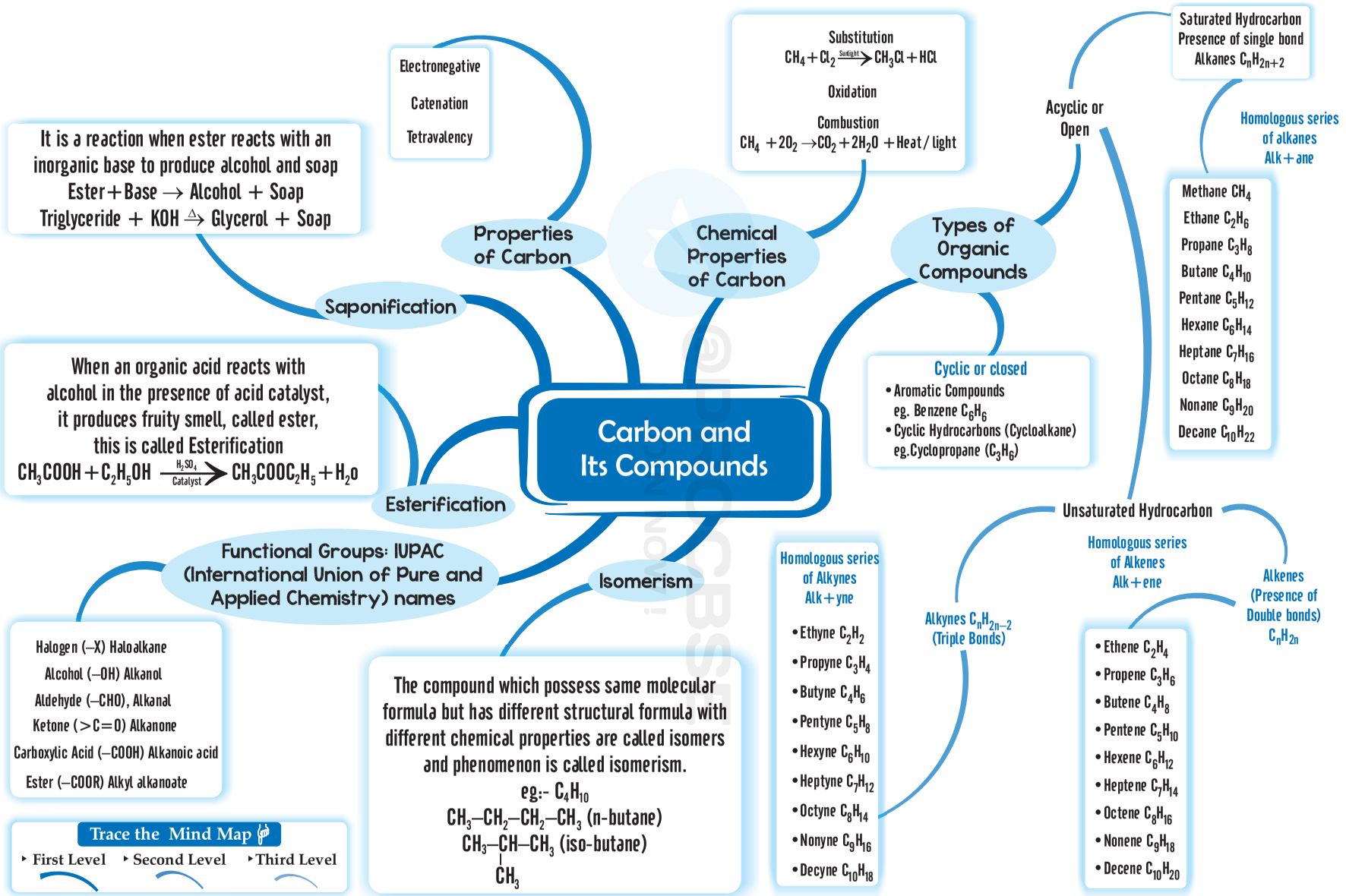
$2Al$	+	Fe_2O_3	$\longrightarrow$	$2Fe$	+	Al_2O_3	+	Heat
Aluminium		Haematite		Molten iron		Aluminium oxide		

- **Refining:** It is a process of converting impure metal into pure metal by different processes depending on the nature of metals. It is a process of purification of metal.
- **Flux:** The substance which reacts with gangue to form a fusible mass which can easily be removed is known as flux. *e.g.*, CaO (Calcium oxide) is used as flux so as to remove SiO_2 (Silica) as gangue.
- **Slag:** The fusible mass formed by the reaction of flux and gangue is known as **slag**. Slag is lighter than molten metal, hence floats over molten metal and can be easily removed. It prevents metal from oxidation.

OSWAAL LEARNING TOOL
To learn from Oswaal Concept Video
Visit: It is showing invalid link OR Scan this code

❑❑❑

@PROCBSE


Carbon and Its Compounds
Properties of Carbon
Electronegative
Catenation
Tetravalency
Chemical Properties of Carbon
Substitution
$CH_4 + Cl_2 \xrightarrow{Sunlight} CH_3Cl + HCl$
Oxidation
Combustion
$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$ + Heat / light
Types of Organic Compounds
Acyclic or Open
Saturated Hydrocarbon
Presence of single bond
Alkanes C_nH_{2n+2}
Homologous series of alkanes
Alk + ane
Methane CH_4
Ethane C_2H_6
Propane C_3H_8
Butane C_4H_{10}
Pentane C_5H_{12}
Hexane C_6H_{14}
Heptane C_7H_{16}
Octane C_8H_{18}
Nonane C_9H_{20}
Decane $C_{10}H_{22}$
Unsaturated Hydrocarbon
Alkynes C_nH_{2n-2} (Triple Bonds)
Homologous series of Alkynes
Alk + yne
Ethyne C_2H_2
Propyne C_3H_4
Butyne C_4H_6
Pentyne C_5H_8
Hexyne C_6H_{10}
Heptyne C_7H_{12}
Octyne C_8H_{14}
Nonyne C_9H_{16}
Decyne $C_{10}H_{18}$
Homologous series of Alkenes
Alk + ene
Alkenes (Presence of Double bonds) C_nH_{2n}
Ethene C_2H_4
Propene C_3H_6
Butene C_4H_8
Pentene C_5H_{10}
Hexene C_6H_{12}
Heptene C_7H_{14}
Octene C_8H_{16}
Nonene C_9H_{18}
Decene $C_{10}H_{20}$
Cyclic or closed
Aromatic Compounds
eg. Benzene C_6H_6
Cyclic Hydrocarbons (Cycloalkane)
eg. Cyclopropane (C_3H_6)
Saponification
It is a reaction when ester reacts with an inorganic base to produce alcohol and soap
Ester + Base → Alcohol + Soap
Triglyceride + KOH $\xrightarrow{\Delta}$ Glycerol + Soap
Esterification
When an organic acid reacts with alcohol in the presence of acid catalyst, it produces fruity smell, called ester, this is called Esterification
$CH_3COOH + C_2H_5OH \xrightarrow[Catalyst]{H_2SO_4} CH_3COOC_2H_5 + H_2O$
Isomerism
The compound which possess same molecular formula but has different structural formula with different chemical properties are called isomers and phenomenon is called isomerism.
eg:- C_4H_{10}
$CH_3–CH_2–CH_2–CH_3$ (n-butane)
$CH_3–CH(CH_3)–CH_3$ (iso-butane)
Functional Groups: IUPAC (International Union of Pure and Applied Chemistry) names
Halogen (–X) Haloalkane
Alcohol (–OH) Alkanol
Aldehyde (–CHO), Alkanal
Ketone (>C=O) Alkanone
Carboxylic Acid (–COOH) Alkanoic acid
Ester (–COOR) Alkyl alkanoate
Trace the Mind Map
First Level
Second Level
Third Level

@PROCBSE

CHAPTER

4

CARBON COMPOUNDS

Syllabus

Covalent bonding in carbon compounds, versatile nature of carbon, homologous series. Nomenclature of carbon compounds containing functional groups (halogens, alcohols, ketones, aldehydes, alkanes and alkynes), difference between saturated and unsaturated hydrocarbons, chemical properties of carbon compounds (combustion, oxidation, addition and substitution reaction). Ethanol and ethanoic acid (only properties and uses), soaps and detergents.

Trend Analysis

@PROCBSE JOIN NOW !

List of Concepts	2018	2019		2020	
	OD/D	OD	D	OD	D
Carbon and its properties, Homologous Series and IUPAC Names	1Q (3 M)	1Q (2 M) 1Q (3 M)	1Q (5 M)	1Q (1 M)	1Q (1 M)
Carbon compounds, Soap and Detergents	1Q (2 M)		1Q (5M)	1Q (5 M)	1Q (3 M)

TOPIC - 1
Carbon and its Properties, Homologous Series and IUPAC Names

Revision Notes

Properties of Carbon

- The element carbon is non-metal. Its symbol is C.
- Carbon is a versatile element. The percentage of carbon present in earth's crust in form of mineral is 0.02% and in atmosphere as CO_2 is 0.03%.
- All the living things, like plants and animals are made up of carbon based compounds.
- Carbon always forms covalent bonds.
- The atomic number of carbon is 6.

TOPIC - 1
Carbon and its Properties, Homologous Series and IUPAC Names
Page No. 63

TOPIC - 2
Ethanol, Ethanoic acid, Soap and Detergents
Page No. 80

@PROCBSE

- **Electronic configuration:**

	K	L
C (6)	2	4

- **How carbon attain noble gas configuration ?**

(i) Carbon is tetravalent in nature. It does not form ionic bond because it has 4 valence electrons, half of an octet. To form ionic bonds, carbon molecules must either gain or lose 4 electrons. It is because, that is difficult to hold four extra electron and would require large amount of energy to remove four electrons. So, carbon can form bond by sharing of its electron with the electrons of other carbon atom or with other element and attain noble gas configuration.

(ii) The atoms of other elements like hydrogen, oxygen, nitrogen and chlorine also form bonds by sharing of electrons.

(iii) The bond formed by sharing of electrons between same or different atoms is covalent bond.

- **Covalent Bond:** A covalent bond is formed by sharing of electrons between atoms. In a covalent bond, the shared pair of electrons belongs to the valence shell of both the atoms.

Scan to know more about this topic

Structure of Methane

- **Conditions for formation of a covalent bond:**

(i) The combining atoms should have 4 to 7 electrons in their valence shell.

(ii) The combining atoms should not lose electrons easily.

(iii) The combining atoms should not gain electrons readily.

(iv) The difference in electronegativity of two bonded atoms should be low.

@PROCBSE JOIN NOW !

- **Properties of covalent compounds:**

(i) Physical state: They are generally liquids or gases. Some covalent compounds may exist as solid.

(ii) Solubility: They are generally insoluble in water and other polar solvents but soluble in organic solvents such as benzene, toluene etc.

(iii) Melting and boiling points: They generally have low melting and boiling points.

(iv) Electrical conductivity: They do not conduct is more apt word instead of electrical current.

- **Steps for writing the Lewis dot Structures of a covalent compound:**

Scan to know more about this topic

Covalent bond

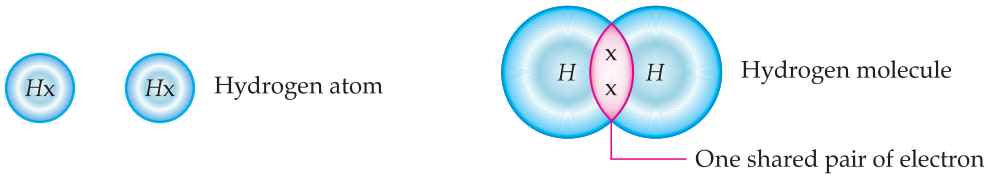
(i) Write the electronic configuration of all the atoms present in the molecule.

(ii) Identify how many electrons are needed by each atom to attain noble gas configuration.

(iii) Share the electrons between atoms in such a way that all the atoms in a molecule have noble gas configuration.

(iv) Keep in mind that the shared electrons are counted in the valence shell of both the atoms sharing it.

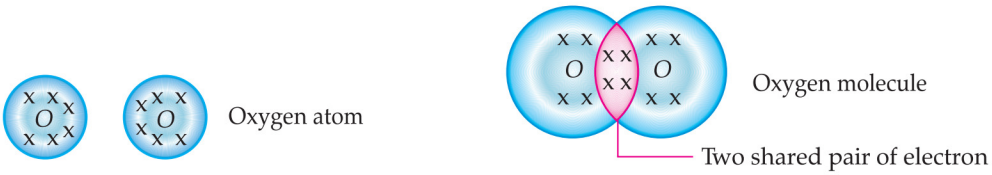
- **Examples: (i)** H_2



H – H: Single bond between hydrogen atoms

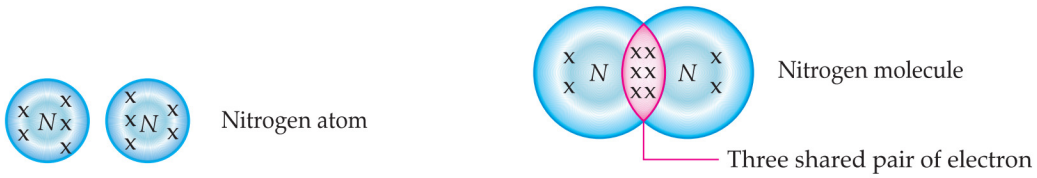
@PROCBSE

(ii) O_2



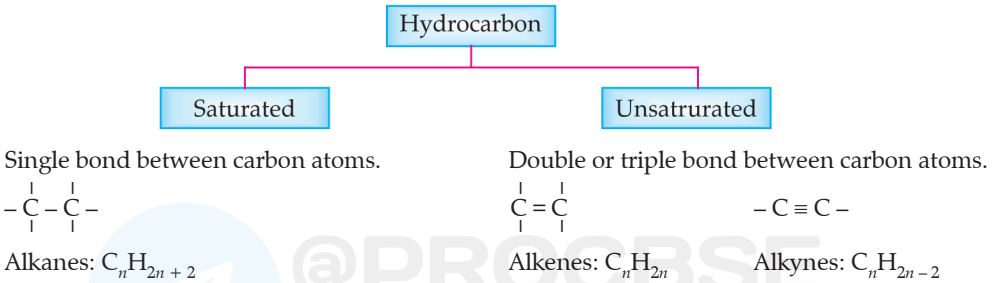
O = O: Double bond between oxygen atoms

(iii) N_2



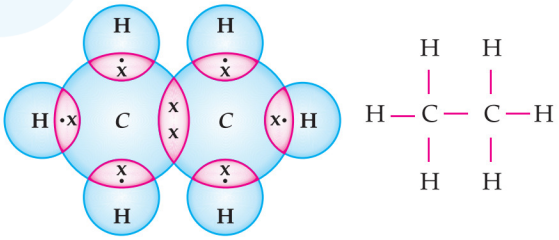
N ≡ N: Triple bond between nitrogen atoms

➢ **Hydrocarbon:** Compounds made up of hydrogen and carbon are called hydrocarbon.



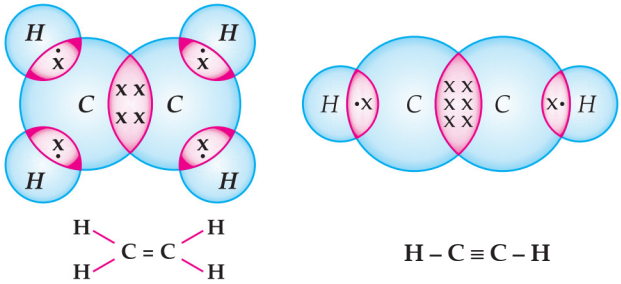
➢ **Electron dot structure of saturated hydrocarbons:**

Ethane C_2H_6



➢ **Electron dot structure of unsaturated hydrocarbons:**

Ethene: C_2H_4 Ethyne: C_2H_2



H – C ≡ C – H

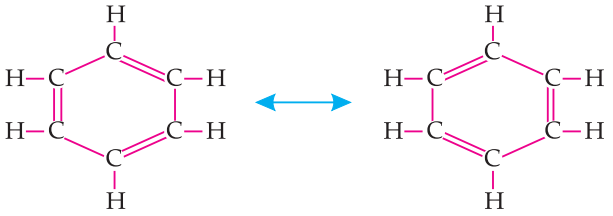
➢ **Cyclic or Closed Chain Hydrocarbons:** These are the hydrocarbons which have carbon - carbon closed chain. They are classified as:

(i) Alicyclic hydrocarbons: These are the hydrocarbons which do not have benzene ring in their structures.

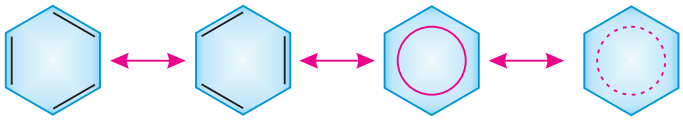
(ii) Aromatic hydrocarbons: The hydrocarbons which have benzene ring in their structures. When hydrogen bonded to carbon of benzene is substituted with halogens, radicals or other functional groups, the derivatives are called aromatic compounds.

@PROCBSE

- **Benzene:** It is an aromatic hydrocarbon which has the molecular formula C_6H_6. It has alternating carbon - carbon single and double bonds.



- **Benzene can also be represented as:**



Scan to know more about this topic

IUPAC name for branched hydrocarbon

- **IUPAC name of hydrocarbon consists of two parts. It involves:**

(i) Word root: Number of carbons in the longest carbon chain.

Number of carbon atoms	Word root (Greek name)
1	Meth
2	Eth
3	Prop
4	But
5	Pent
6	Hex
7	Hept
8	Oct
9	Non
10	Dec

(ii) Suffix: It depends on the type of carbon - carbon bond, for single bond suffix is – ane; for double bond, suffix is – *ene*; and for triple bond suffix is – *yne*.

- **Types of Formula for Writing Hydrocarbons:**

(i) Molecular formula: It involves the actual number of each type of atom present in the compound.

(ii) Structural formula: The actual arrangement of atoms is written in structural formula.

(iii) Condensed formula: It is the shortened form of the structural formula.

- In hydrocarbon chain, one or more hydrogen atom is replaced by other atoms in accordance with their valencies. These are heteroatoms.
- These heteroatoms or group of atoms which make carbon compound reactive and decides its properties are called functional groups.

Hetero atom	Functional group	Formula of functional group
Cl/Br	Halo (Chloro/Bromo)	— Cl, — B*r*, — I
Oxygen	1. Alcohol	— OH
	2. Aldehyde	— CHO
	3. Ketone	— C — (=O)
	4. Carboxylic acid	— C(=O) — OH
Double bond	1. Alkene group	> C = C <
Triple bond	2. Alkyne group	— C ≡ C —

@PROCBSE

- **Homologous Series:** A series of organic compounds in which every succeeding member differs from the previous one by – CH_2 or 14 a.m.u. is called homologous series. The molecular formula of all the members of a homologous series can be derived from a general formula.
- **Properties of a homologous series:** As the molecular mass increases in a series, physical properties of the compounds show a variation, but chemical properties which are determined by a functional group remain the same within a series.
- **Homologous series of alkanes:** General formula: C_nH_{2n+2}, where n = number of carbon atoms. CH_4, C_2H_6, C_3H_8.
- **Homologous series of alkenes:** General formula: C_nH_{2n}, where n = number of carbon atoms. C_2H_4, C_3H_6, C_4H_8.
- **Homologous series of alkynes:** General formula: C_nH_{2n-2}, where n = number of carbon atoms. C_2H_2, C_3H_4, C_4H_6.
- **Chemical Properties of carbon compounds**

(a) Combustion: Carbon compounds burn in air to give carbon dioxide, water, heat and light.

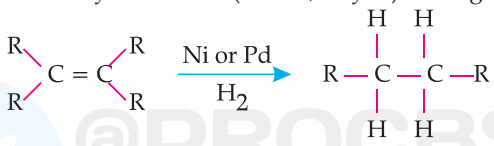
$$CH_4 + 2O_2 \xrightarrow{\text{Combustion}} CO_2 + 2H_2O + \text{Heat} + \text{Light}$$

- Carbon and its compounds are used as fuels because they burn in air releasing lot of heat energy.
- Saturated hydrocarbon generally burn in air with blue and non-sooty flame.
- Unsaturated hydrocarbon burns in air with yellow sooty flame because percentage of carbon is higher than saturated hydrocarbon which does not get completely oxidized in air.

(b) Oxidation: Alcohols can be converted into carboxylic acid in the presence of oxidizing agent like alkaline $KMnO_4$ (potassium permanganate) or acidic potassium dichromate $K_2Cr_2O_7$.

$$\underset{\text{Ethanol}}{CH_3CH_2OH} \xrightarrow[\text{Acidic } K_2Cr_2O_7]{\text{Alkaline } KMnO_4 \text{ Or}} \underset{\text{Ethanoic acid}}{CH_3COOH}$$

(c) Addition Reaction: Unsaturated hydrocarbons (alkene, alkyne) undergo addition reactions.



In unsaturated hydrocarbon, hydrogen added in the presence of catalyst palladium or nickel. Vegetable oils are converted into vegetable ghee using this process. It is also called hydrogenation of vegetable oils.

(d) Substitution Reaction: Saturated hydrocarbons undergo substitution reaction in the presence of sunlight.

$$CH_4 + Cl_2 \xrightarrow{\text{Sunlight}} CH_3Cl + HCl$$

Mnemonics

Concept: saturated and unsaturated compounds		**Concept: homologous series**
Mnemonics: **T**hank **Y**ou **DeSa**		Mnemonics: **M**onkeys **E**at **P**eeled **B**ananas
Interpretation:		**Interpretation:**
T: **T**riple bond	**Y:** **A**lkyne	**M:** **M**ethane (1C)
D: **D**ouble bond	**e:** **A**lkene	**E:** **E**thane (2C)
S: **S**ingle bond	**a:** **A**lkane	**P:** **P**ropane (3C)
		B: **B**utane (4C)
Concept: Reaction in saturated and Unsaturated compounds		
Mnemonics: **SaSUnA**		
Interpretation:		
Sa: **Sa**turated		
S: **S**ubstitution		
Un: **Un**saturated		
A: **A**ddition		

@PROCBSE

How is it done on the GREENBOARD?

Q.What is a homologous series of carbon compounds? List its any two characteristics. Write the name and formula of next higher homologous of HCOOH.

Ans. Step I: A group of organic compounds having the same functional group and similar structures in which any two successive members differ by – CH_2.

Step II: All members have similar chemical properties

Step III: There is gradation in the physical properties. (or any other)

Name — Ethanoic acid/Acetic acid

Formula — CH_3COOH

Objective Type Questions — 1 mark each

A Multiple Choice Questions

Q. 1. Which of the following is not observed in a homologous series? Give reason for your choice. [SQP 2020]

(a) Change in chemical properties
b) Difference in —CH_2 and 14u molecular mass
(c) Gradation in physical properties
(d) Same functional group

Ans. Correct option: (a)
Explanation: Change in chemical properties due to presence of same functional group

Q. 2. Ethane, with the molecular formula C_2H_6 has

(a) 6 covalent bonds **(b) 7 covalent bonds**
(c) 8 covalent bonds **(d) 9 covalent bonds**

Ans. Correct option: (b)
Explanation: Ethane has 7 covalent bonds. One bond is between two carbon atoms and rest of the six are between hydrogen atoms.

Q. 3. Carbon forms four covalent bonds by sharing its four valence electrons with four univalent atoms, *e.g.* hydrogen. After the formation of four bonds, carbon attains the electronic configuration of

(a) helium **(b) neon**
(c) argon **(d) krypton**

Ans. Correct option: (b)
Explanation: The nearest inert gas from carbon is Neon and. An element try to attain the electronic configuration of its nearest noble gas while attaining a fully-filled outermost shell.

Q. 4. The correct electron dot structure of a water molecule is

(a) $H\cdot\ddot{O}\cdot H$ **(b)** $H:\ddot{O}\cdot H$

(c) $H:\ddot{O}:H$ **(d)** $H:O:H$

Ans. Correct option: (c)
Explanation: Oxygen has a complete after octet, while each atom of hydrogen has two electrons in outermost shell.

Q. 5. Which among the following are unsaturated hydrocarbons?

(i) $H_3C-CH_2-CH_2-CH_3$

(ii) $H_3C-C\equiv C-CH_3$

(iii) $H_3C-\underset{\displaystyle CH_3}{\underset{|}{CH}}-CH_3$

(iv) $H_3C-\underset{\displaystyle CH_3}{\underset{|}{C}}=CH_2$

(a) (i) and (iii) **(b) (ii) and (iii)**
(c) (ii) and (iv) **(d) (iii) and (iv)**

Ans. Correct option: (c)
Explanation: Unsaturated hydrocarbons have multiple covalent bonds (double or triple bond) like alkene and alkyne.

Q. 6. Oils on treating with hydrogen in the presence of palladium or nickel catalyst form fats. This is an example of

(a) Addition reaction **(b) Substitution reaction**
(c) Displacement reaction **(d) Oxidation reaction**

Ans. Correct option: (a)
Explanation: Hydrogenation reaction means addition of hydrogen to double bonds of unsaturated compounds found in oil in the presence of catalysts such as palladium or nickel to give saturated hydrocarbons. **1**

Q. 7. In which of the following compounds, —OH is the functional group?

(a) Butanone **(b) Butanol**
(c) Butanoic acid **(d) Butanal**

Ans. Correct option: (b)
Explanation: Compounds with –OH functional group are ended with suffix –ol. **1**

@PROCBSE JOIN NOW

B Assertions and Reasons Type Questions

Directions: In the following questions, a statement of assertion (A) is followed by a statement of reason (R). Mark the correct choice as:

(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

(b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).

(c) Assertion (A) is true but reason (R) is false.

(d) Assertion (A) is false but reason (R) is true.

AI **Q. 1. Assertion (A): In a homologous series of alcohols, the formula for the second member is C_2H_5OH and the third member is C_3H_7OH.**

Reason (R): The difference between the molecular masses of the two consecutive members of a homologous series is 14u. AE

Ans. Correct option: (c)

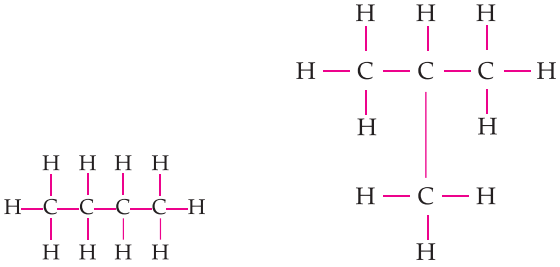
Explanation: In homologous series of alcohols, the formula for the second member is C_2H_5OH and the third member is C_3H_7OH. The difference between the molecular masses of the two consecutive members of a homologous series is 14u.

Q. 2. Assertion (A): Following are the members of a homologous series : CH_3OH, CH_3CH_2OH, $CH_3CH_2CH_2OH$

Reason (R): A series of compounds with same functional group but differing by —CH_2 – unit is called a homologous series. [Delhi Set-II, 2020]

Ans. Correct option: (a)

Q. 3. Assertion: Following are the structural isomers of butane.



Reason: Structural isomers have the same molecular formula but they differ in their structures. [Board SQP, 2020]

Ans. Correct option: (a)

Explanation: Isomers are defined as those compounds that possess same molecular formula but different structural arrangement. Butane has the molecular formulae C_4H_{10}. Therefore, the structural isomers of butane will be n-butane and iso-butane. **[1]**

Q. 4. Assertion (A): Third member of alkane is propane (C_3H_8)

Reason (R): It is obtained from general formula C_nH_{2n+2}

Ans. Correct option: (a)

Explanation: C_3H_8 can be obtained from general formula, C_nH_{2n+2}. **1**

Q. 5. Assertion (A): Iso- butane is the isomer of C_4H_{10}.

Reason (R): Iso-butane has four C and ten-H atom.

Ans. Correct option: (b)

$$CH_3-\underset{|}{\overset{CH_3}{CH}}-CH_3$$

Explanation: $CH_3 — CH — CH_3$ is the structural isomer of butane. **1**

Q. 6. Assertion (A): CH_3Cl is obtained from CH_4 by the action of Cl_2 in the presence of sunlight.

Reason (R): It is obtained by addition reaction.

Ans. Correct option: (c)

Explanation: CH_3Cl is obtained from CH_4 by substitution reaction by the action of Cl_2 in the presence of sunlight. **1**

Q. 7. Assertion (A): Most of the carbon compounds are good conductors of electricity.

Reason (R): They do not dissociate to form ions and remain as molecules.

Ans. Correct option: (d)

Explanation: Carbon compounds are mainly poor conductors of electricity. **1**

@PROCBSE JOIN NOW !

C Very Short Answer Type Questions

Q. 1. Define catenation. R [Board SQP, 2020]

Ans. The property of self-linking of atoms of an element through covalent bonds in order to form straight chain, branched chains or cyclic chains of different sizes is called catenation. **1**

[CBSE SQP Marking Scheme, 2020]

Q. 2. Name a cyclic unsaturated carbon compound. R

Ans. Benzene. [CBSE, 2020] **1**

AI **Q. 3. Name the functional group present in propanone.** [CBSE Delhi Set-II, 2020] R

Ans. Ketone. **1**

Q. 4. How are covalent bonds formed ? [CBSE OD Set-I, 2020] R

Ans. Covalent bonds are formed by the sharing of electrons between the atoms. **1**

AI **Q. 5. Write the molecular formula of first two members of homologous series having function group – Cl.** U [Delhi 31/1/1, 2017]

Ans. The molecular formula of first two consecutive members of this series is:

CH_3Cl (Chloromethane)

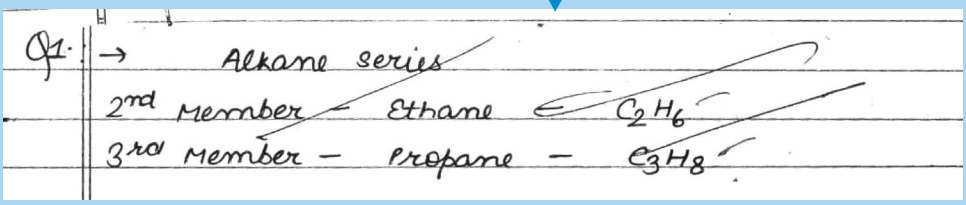
C_2H_5Cl (Chloroethane) ½ + ½

@PROCBSE

Q. 6. Write the molecular formula of the 2nd and the 3rd member of the homologous series whose first member is methane. AE [CBSE OD 31/1, 2017] [SA-II, OD. Set-I, 2017]'

Ans. Ethane (C_2H_6)
Propane (C_3H_8) ½ + ½

Topper Answer, 2017



COMMONLY MADE ERROR

- Usually students get confused between the first few members of alkane, alkene and alkyne series.

ANSWERING TIP

- Learn and practice the first few members of alkane, alkene and alkyne series with their formulae.

Q. 7. Write the molecular formula of first two members of homologous series having functional group -Br. U

Ans. CH_3Br, C_2H_5Br 1 [CBSE Marking Scheme, 2017]

AI **Q. 8. Write the molecular formula of the 2nd and 3rd member of the homologous series whose first member is ethene.** C

Ans. C_3H_6 and C_4H_8 1 [CBSE Marking Scheme, 2017]

Q. 9. Write the molecular formula of the 2nd member of the homologous series where the first member is ethyne. U [CBSE OD Set-III, 2017]

Ans. C_3H_4, C_4H_6 1 [CBSE Marking Scheme, 2017]

Q. 10. What is a homologous series of carbon compounds ? R [Board Term II, Foreign Set-II, 2016]

Ans. A homologous series is the family of organic compound having the same functional group, and the successive (adjacent) members of which differ by CH_2 unit or 14 mass unit. 1 [CBSE Marking Scheme, 2016]

Q. 11. Write the next homologue of each of the following:
(i) C_2H_4, **(ii)** C_4H_6
U [Board Term II, Delhi Set-I, 2016]

Ans. (i) C_3H_6, **(ii)** C_5H_8. ½+½ [CBSE Marking Scheme, 2016]

Q. 12. Name the following compounds:

(i) $CH_3—CH_2—OH$, **(ii)**



C [Board Term II, Delhi Set-I, 2016]

Ans. (i) Ethanol, **(ii)** Ethanal. ½ + ½ [CBSE Marking Scheme, 2016]

Q. 13. Which element exhibits the property of catenation to maximum extent and why ?
U [Board Term II, Delhi Set-I, 2016]

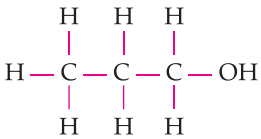
Ans. Carbon, due to strong C—C bond. 1 [CBSE Marking Scheme, 2016]

AI **Q. 14. Select saturated hydrocarbons from the followings: C_3H_6, C_5H_{10}, C_4H_{10}, C_6H_{14}, C_2H_4**
A [Board Term II, Delhi Set-III, 2016]

Ans. C_4H_{10}; C_6H_{14}. ½ + ½ [CBSE Marking Scheme, 2016]

Q. 15. Write the name and structure of an alcohol with three carbon atoms in its molecule.
C [Board Term II, O.D. Set-I, 2016]

Ans. Propanol,



Or $CH_3—CH_2—CH_2—OH$ 1

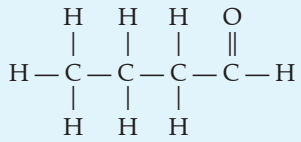
Q. 16. Write the name and structure of an aldehyde with four carbon atoms in its molecule.
C [Board Term II, OD. Set-III, 2016]

@PROCBSE JOIN NOW !

@PROCBSE

Ans. Butanal, $CH_3 — CH_2 — CH_2 — CHO$

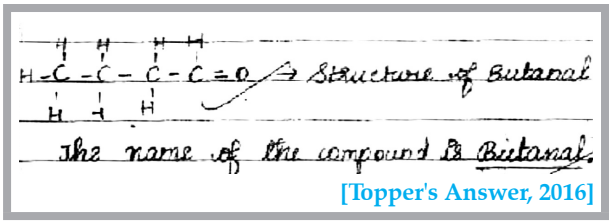
Or



1

[CBSE Marking Scheme, 2016]

OR



[Topper's Answer, 2016]

COMMONLY MADE ERROR

- Sometimes students get confused and do mistakes while writing the structure, its name and also with the functional group involved.

ANSWERING TIP

- Please understand the basic concept of functional groups. Drawing structures and practicing them is mandatory.

AI **Q. 17. Name the process of converting vegetable oil to vegetable ghee.** R [Board Term II SQP, 2016]

OR

Name the process by which unsaturated fats gets changed to saturated fats.

R [Board Term II Foreign Set-I, 2015]

Ans. Hydrogenation. 1

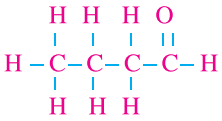
[CBSE Marking Scheme, 2016]

Q. 18. Write the name and structure of an aldehyde with four carbon atoms in its molecule. AE

[CBSE OD, 2016]

Ans. Butanal, $CH_3 – CH_2 – CH_2 – CHO$

OR



AI **Q. 19. Write the name and formula of the 2nd member of homologous series having general formula C_nH_{2n}.** A [Delhi Set-I, 2015]

Ans. Name: Propene
Formula: C_3H_6 ½+½

[CBSE Marking Scheme, 2015]

Q. 20. Write the number of covalent bonds in the molecule of ethane.

U [Board Term II O.D. Set-I, 2015]

Ans. Seven covalent bonds. 1

[CBSE Marking Scheme, 2015]

COMMONLY MADE ERROR

- Students do mistakes in counting the covalent bonds in the structure They must remember a covalent bond between two carbon atoms too.

ANSWERING TIP

- Draw the structure and count the covalent bonds by numbering them.

Short Answer Type Questions-I — 2 marks each

Q. 1. Give a test that can be used to confirm the presence of carbon in a compound. With a valency of 4, how is carbon able to attain noble gas configuration in its compounds? C [SQP 2020]

Ans. Burn compound in air/ oxygen;
Gas evolved turns lime water milky - By sharing its four valence electrons with other elements.

Q. 2. The number of carbon compounds is more than those formed by all other elements put together. Justify the statement by giving two reasons.

U [SQP 2020]

Ans. (i) Due to self linking ability of carbon/catenation.

(ii) Since carbon has a valency of four it can form bonds with four other atoms of carbon or atoms of some other mono-valent element.

(iii) Due to small size of carbon it forms very strong and (or) stable bonds with other elements.

Q. 3. Unsaturated hydrocarbons contain multiple bonds between two carbon atoms and these compounds show addition reactions. Out of saturated and unsaturated carbon compounds, which compounds are more reactive? Write a test to distinguish ethane from ethene. AE

[CBSE OD, III 2019]

@PROCBSE

Ans. Unsaturated compounds are more reactive. **1**
Test: Bayer's reagent test / Bromine water test given by ethene and not by ethane / Ethane gives clear

flame while ethene gives a yellow flame with lots of black smoke. (any one test) **1**

[CBSE Marking Scheme, 2019]

Q. 4. On dropping a small piece of sodium in a test-tube containing carbon compound 'X' with molecular formula C_2H_6O, a brisk effervescence is observed and a gas 'Y' is produced. On bringing a burning splinter at the mouth of the test-tube the gas evolved burns with a pop sound. Identify 'X' and 'Y'. Also write the chemical equation for the reaction. Write the name and structure of the product formed, when you heat 'X' with excess conc. sulphuric acid. AE [CBSE OD Set -3, 2016]

Ans. X — C_2H_5OH; Y — H_2 gas

$2C_2H_5OH + 2Na \longrightarrow 2C_2H_5ONa + H_2\uparrow$ ½+½

Ethene; C_2H_4 ½+½

Short Answer Type Questions-II — 3 marks each

Q. 1. What is a homologous series of carbon compounds? Give an example and list its three characteristics.

R [Outside Delhi, Set- I, 2019]

Ans. A series of compounds in which the same functional group substitutes for hydrogen in a carbon chain is called a homologous series. **1**

Example: Alkane / Alkene / Alkyne / Alcohol or any other one correct example. ½

Characteristics:

(i) They have same general formula.

(ii) They have same functional group.

(iii) The difference in the molecular mass of two successive member in 14*u*.

(iv) The difference in the molecular formula of two successive member is of CH_2 unit.

(v) They have similar chemical properties.

(Any three points) ½ × 3

[CBSE Marking Scheme, 2019]

AI **Q. 2. Which compounds are called (i) alkanes, (ii) alkenes and (iii) alkynes ? C_4H_{10} belongs to which of these? Draw two structural isomers of this compound.**

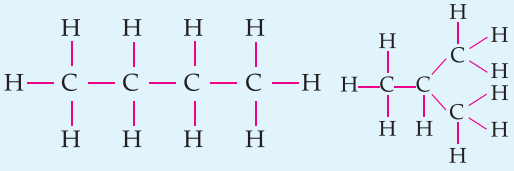
R [Board Outside Delhi, Set- II, 2019]

Ans. • **Alkane**
Saturated hydrocarbon with C–C single bond

- **Alkene**
Unsaturated Hydrocarbon with double bond in C=C
- **Alkyne**
Unsaturated Hydrocarbon with triple bond in C ≡ C

(or any other) ½ × 3

- **Alkane** ½
2 structural isomers



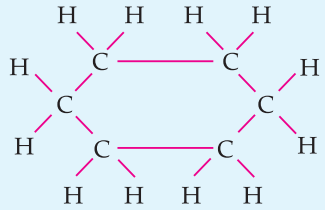
[CBSE Marking Scheme, 2019] ½ + ½

Q. 3.(a) Why most of the carbon compounds are poor conductor of electricity ?

(b) Write the name and structure of a saturated compound in which the carbon atoms are arranged in a ring. Give the number of single bonds present in this compound. U + R [Delhi/Outside Delhi, 2018]

Ans. (a) Carbon compounds form covalent bonds/do not dissociate into ions/do not have charged particles (ions)

(b) Cyclohexane



Total no. of single bonds = 18

(OR any other cycloalkane with corresponding number of bonds) [CBSE Marking Scheme, 2018] **1 + 1 +1**

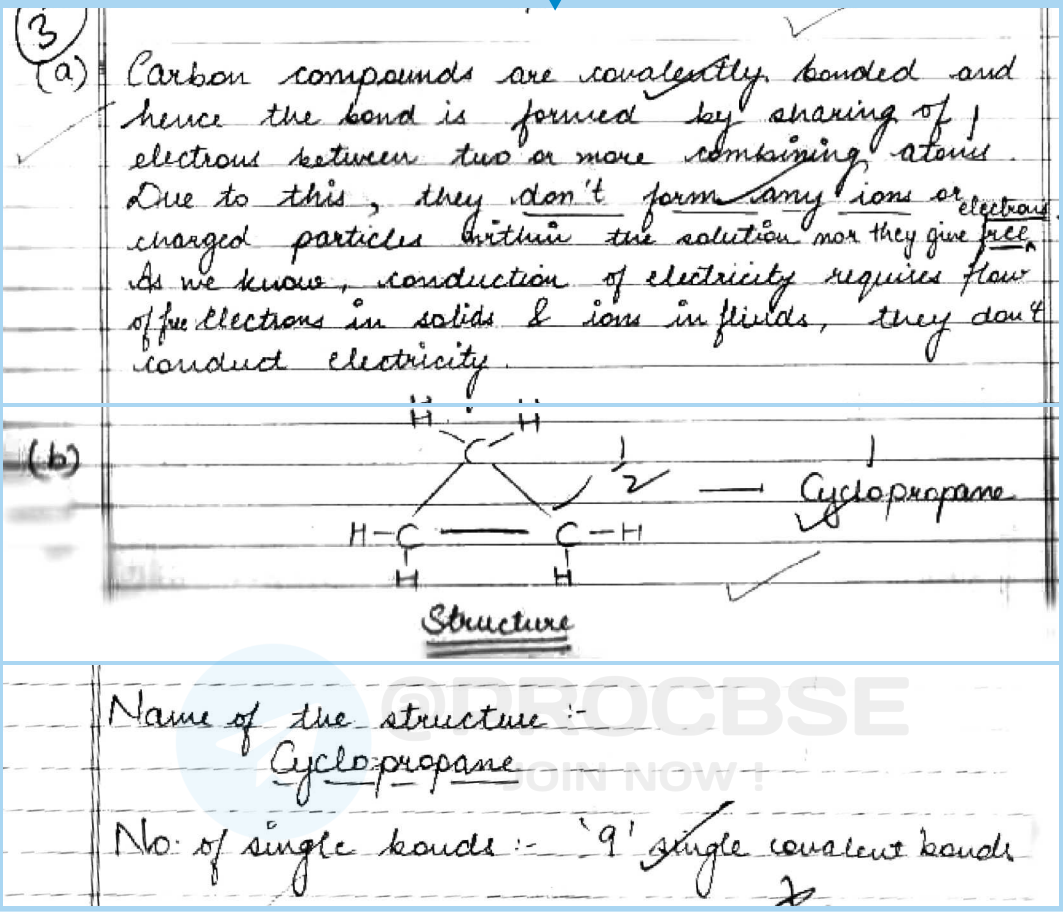
@PROCBSE JOIN NOW !

@PROCBSE

Or

Topper Answer, 2018

Ans.



COMMONLY MADE ERROR

- Students usually get confused in the structure and the number of single bonds present in the compound.

ANSWERING TIP

- Practice the structure of different compounds involved in the homologous series.

Q. 4. What happens when hydrogen is added to a vegetable oil in the presence of nickel ? Name the reaction and write one difference between the physical property of the vegetable oil and the product obtained in this reaction. Write the role of nickel in this reaction.

C [Comptt. Set 1, 2, 3, 2018]

Ans. (i) Vegetable oil is converted into saturated fat. ½
(ii) The reaction is Hydrogenation **1**
(iii) Unsaturated vegetable oil is liquid and saturated fat is solid at room temperature **1**
(iv) Nickel acts as a catalyst. ½

[CBSE Marking Scheme, 2018]

COMMONLY MADE ERROR

- Students write irrelevant answers. Be specific. Read question carefully and write only what is asked.

ANSWERING TIP

- Do not overlook any part of a question and avoid being in a hurry to conclude the answer.

@PROCBSE

AI **Q. 5. What are covalent compounds? How are they different from ionic compounds? List any two properties of covalent compounds.**
A [CBSE OD Comptt., 2017]

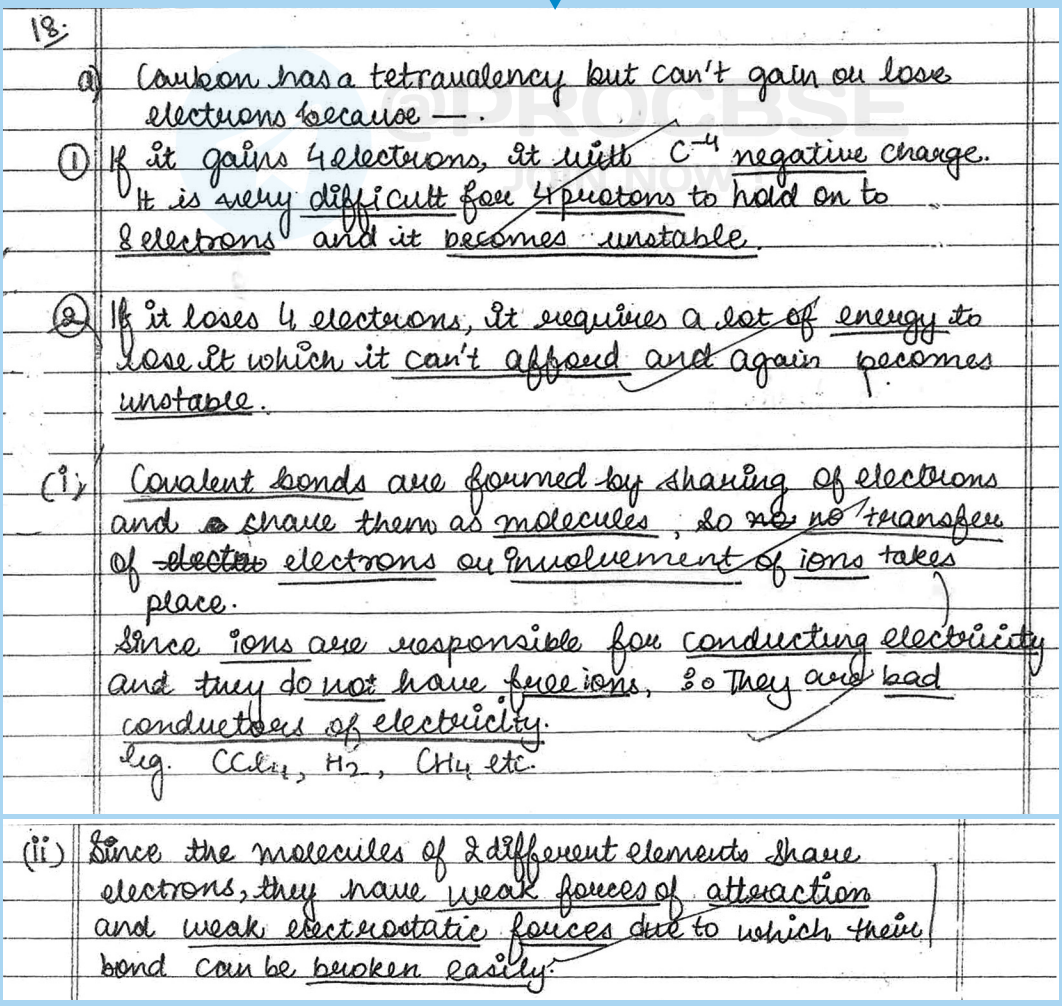
Ans. The compounds that are formed due to sharing of electrons between two atoms/compounds having covalent bonds. **1**

Ionic compounds are formed due to transfer of electrons from one atom to another/compounds having ionic bonds/compounds having attraction between oppositely charged ions **1**
(i) They are poor conductors of electricity ½
(ii) They have low melting and boiling point. ½
(or any other)
[CBSE Marking Scheme, 2017]

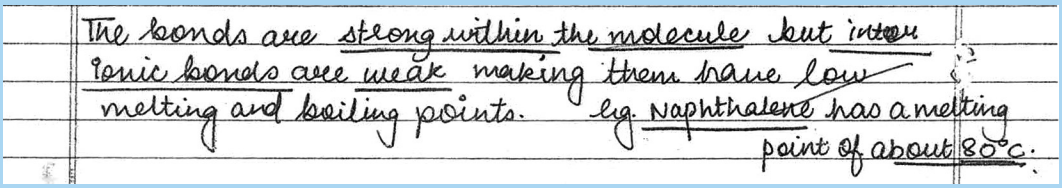
Q. 6. Give reason why carbon can neither form C^{4+} cations nor C^{4-} anions, but forms covalent compounds. Also, state the reason to explain why covalent compounds are bad conductors of electricity and have low melting and boiling points?
AE [Delhi Set Comptt. II, 2017]

Ans. Carbon cannot form C^{4+} cation because removal of 4 electrons from a carbon atom would require a large amount of energy. ½
Carbon cannot form C^{4-} anion because it would be difficult for the nucleus with 6 protons to hold on to 10 electrons. ½
Hence, carbon atoms share electrons forming covalent compounds **1**
Covalent compounds do not form ions/ charged particles and therefore do not conduct electricity. ½
Inter molecular forces of attraction are weak, hence they have low melting and boiling points. ½
[CBSE Marking Scheme, 2017]

Topper Answer, 2017


18:
a) Carbon has a tetravalency but can't gain or lose electrons because —.
(1) If it gains 4 electrons, it will C^{-4} negative charge. It is very difficult for 4 protons to hold on to 8 electrons and it becomes unstable.
(2) If it loses 4 electrons, it requires a lot of energy to lose it which it can't afford and again becomes unstable.
(i) Covalent bonds are formed by sharing of electrons and share them as molecules, so no transfer of ~~electrons~~ electrons or involvement of ions takes place.
Since ions are responsible for conducting electricity and they do not have free ions, so they are bad conductors of electricity.
Eg. CCl_4, H_2, CH_4 etc.
(ii) Since the molecules of 2 different elements share electrons, they have weak forces of attraction and weak electrostatic forces due to which their bond can be broken easily.

@PROCBSE


The bonds are strong within the molecule but inter ionic bonds are weak making them have low melting and boiling points. eg. Naphthalene has a melting point of about 80°C.

Q. 7. Two carbon compounds X and Y have the molecular formula C_4H_8 and C_5H_{12} respectively. Which one of these is most likely to show addition reaction? Justify your answer. Also, give the chemical equation to explain the process of addition reaction in this case. AE [Delhi 31/1/1 2017]

Ans. C_4H_8, it is an unsaturated hydrocarbon due to the presence of a double bond. **1 + 1**

$C_4H_8 + H_2 \xrightarrow{Ni/Pd} C_4H_{10}$ **½ Catalyst**

½ Equation

(or any other) ½ + ½

[CBSE Marking Scheme, 2017]

Detailed Answer:

Saturated compound — C_5H_{12} (Compound Y) undergo substitution reaction.

Unsaturated compound — C_4H_8 (Compound X) undergo addition reaction at the multiple bonds.

For example, 1-butene and 2-butene will add a chlorine molecule (Cl_2) to form 1, 2-dichlorobutane and 2, 3-dichlorobutane respectively.

The reaction will be:

$CH_3 - CH_2 - CH = CH_2 + Cl_2 \rightarrow CH_3 - CH_2 - CH(Cl) - CH_2Cl$

or $CH_3 - CH = CH - CH_3 + Cl_2 \rightarrow CH_3 - CH(Cl) - CH(Cl) - CH_3$ **3**

COMMONLY MADE ERROR

- Generally students get confused between saturated and unsaturated compounds and their molecular formula.

ANSWERING TIP

- Be clear with basic concepts, saturated and unsaturated compounds, their molecular formulas. Also remember how saturated and unsaturated compounds react differently.

Q. 8. What is an oxidising agent ? What happens when an oxidising agent is added to propanol ? Explain with the help of a chemical equation.

A [Delhi Set-II, 2016] [DDE 2017]

Ans. (i) It is a substance which can give oxygen to other substances. **1**

(ii) $CH_3—CH_2—CH_2—OH \xrightarrow[OR\ \text{Acidified } K_2Cr_2O_7 + \text{Heat}]{\text{Alkaline } KMnO_4 + \text{Heat}}$

Propanol $CH_3 — CH_2 — \underset{\underset{O}{\|}}{C} — OH$

Propanoic acid **1**

(iii) Propanol is oxidised to Propanoic acid. **1**

[CBSE Marking Scheme, 2016]

Q. 9. What happens when (write chemical equation in each case)

(a) ethanol is burnt in air ?

(b) ethanol is heated with excess conc. H_2SO_4 at 443 K ?

(c) a piece of sodium is dropped into ethanol ?

[CBSE OD Set-II, 2017]

Ans. • $C_2H_5OH + 3O_2 \rightarrow 2CO_2 + 3H_2O$ **1**

• $CH_3CH_2OH \rightarrow C_2H_4 + H_2O$ **1**

• $2C_2H_5OH + 2Na \rightarrow 2C_2H_5ONa + H_2$ **1**

[CBSE Marking Scheme, 2017]

Q. 10. (i) Define the term functional group. Identify the functional group present in the following:

(a) $H — \underset{\underset{O}{\|}}{C} — H$, **(b)** $H — \underset{\underset{H}{|}}{\overset{\overset{H}{|}}{C}} — \overset{\overset{OH}{|}}{C} = O$

(ii) What happens when 5% alkaline $KMnO_4$ solution is added drop by drop to warm ethanol taken in a test-tube ? State the role of alkaline $KMnO_4$ solution in this reaction.

U [Board Term II Foreign Set-I, 2016]

Ans. (i) Functional group: Hetero atom or group of atoms attached to the carbon chain, which gives specific properties to the compounds, is called a functional group. **1**

(a) Aldehyde group, **(b)** Carboxylic acid ½ + ½

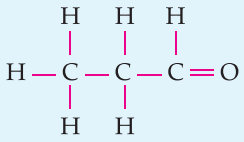
(ii) Acetic/Ethanoic acid is formed. It is an oxidizing agent. ½ + ½

[CBSE Marking Scheme, 2016]

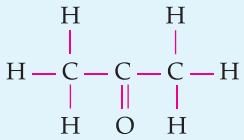
Q. 11. An aldehyde as well as a ketone can be represented by the same molecular formula, say C_3H_6O. Write their structures and name them. State the scientific relation between the two. A [OD. Set-I, 2016]

@PROCBSE

Ans. (i) Propanal (aldehyde); ½ + ½



(ii) Propanone (Ketone); ½ + ½



(iii) Isomers (same molecular formula but different structural formula/different functional group) **1**

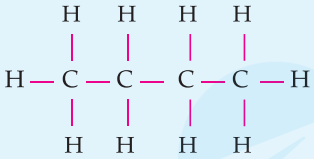
[CBSE Marking Scheme, 2016]

Q. 12. What is meant by isomers ? Draw the structure of two isomers of butane, C_4H_{10}. Explain why we cannot have isomers of first three members of alkane series. AE **[Board Term II, Delhi Set-I, 2015]**

Ans. Isomers are the compounds which have the same molecular formula but different structural formula.

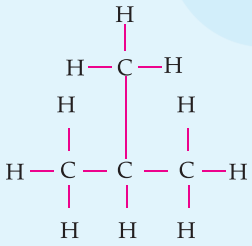
Isomers of Butane:

(i)



n-butane

(ii)



iso-butane

We cannot have isomers of the first three members of the alkane series because of the following laws of isomers:

(i) The parent chain should have the most number of carbon atoms.

(ii) The branching cannot be done from the first and the last carbon atom of the structure. **1+1+1**

[CBSE Marking Scheme, 2015]

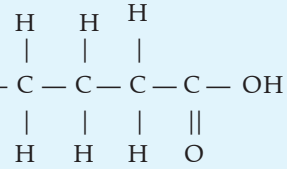
AI **Q. 13. Draw the structures of the following compounds and identify the functional group present in them:**

(i) Butanoic acid

(ii) Bromopropane

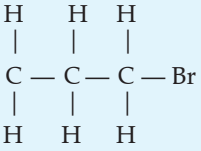
(iii) Butyne AE **[Board Term-II, 2015]**

Ans. (i)



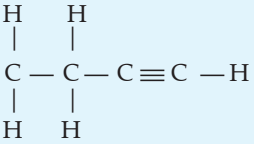
Carboxylic group – COOH

(ii)



Halogen atom – Br

(iii)



Triple bond – C ≡ C –

[CBSE Marking Scheme, 2015] 1+1+1

COMMONLY MADE ERROR

- Students mostly commit errors in writing structural formulae.

ANSWERING TIP

- Sufficient practice must be taken to write the structural formulae of organic compounds with correct functional groups.

Q. 14. Write the molecular formula of the following compounds and draw their electron-dot structures:

(i) Ethane

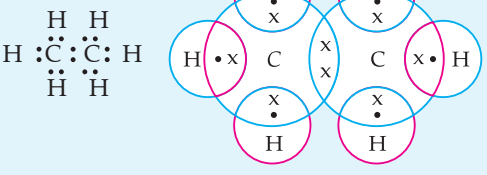
(ii) Ethene

(iii) Ethyne

C **[Foreign Set-I, 2015]**

Ans.

(i) Ethane: C_2H_6

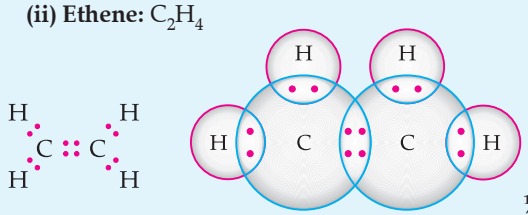


½ + ½

@PROCBSE JOIN NOW !

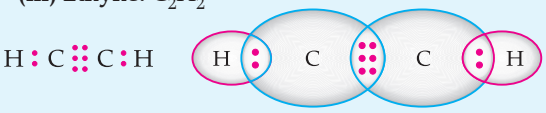
@PROCBSE

(ii) Ethene: C_2H_4



½ + ½

(iii) Ethyne: C_2H_2



[CBSE Marking Scheme, 2015] ½ + ½

COMMONLY MADE ERROR

- Students often make mistake while drawing electron dot structures.

ANSWERING TIP

- Understand the basic concepts involved in drawing the dot structure. Make sure that you have made dots for all shared bonds.

AI **Q. 15. Explain the following:**

(i) CH_3COOH is a weak acid.

(ii) Propene undergoes addition reaction.

(iii) The gas stoves have inlets for air.

A [Board Term II, 2015]

Ans. (i) Due to the incomplete ionization of acetic (CH_3COOH) acid.

(ii) $CH_3 — CH = CH_2$ (Propene) undergoes addition reaction because of double bond.

(iii) To supply sufficient oxygen for complete combustion.

[CBSE Marking Scheme, 2015] **1+1+1**

Long Answer Type Questions — 5 marks each

Q. 1. The formulae of four organic compounds are given below:

A	B	C	D
C_2H_4	CH_3COOH	C_2H_5OH	C_2H_6

(i) Which one of these compounds A, B, C or D is a saturated hydrocarbon?

(ii) Identify the organic acid and give its structural formula.

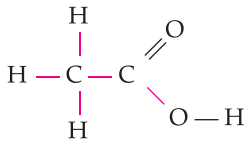
(iii) Which of the above compounds when heated at 443K in the presence of concentrated H_2SO_4 forms ethene as the major product? What is the role played by concentrated H_2SO_4 in this reaction? Also, write the chemical equation involved.

(iv) Give a chemical equation when B and C react with each other in presence of concentrated H_2SO_4. Name the major product formed and mention one of its important use. A [Board SQP, 2020]

Ans. (i) D is a saturated hydrocarbon.

(ii) B is an organic acid.

Structural formula:



(iii) C is an alcohol.

conc. H_2SO_4 acts as a dehydrating agent and remove a water molecule from ethanol.

$$C_2H_5OH \xrightarrow{\text{Hot conc.}H_2SO_4} C_2H_4 + H_2O$$

(iv) $CH_3COOH + C_2H_5OH \xrightarrow{\text{conc } H_2SO_4} CH_3COOC_2H_5 + H_2O$

Major product is an ester and it is used in making perfumes / flavouring agents. ½ + 1+ 2 + 1 ½

AI **Q. 2. Write the chemical formula and name of the compound which is the active ingredient of all alcoholic drinks. List its two uses. Write chemical equation and name of the product formed when this compound reacts with: (i) sodium metal (ii) hot concentrated sulphuric acid.**

R [CBSE Board Delhi, Set- I, 2019]

Ans. • C_2H_5OH, Ethanol/Ethyl alcohol

• Good solvent; used in medicines **(Any other)**

(i) $2C_2H_5OH + 2Na \longrightarrow \underset{\text{Sodium ethoxide}}{2C_2H_5ONa} + H_2$

(ii) $C_2H_5OH \xrightarrow[443\,K]{\text{Hot Conc. } H_2SO_4} \underset{\text{Ethene}}{CH_2=CH_2} + H_2O$

[CBSE Marking Scheme, 2019] **1+1+1+ ½ + 1 + ½**

Detailed Answer:

Ethanol with chemical formula: CH_3CH_2OH is an active ingredient of all alcoholic drinks. **1**

Two uses are:

(a) It is used in the manufacture of paints and varnishes.

(b) It is used in medical swabs and hand sanitizers. **2**

Chemical reactions of ethanol:

(i) With sodium metal:

$$\underset{\text{Ethanol}}{2CH_3CH_2OH} + \underset{\text{Sodium}}{2Na} \longrightarrow \underset{\text{Sodium ethoxide}}{2CH_3CH_2ONa} + 2H_2$$

(ii) With hot concentrated sulphuric acid:

$$\underset{\text{Ethanol}}{CH_3CH_2OH} \xrightarrow[H_2SO_4]{\text{Hot conc}} \underset{\text{Ethene}}{CH_2=CH_2} + H_2O$$

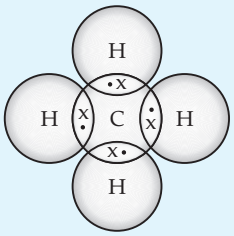
1

@PROCBSE

Q. 3. What is methane ? Draw its electron dot structure. Name the type of bonds formed in this compound. Why are such compounds: (i) poor conductors of electricity and (ii) have low melting and boiling points ? What happens when this compound burns in oxygen ?

R + A **[CBSE Board Delhi, Set- I, 2019]**

Ans. • CH_4/Simplest hydrocarbon



• Covalent bonds

(i) No ions or charged particles are formed

(ii) Due to weak covalent bonds

• Carbon dioxide and water are produced/

$$CH_4 + 2O_2 \longrightarrow CO_2 + 2H_2O$$

[CBSE Marking Scheme, 2019] ½ + 1 + ½ + 1+1+1

Detailed Answer:

Methane is a colourless and highly flammable gas produced on decomposition of vegetation naturally in marshlands. It is the simplest hydrocarbon (CH_4).

Electron dot structure:

All the bonds present between four hydrogen atoms and one carbon atom at the centre are covalent bonds.

(i) Methane is a poor conductor of electricity as all the bonds present are covalent bonds. Hence, no free electrons are available for conduction of electricity.

(ii) As force of attraction between the molecules are not very strong in covalently bonded carbon compounds, therefore, methane being a covalent compound has very low melting and boiling point.

When methane burns in oxygen, carbon dioxide, water and large amount of heat and light is released.

$$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O + \text{heat and light}$$

[CBSE Marking Scheme, 2019] 1+1+1+1+1

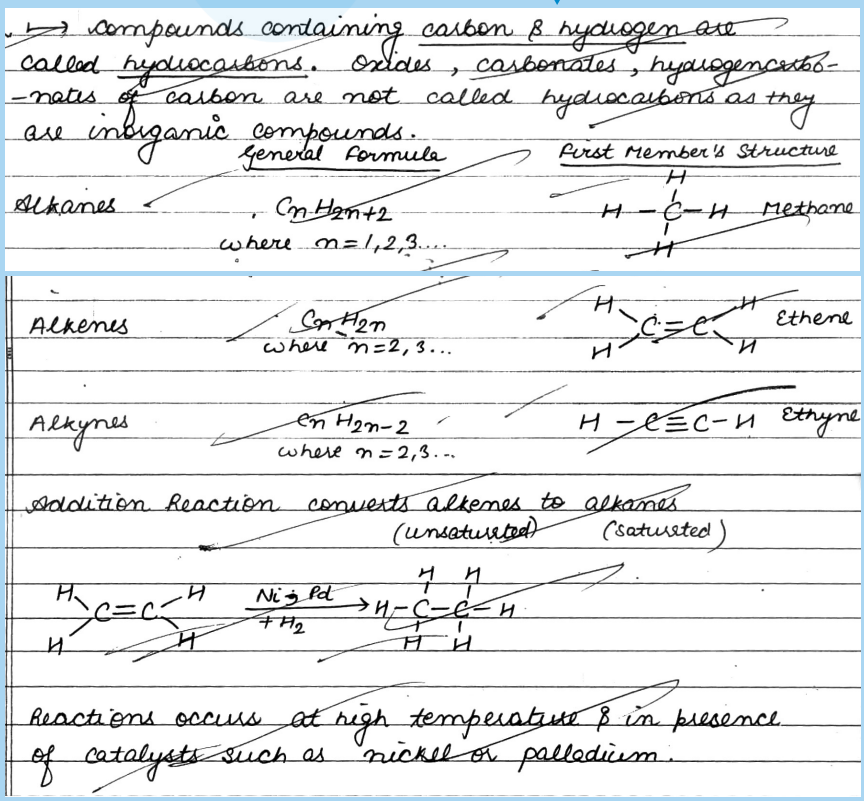
Q. 4. Why are certain compounds called hydrocarbons ? Write the general formula for homologous series of alkanes, alkenes and alkynes and also draw the structure of the first member of each series. Write the name of the reaction that converts alkenes into alkanes and also write a chemical equation to show the necessary conditions for the reaction to occur.

U **[OD Set-1 2017]**

@PROCBSE JOIN NOW !

Topper Answer, 2017

Ans.



@PROCBSE

AI **Q. 5. Describe the following chemical properties of carbon compounds briefly and give one chemical reaction for each:**

(i) Combustion

(ii) Addition

(iii) Substitution

(iv) Esterification

(v) Oxidation R **[CBSE, 2016]**

Ans. (i) Combustion: 'This reaction involves burning of carbon compounds releasing carbon dioxide and water with excess heat and light'

$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$ + Energy + Light

(ii) Addition: It is the reaction in which unsaturated compound reacts with hydrogen in presence of nickel as a catalyst to form saturated compound. '

$CH_2 = CH_2 + H_2 \xrightarrow{Ni} C_2H_6$

(iii) Substitution: This is a reaction in which an atom or group of atoms of a compound are replaced by other atom or group of atoms.

$CH_4 + Cl_2 \xrightarrow{\text{Sunlight}} CH_3Cl + HCl$

(iv) Esterification: Reaction between an acid and an alcohol, where acid is catalysed to form sweet-smelling compound called esters.

$CH_3COOH + C_2H_5OH \xrightarrow{H^+} CH_3COOC_2H_5 + H_2O$

(v) Oxidation: When there is an addition of oxygen in the reaction, it is known as oxidation reaction. This reaction takes place in the presence of oxidising agents.

$C_2H_5OH \xrightarrow{\text{alk. } KMnO_4} CH_3COOH.$

1 + 1 + 1 + 1 + 1

[CBSE Marking Scheme, 2016]

Q. 6. A carbon compound 'P' on heating with excess conc. H_2SO_4 forms another carbon compound 'Q' which on addition of hydrogen in the presence of nickel catalyst forms a saturated carbon compound 'R'. One molecule of 'R' on combustion forms two molecules of carbon dioxide and three molecules of water. Identify P, Q and R and write chemical equations for the reactions involved.

C **[CBSE O.D. Set-I, 2016]**

Ans. P = Ethanol/C_2H_5OH, Q = Ethene/$CH_2 = CH_2$, R = Ethane/C_2H_6 **3 × ½**

$C_2H_5OH \xrightarrow[443k]{\text{Conc } H_2SO_4} CH_2 = CH_2 + H_2O$ **1½**

Ethanol Ethene

$CH_2 = CH_2 \xrightarrow[H_2]{\text{Nickel Catalyst}} CH_3 - CH_3/C_2H_6$ **1**

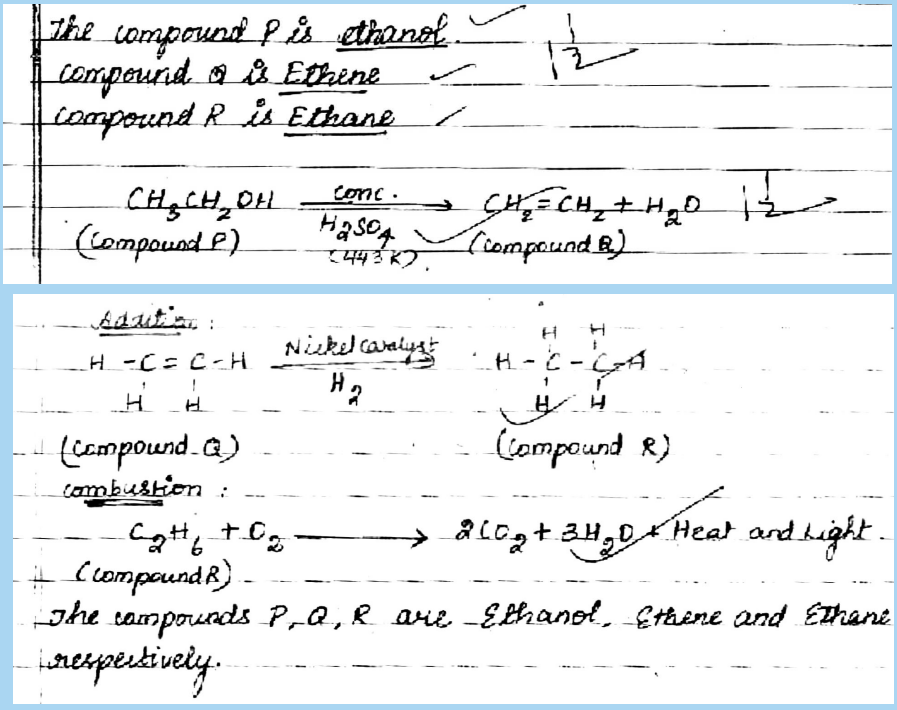
Ethane

$C_2H_6/CH_3 - CH_3 + \frac{7}{2} O_2 \longrightarrow 2CO_2 + 3H_2O$

[CBSE Marking Scheme, 2016] 1

Topper Answer, 2017

Ans.



@PROCBSE

Q. 7. (i) Give a chemical test to distinguish between saturated and unsaturated hydrocarbon.

(ii) Name the products formed when ethane burns in air. Write the balanced chemical equation for the reaction showing the types of energies liberated.

(iii) Why is reaction between methane and chlorine in the presence of sunlight considered a substitution reaction ?

U **[OD Comptt., 2017] [Delhi Set-I, 2015]**

Ans. (i) Pass the vapours of the given samples of saturated and unsaturated hydrocarbons into bromine water taken in two separate test-tubes. The one which discharges the colour of bromine water is that of unsaturated hydrocarbon and the other represents saturated hydrocarbon. **(Or any other test) 2**

(ii) On burning ethane in air, the products obtained are carbon dioxide and water, along with heat and light.

$2C_2H_6(g) + 7O_2(g) \rightarrow 4CO_2(g) + 6H_2O(l) + \text{Heat} + \text{Light}$ **2**

(iii) It is considered a substitution reaction because the hydrogen atoms of methane (CH_4) are replaced by chlorine atoms one by one. **1**

Q. 8. Describe the addition reaction of carbon compounds with its application. State the function of catalyst in this reaction. How this reaction is different from a substitution reaction?

U **[Board Term II, Delhi, 2015]**

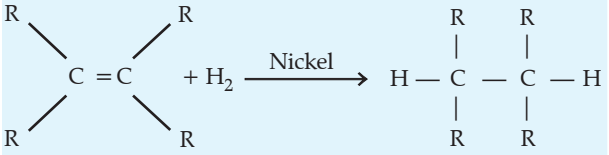
Ans. When any molecule like H_2 adds to unsaturated hydrocarbon because of double and triple bond in the presence of Ni as catalyst, it is called addition reaction.

$CH_2 = CH_2 + H_2 \xrightarrow{Ni} C_2H_6$

Use: Hydrogenation of vegetable oils in the presence of Ni as catalyst. **2**

Catalyst: Increases the rate of reaction. **1**

Hydrogenation reaction: It is the process in which unsaturated compound reacts with hydrogen in presence of nickel as a catalyst to form saturated compound.



Vegetable Oil Vegetable Ghee

[CBSE Marking Scheme, 2015] **2**

@PROCBSE

TOPIC - 2
Ethanol, Ethanoic acid, Soap and Detergents

Revision Notes

- **Ethanol:**
  - **Chemical Properties:**
    - **(i) Reaction with sodium:** Formation of sodium ethoxide and hydrogen.
      $2CH_3CH_2OH + 2Na \rightarrow 2CH_3CH_2ONa + H_2$
    - **(ii) Reaction with acid:** Formation of ester (ethyl ethanoate) – a sweet smelling ester. This process is called esterification.
      $CH_3COOH + C_2H_5OH \underset{}{\overset{\text{conc. } H_2SO_4}{\rightleftharpoons}} CH_3COOCH_2CH_3 + H_2O$
  - **Uses:** In preparation of soap, cosmetics, in alcoholic beverages, in medicines, in laboratory reagent.
- **Ethanoic acid:**
  - Vinegar — 5-8 % solution of acetic acid in water.
  - Glacial acetic acid — Pure acetic acid
  - **Chemical Properties of ethanoic acid**
    - **(i) Reaction with sodium carbonate:**
      $2CH_3COOH + Na_2CO_3 \rightarrow 2CH_3COONa + H_2O + CO_2$
    - **(ii) Reaction with sodium hydrogen carbonate:**
      $CH_3COOH + NaHCO_3 \rightarrow CH_3COONa + H_2O + CO_2$
      Brisk effervescence marks the presence of carbon dioxide.
    - **(iii) Reaction with NaOH:**
      $CH_3COOH + NaOH \rightarrow CH_3COONa + H_2O$

Scan to know more about this topic

Properties of ethanoic acid

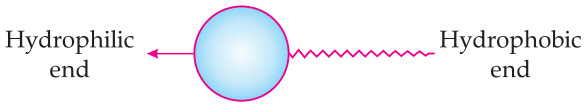
@PROCBSE

(iv) Reaction with ethanol (Esterification):

$$CH_3COOH + CH_3CH_2OH \underset{}{\overset{\text{conc.}H_2SO_4}{\rightleftharpoons}} CH_3COOC_2H_5 + H_2O$$

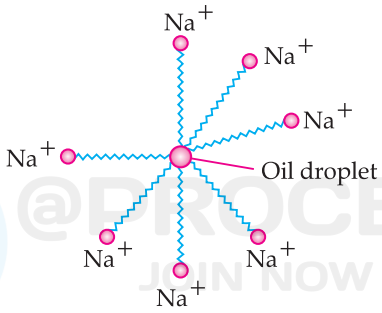
On hydrolysis, ester gives parent alcohol and sodium salt of carboxylic acid. Alkaline hydrolysis of ester is called saponification.

- Soap is sodium or potassium salt of long chain carboxylic acid. *e.g.*, $C_{17}H_{35}COONa^+$
- Soaps are effective only in soft water.
- Detergents are ammonium or sulphonate salt of long chain of carboxylic acid.
- Detergents are effective in both hard and soft water.
- **Soap molecule has:**
  (i) Ionic (hydrophilic) part
  (ii) Long hydrocarbon chain (hydrophobic) part



Structure of soap molecule

- **Cleansing Action of Soap:** Most dirt is oily in nature. The hydrophobic end of soap molecule attaches itself with dirt and the ionic end is surrounded with molecule of water. This result in formation of a radial structure called micelles.
- Soap micelles helps to dissolve dirt and grease in water and cloth gets cleaned.



@PROCBSE JOIN NOW !

- The magnesium and calcium salt present in hard water reacts with soap molecule to form insoluble product called scum. This scum create difficulty in cleansing action.
- By use of detergent, insoluble scum is not formed with hard water and cloths get cleaned effectively.

How is it done on the GREENBOARD?

AI Q. What are micelles ? Why does it form when soap is added to water ? Will a micelle be formed in other solvents such as ethanol also ? State briefly how the formation of micelles help to clean the clothes having oily spots.

Ans. Step I: Soap molecules have two ends– one end is the hydrocarbon chain which is water repellent, where as the other end is the ionic part that is water soluble end. When soap is dissolved in water it forms a group of many molecules, known as micelle. 1

Step II: These micelles are formed because their hydrocarbon chains come together and the polar ends are projected outwards that help to remove oily spots from clothes. 1

Step III: Micelle formation in ethanol will not occur because the hydrocarbon chain end of the soap will dissolve in ethanol. 1

@PROCBSE

Objective Type Questions — 1 mark each

A Multiple Choice Questions

Q. 1. When sodium hydrogen carbonate is added to ethanoic acid a gas evolves. Consider the following statements about the gas evolved.

(a) It turns lime water milky.
(b) It is evolved with a brisk effervescence.
(c) It has a smell of burning sulphur.
(d) It is also a by-product of respiration.

The correct statements are :

(a) (A) and (B) only
(b) (B) and (D) only
(c) (A), (C) and (D)
(d) (A), (B) and (D) U **[CBSE Delhi Set-III, 2020]**

Ans. Correct option: (d)

Explanation: (A), (B) and (D). The gas evolved is carbon dioxide with brisk effervescence. It turns lime water milky. It is also a by-product of respiration.

Q. 2. While studying the saponification reaction, what do you observe when you mix an equal amount of colourless vegetable oil and 20% aqueous solution of NaOH in a beaker?

(a) The colour of the mixture has become dark brown
(b) A brisk effervescence is taking place in the beaker
(c) The outer surface of the beaker has become hot
(d) The outer surface of the beaker has become cold

[CBSE Board, All India Region, 2017]

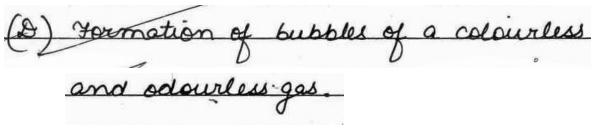
Ans. Correct option: (c)

Explanation: The beaker becomes hot because it is an exothermic reaction.

Q. 3. When you add a few drops of acetic acid to a test-tube containing sodium bicarbonate powder, which one of the following is your observation ?

(a) No reaction takes place.
(b) A colourless gas with pungent smell is released with brisk effervescence.
(c) A brown coloured gas is released with brisk effervescence.
(d) Formation of bubbles of a colourless and odourless gas. AE **[SA-II, OD. Set-I, 2017]**

Ans.



[Topper's Answer, 2017]

Q. 4. In the soap micelles

(a) the ionic end of soap is on the surface of the cluster while the carbon chain is in the interior of the cluster.
(b) ionic end of soap is in the interior of the cluster and the carbon chain is out of the cluster.
(c) both ionic end and carbon chain are in the interior of the cluster.
(d) both ionic end and carbon chain are on the exterior of the cluster.

Ans. Correct option: (a)

Explanation: A micelle is a spherical aggregation of soap molecules in water in which hydrocarbon ends are directed towards the centre and ionic ends are directed outwards.

Q. 5. Ethanol reacts with sodium and forms two products. These are

(a) sodium ethanoate and hydrogen
(b) sodium ethanoate and oxygen
(c) sodium ethoxide and hydrogen
(d) sodium ethoxide and oxygen

Ans. Correct option: (c)

Explanation: Ethanol (C_2H_5OH) reacts with sodium to form sodium ethoxide (C_2H_5ONa) along with liberation of hydrogen gas.

$$2C_2H_5OH + 2Na \rightarrow 2C_2H_5ONa + H_2 \uparrow$$

Q. 6. Vinegar is a solution of

(a) 50% – 60% acetic acid in alcohol
(b) 5% – 8% acetic acid in alcohol
(c) 5% – 8% acetic acid in water
(d) 50% – 60% acetic acid in water

Ans. Correct option: (c)

Explanation: Vinegar is a 5%–8% aqueous solution of acetic acid.

B Assertions and Reasons Type Questions

Directions: In the following questions, a statement of assertion (A) is followed by a statement of reason (R). Mark the correct choice as:

(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).
(b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).
(c) Assertion (A) is true but reason (R) is false.
(d) Assertion (A) is false but reason (R) is true.

Q. 1. Assertion (A): Esterification is a process in which a sweet smelling substance is produced.

Reason (R): When esters react with sodium hydroxide an alcohol and sodium salt of carboxylic acid are obtained. AE **[CBSE, 2020]**

Ans. Correct option: (b)

Explanation: Esterification is a reaction in which alcohol like ethanol reacts with carboxylic acids to form esters and water in the presence of sulphuric acid. Esters are generally sweet smelling substances

@PROCBSE

$$CH_3-COOH + CH_3-CH_2OH \xrightarrow{Acid}$$

(Ethanoic acid) (Ethanol)

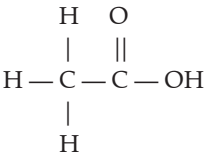
$$CH_3-\underset{\underset{O}{||}}{C}-O-CH_2-CH_3$$

(Ester)

Q. 2. Assertion (A): Acetic acid has six single bond and one double bond.
Reason (R): It is unsaturated organic compound.

Ans. Correct option: (a)

Explanation: Acetic acid has structure which has six single bond and only one double bond. It is an unsaturated organic compound.



Q. 3. Assertion (A): In esterification, carboxylic acid and alcohol reacts in the presence of acid to give ester.
Reason (R): Esterification is the reverse of saponification.

Ans. Correct option: (a)

Explanation: In esterification, RCOOH, – H is replaced by – R' of R'OH in the presence of acid to form RCOOR'.

Q. 4. Assertion (A): Soap has good cleansing action.
Reason (R): Soap has short chain of hydrocarbon which acts as hydrophobic and long ionic part which acts as hydrophilic.

Ans. Correct option: (c)

Explanation: Soap has long chain of hydrocarbon and short chain of ionic part.

C Very Short Answer Type Questions

Q. 1. What is the chemical formula of acetic acid? R

Ans. CH_3COOH **1**

Q. 2. Medicines like tincture iodine or cough syrup uses ethanol for their preparation. Why?

Ans. Ethanol is a solvent used to make tincture iodine or cough syrup because the cell membrane of micro-organisms is made up of lipids and ethanol is the solvent, which can dissolve the lipid easily and kill the micro-organisms that may be pathogenic.

Q. 3. While converting ethanol to ethane what role is payed by conc.H_2SO_4 ? R

Ans. Concentrated sulphuric acid acts as dehydrating agent *i.e.*, removes water molecule from ethanol and also catalyse the reaction and convert ethanol to ethane. ½ + ½

Q. 4. Show conversion of ethanol to ethanoic acid in the presence of $KMnO_4$. R

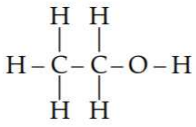
Ans. $CH_3CH_2OH \xrightarrow{KMnO_4[O]} CH_3COOH$

Ethanol Ethanoic acid **1**

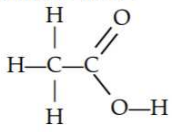
Short Answer Type Questions-I — 2 marks each

Q. 1. Draw the structures for (i) ethanol, (ii) ethanoic acid. C [Delhi Set-3 2020]

Ans. Structure of ethanol :



Structure of ethanoic acid :



Q. 2. Carry out following conversions:
(i) Ethanol to ethane
(ii) Ethanol to Ethanoic acid

U [CBSE OD SET-II, 2020]

Ans. $2CH_3CH_2OH \xrightarrow[H_2SO_4]{\text{Hot Conc.}} 2CH_2 = CH_2 + H_2O$

Ethanol Ethene

$$CH_3-CH_2OH \xrightarrow[\text{or acidified } K_2Cr_2O_7 + \text{Heat}]{\text{Alkaline } KMnO_3 + \text{Heat}} CH_3COOH$$

Q. 3. Why is the conversion of ethanol to ethanoic acid considered an oxidation reaction? Write the oxidising agent used in the reaction involved.
C [Delhi Set-3 2020]

Ans. Conversion of ethanol to ethanoic acid is an oxidation reaction because oxygen is added to ethanol to convert it to ethanoic acid.

$$CH_3-CH_2OH \xrightarrow[\text{or acidified } K_2Cr_2O_7 + \text{Heat}]{\text{Alkaline } KMnO_3 + \text{Heat}} CH_3COOH + H_2$$

In the above reaction alk. $KMnO_4$/acidified $K_2Cr_2O_7$ has added oxygen to ethanol hence they are called oxidising agent.

Q. 4. List two chemical properties on the basis of which ethanol and ethanoic acid may be differentiated and explain how. R [CBSE O.D. Set-III, 2019]

Ans. Ethanoic acid reacts with NaOH to give sodium salt and water but C_2H_5OH does not show this reaction. **1**

Ethanoic acid reacts with $NaHCO_3$ (Sodium Bicarbonate) or Na_2CO_3 (Sodium Carbonate) and given sodium salt of ethanoic acid, water and carbon dioxide. **1**

[CBSE Marking Scheme, 2019]

@PROCBSE JOIN NOW !

@PROCBSE

Q. 5. Which organic compound is added to make ethanol unfit for drinking? Name the mixture thus formed?

Ans. Methanol,a highly poisonous substance is added to make ethanol unfit for drinking. The mixture thus formed is methylated spirit or denatured alcohol.

Q. 6. Why the mixture of ethyne and air is not used for welding though air is easily available. Instead, a mixture of ethyne and oxygen is used for welding.

Ans. Air contains a mixture of nitrogen and oxygen. Nitrogen which is more in quantity does not support combustion.
While when ethyne is burnt in oxygen, large quantity of heat and light is evolved. The heat evolved can be used for welding.

Q. 7. Butter and cooking oil can be distinguished using alkaline $KMnO_4$. Cooking oil is unsaturated compound and thus decolourises the pink colour of $KMnO_4$ while butter is a saturated compound so it does not.

Ans. Bromine water test in which only cooking oil discharges brown colour due to cooking oil being unsaturated compound.

Q. 8. What is a homologous series of carbon compounds? Give an example and list its three characteristics.

Ans. A series of compounds in which the same functional group substitutes for hydrogen in a carbon chain is called a homologous series.
Example: Alkane / Alkene / Alkyne / Alcohol or any other one correct example.
Characteristics:
- They have same general formula.
- They have same functional group.
- The difference in the molecular mass of two successive member is 14u.
- The difference in the molecular formula of two successive member is of CH_2 unit
- They have similar chemical properties.

(Any three points) ½ × 3

Q. 9. What are covalent compounds ? How are they different from ionic compounds ? List any two properties of covalent compounds.

Ans. • The compounds that are formed due to sharing of electrons between two atoms/compounds having covalent bonds. **1**
- Ionic compounds are formed due to transfer of electrons from one atom to another/ compounds having ionic bonds/compounds having attraction between oppositely charged ions. **1**

Properties:
- They are poor conductors of electricity ½
- They have low melting and boiling point. ½

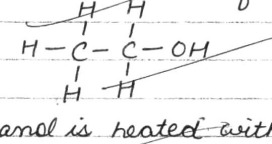
Short Answer Type Questions-II — 3 marks each

Q. 1. Write the structural formula of ethanol. What happens when it is heated with excess of conc. H_2SO_4 at 443 K ? Write the chemical equation for the reaction stating the role of conc. H_2SO_4 in this reaction.

A [CBSE OD Set-I, 2017] **3**

Topper Answer, 2017

Ans. Structural Formula of Ethanol



When ethanol is heated with excess H_2SO_4 at 443K, dehydration reaction occurs and ethene & water are formed as by products.

$$CH_3CH_2OH \xrightarrow[\text{dehydrating agent}]{\text{conc. } H_2SO_4 + \Delta} \underset{\text{(Ethene)}}{CH_2=CH_2} + H_2O$$

Here, H_2SO_4 acts as dehydrating agent to remove water from ethanol.

AI **Q. 2.Distinguish between esterification and saponification reactions with the help of the chemical equations for each. State one use of each (i) esters, and (ii) saponification process.** R [CBSE OD Set-I, 2017]

@PROCBSE

Topper Answer, 2017

Ans.

ESTERIFICATION REACTION	SAPONIFICATION REACTION
1) In this reaction, alcohol (like ethanol) reacts with carboxylic acid (like CH_3COOH) to form esters & H_2O in the presence of sulphuric acid	1) In this reaction, alkaline (NaOH) hydrolysis of esters gives soap & alcohol. (salt)
$CH_3COOH + C_2H_5OH \xrightarrow{\text{conc. } H_2SO_4} CH_3COOC_2H_5$ (Ethyl Ethanoate) $+ H_2O$	$CH_3COOC_2H_5 + NaOH \longrightarrow CH_3COONa + C_2H_5OH$
Use	
(i) Esters → used in perfumes or as flavouring agents.	
(ii) Saponification process → used to prepare soap	

OR

In esterification, a carboxylic acid and alcohol react to form ester in presence of acid. It is reverse of saponification.

$$RCOOH + R'OH \xrightarrow{H^+} \underset{\text{Ester}}{RCOOR'} + H_2O$$

In saponification, an ester reacts with a strong base or an acid to give soap and alcohol.

$$RCOOR' + NaOH \rightarrow \underset{\text{Soap}}{RCOONa} + R'OH$$ **2**

(i) Use of esters:

As esters have fragrant odours, they are used as a constituent of perfumes, essential oils, food flavourings etc.

(ii) Use of saponification process:

In the manufacturing of soap used as cleansing agent. **1**

Q. 3. Complete the following chemical equations:

(i) $CH_3COOC_2H_5 + NaOH \rightarrow$

(ii) $CH_3COOH + NaOH \rightarrow$

(iii) $C_2H_5OH + CH_3COOH \xrightarrow{\text{Conc. } H_2SO_4}$

A [Delhi 31/1/1 2017]

Ans. (i) $CH_3COOC_2H_5 + NaOH \rightarrow CH_3COONa + C_2H_5OH$

(ii) $CH_3COOH + NaOH \rightarrow CH_3COONa + H_2O$

(iii) $C_2H_5OH + CH_3COOH \xrightarrow{\text{Conc. } H_2SO_4} CH_3COOC_2H_5 + H_2O$

[CBSE Marking Scheme, 2017] **1 × 3**

COMMONLY MADE ERROR

- Students often write incorrect reactions.

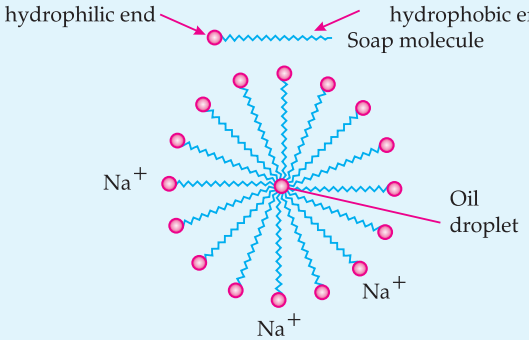
ANSWERING TIP

- Understand the reactions and how it takes place. Make a list of important reactions (reactants, conditions and products) of this chapter and practice them.

Q. 4. With the help of a diagram, explain cleansing action of soap. R [Board Term II, 2017] [DDE, 2017]

Ans. Soap molecules form micelles where one end, *i.e.* hydrocarbon is towards the oil droplet while the ionic end faces outside. **1**

The micelle stays in solution as an emulsion. The soap solution thus helps in dissolving the dirt in water and we can wash the clothes clean. **1**



1

[CBSE Marking Scheme, 2017]

AI **Q. 5. Complete the following chemical equations:**

(i) $CH_3COOH + Na_2CO_3 \rightarrow$

(ii) $CH_4 + O_2 \rightarrow$

(iii) $C_2H_5OH + Na \rightarrow$ C [CBSE Delhi Set-II, 2017]

@PROCBSE

Ans. (i) $2CH_3COOH + Na_2CO_3 \rightarrow 2CH_3COONa + H_2O + CO_2$ **1**

(ii) $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$ **1**

(iii) $2C_2H_5OH + 2Na \rightarrow 2C_2H_5ONa + H_2$ **1**

[CBSE Marking Scheme, 2017]

Q. 6. Write three different chemical reactions showing the conversion of ethanoic acid to sodium ethanoate. Write balanced chemical equation in each case. Write the name of the reactants and the products other than ethanoic acid and sodium ethanoate in each case. U [Board Term II, O.D. Set-III, 2016]

Ans. $2CH_3COOH + Na_2CO_3 \longrightarrow$
Sodium carbonate
$2CH_3COONa + H_2O + CO_2$
Water, Carbon dioxide

$CH_3COOH + NaHCO_3 \longrightarrow$
Sodium hydrogen carbonate
$CH_3COONa + H_2O + CO_2$
Water, Carbon dioxide

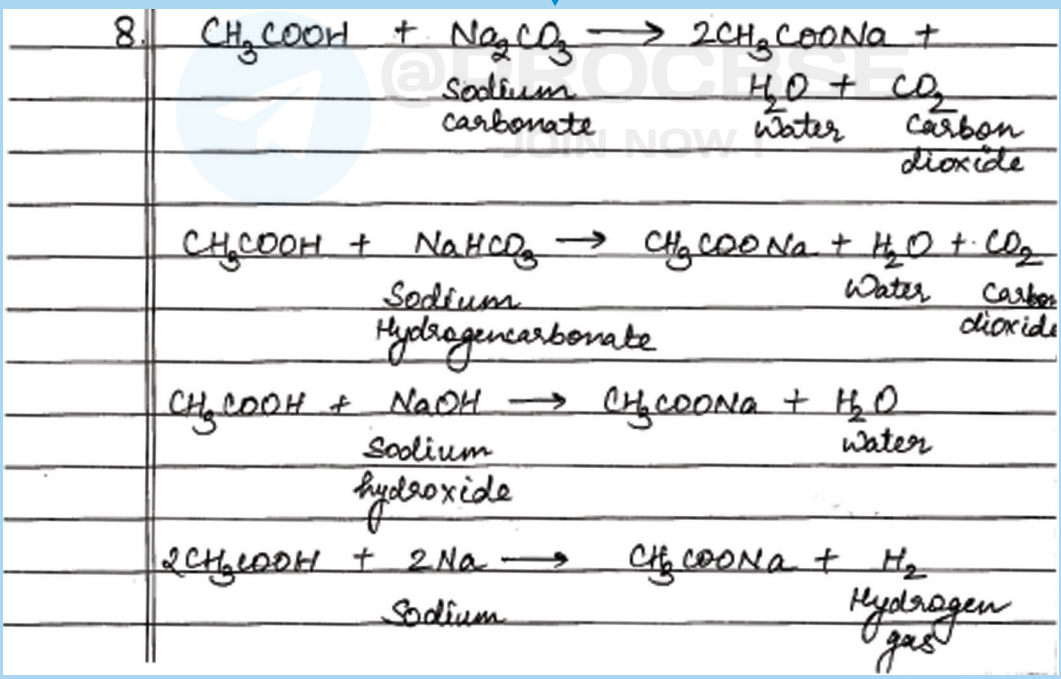
$CH_3COOH + NaOH \longrightarrow CH_3COONa + H_2O$
Sodium hydroxide, Water

$2CH_3COOH + 2Na \longrightarrow 2CH_3COONa + H_2$
Sodium, Hydrogen gas

(Any three reaction) 1+1 +1

[CBSE Marking Scheme, 2016]

Topper Answer, 2016



Q. 7. When ethanol reacts with ethanoic acid in the presence of conc. H_2SO_4, a substance with fruity smell is produced. Answer the following:

(i) State the class of compounds to which the fruity smelling compounds belong. Write the chemical equation for the reaction and write the chemical name of the product formed.

(ii) State the role of conc. H_2SO_4.

A [Board Term II, Set-I, III, 2016]

Ans. (i) Esters. ½

Chemical Equation:

$$CH_3-\overset{\overset{O}{\|}}{C}-OH + CH_3CH_2OH \xrightarrow{\text{Conc. } H_2SO_4} CH_3-\overset{\overset{O}{\|}}{C}-O-CH_2-CH_3 + H_2O$$

1

@PROCBSE

Product's chemical name—Ethyl ethanoate ½

(ii) Conc. H_2SO_4 acts as a dehydrating agent. (Helps in the removal of water formed in the reaction.) **1**

[CBSE Marking Scheme, 2016]

Q. 8. Name the compound formed when ethanol is heated in excess of conc. sulphuric acid at 443 K. Also write the chemical equation of the reaction stating the role of conc. sulphuric acid in it. What would happen if hydrogen is added to the product of this reaction in the presence of catalysts such as palladium or nickel ?

A [Board Term II, Delhi Set-III, 2016]

Ans. (i) Ethene ½

(ii) $C_2H_5OH \xrightarrow[443K]{\text{Conc. } H_2SO_4 + \text{Heat}} H_2C = CH_2 + H_2O$ ½

Ethene

(iii) Conc. H_2SO_4 acts as a dehydrating agent/removes water from the reactant. **1**

(iv) Ethane/C_2H_6 will be formed. **1**

[CBSE Marking Scheme, 2016]

Q. 9. An organic compound 'P' is a constituent of wine. 'P' on reacting with acidified $K_2Cr_2O_7$ forms another compound 'Q'. When a piece of sodium is added to 'Q' a gas 'R' evolves which burns with a pop sound. Identify P, Q and R and write the chemical equations of the reactions involved.

C [CBSE Foreign Set-I, 2016]

Ans. P-Ethanol, Q-Ethanoic acid, R-Hydrogen ½ + ½ + ½

$CH_3CH_2OH \xrightarrow{\text{Acidified } K_2Cr_2O_7} CH_3COOH$ ½

$2CH_3COOH + 2Na \longrightarrow 2CH_3COONa + H_2$ **1**

[CBSE Marking Scheme, 2016]

Q. 10. Write chemical equation of the reaction of ethanoic acid with the following:

(a) Sodium

(b) Sodium hydroxide

(c) Ethanol

Write the name of one main product of each reaction. [CBSE OD, 2016]

Ans. (a) $2CH_3COOH + 2Na \rightarrow 2CH_3COONa + H_2$

Sodium ethanoate/Sodium acetate ½ + ½

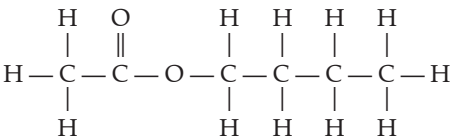
(b) $CH_3COOH + NaOH \rightarrow CH_3COONa + H_2O$

Sodium ethanoate/sodium acetate ½ + ½

(c) $CH_3COOH + C_2H_5OH \rightarrow CH_3COOC_2H_5 + H_2O$

Ethyl ethanoate/ester ½ + ½

Q. 11. The structural formula of an ester is:

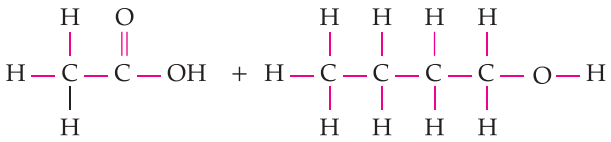


Write the structural formula of the acid and the alcohol from which it might be prepared. Name the process of formation of ester.

AE [Board Term-II, Delhi, 2015]

Ans. $CH_3COOH + C_4H_9OH \longrightarrow CH_3COOC_4H_9 + H_2O$

Acid Alcohol Ester



Ethanoicacid Butanol

Process is Esterification. **1+ 1 + 1**

COMMONLY MADE ERROR

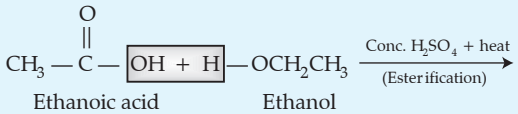
- Students often write incorrect formula.

ANSWERING TIP

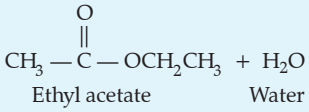
- Be clear with concepts and how the reaction occurs. In the above reaction a water is removed from reactants (acid and alcohol) to form ester. Cautiously count the number of carbon atoms present and then write the name.

Q. 12. When we take 1 ml ethanol and 1 ml ethanoic acid along with a few drops of concentrated sulphuric acid in a test-tube, a sweet smelling substance is formed. Name the compound and give the balanced chemical equation for the reaction. What do we call the reverse reaction to give back alcohol and carboxylic acid which is used in the preparation of soap ? U [CBSE Delhi, 2015]

Ans.



Ethanoic acid Ethanol



Ethyl acetate Water

Reverse reaction = Saponification **2 + 1**

[CBSE Marking Scheme, 2015]

Q. 13. (i) Write the chemical names of CH_3COCH_3, C_2H_5COOH.

(ii) What happens when acetic acid and ethanol react in presence of concentrated H_2SO_4 ? Write the reactions. A [CBSE 2012, 2015]

Ans. (i) CH_3COCH_3: Propanone ½

C_2H_5COOH: Propanoic acid ½

@PROCBSE

(ii) Esterification takes place

$$CH_3COOH + C_2H_5OH \xrightarrow{\text{Conc. } H_2SO_4} CH_3-\underset{\underset{O}{\|}}{C}-O-CH_2-CH_3 + H_2O$$

1

1

[CBSE Marking Scheme, 2012]

COMMONLY MADE ERROR

- Students usually get confused while writing the name of the structures and also writing products in reactions.

ANSWERING TIP

- Understand the basic concept of naming in carbon compounds (involving saturated, unsaturated hydrocarbons, functional groups). Understand how the reactions take place and practice them.

Q. 14. List two tests for experimentally distinguishing between an alcohol and a carboxylic acid and describe how these tests are performed.

U [CBSE O.D. Set-I, 2015]

Ans. (i) Test 1 (Litmus Test): Take two strips of blue litmus paper. Place a drop each of the alcohol and carboxylic acid on these strips separately. The blue litmus paper turns red in the case of carboxylic acid and remains unaffected in the case of alcohol. **1**

(ii) Test 2 (Sodium hydrogen carbonate test/sodium carbonate test): A pinch of sodium hydrogen carbonate or sodium carbonate is added to both test tubes, separately.

If brisk effervescence with the evolution of a colourless gas is observed, it indicates the presence of carboxylic acid. ½

If no change is observed then it confirms the presence of the alcohol. ½

(iii) Test 3 (Ester test or any other suitable test)

(Any two) ½ + ½

[CBSE Marking Scheme, 2015]

Detailed Answer:

(ii) We can distinguish between an alcohol and a carboxylic acid on the basis of their reaction with sodium carbonate and sodium hydrogen carbonate. Carboxylic acids reacts with sodium carbonate and sodium hydrogen carbonate to evolve CO_2 gas that turns lime water milky.

Alcohol, on the other hand, do not react with sodium carbonate and sodium hydrogen carbonate.

(iii) Alcohol reacts with sodium metal to produce hydrogen gas with rapid effervescence. On the other hand, carboxylic acid does not show this type of chemical reaction with sodium metal. **1½+1½**

COMMONLY MADE ERROR

- Students usually get confused between various distinguishing tests for functional groups.

ANSWERING TIP

- Keenly observe experimental tests done during practicals, understand and then learn the tests. Make a list of experimentally done tests used for distinguishing organic compounds with different functional groups and practice them.

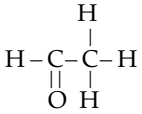
Long Answer Type Questions — 5 marks each

AI **Q. 1. (a) Compare soaps and detergents on the basis of their composition and cleansing action in hard water.**

(b) What happens when ethanol is treated with sodium metal ? State the behaviour of ethanol in this reaction.

(c) Draw the structure of cyclohexane.

(d) Name the following compound.



[CBSE OD., 2020]

Ans. (a) Difference between soap and detergent:

Property	Soap	Detergents
Composition	Soaps are sodium or potassium salts of long chain carboxylic acids/fatty acids	Detergents are the ammonium or sulphonate salts of long chain carboxylic acids.
Cleansing action in hard water	Ca^{2+} and Mg^{2+} present in hard water form insoluble substance (scum) with soap.	Detergents work well with hard and soft water both.

@PROCBSE

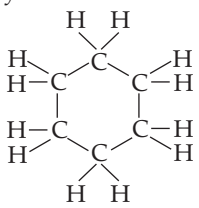
(b) Ethanol reacts with sodium metal to produce sodium ethoxide and hydrogen gas. This salt is colourless and soluble in water.

$$2Na + 2CH_3CH_2OH \rightarrow 2CH_3CH_2ONa + H_2$$

Ethanol — Sodium ethoxide

The reaction is used to test the presence of ethanol or alcohol as hydrogen gas is evolved during the reaction.

(c) Structure of cyclohexane:



(d) ethanal

Q. 2. A compound 'X' on heating with excess conc. Sulphuric acid at 443K gives an unsaturated compound 'Y', 'X' also reacts with sodium metal to evolve a colourless gas 'Z'. Identify 'X', 'Y' and 'Z'. Write the equation of the chemical reaction for formation of 'Y' and also write the role of sulphuric acid in the reaction.

C [CBSE Delhi/O.D, 2018]

Ans. Compound X is ethanol, Y is ethene and Z is hydrogen gas.

$$CH_3CH_2OH \xrightarrow[\text{Heat [443K]}]{\text{Conc.}H_2SO_4} CH_2{=}CH_2 + H_2O$$

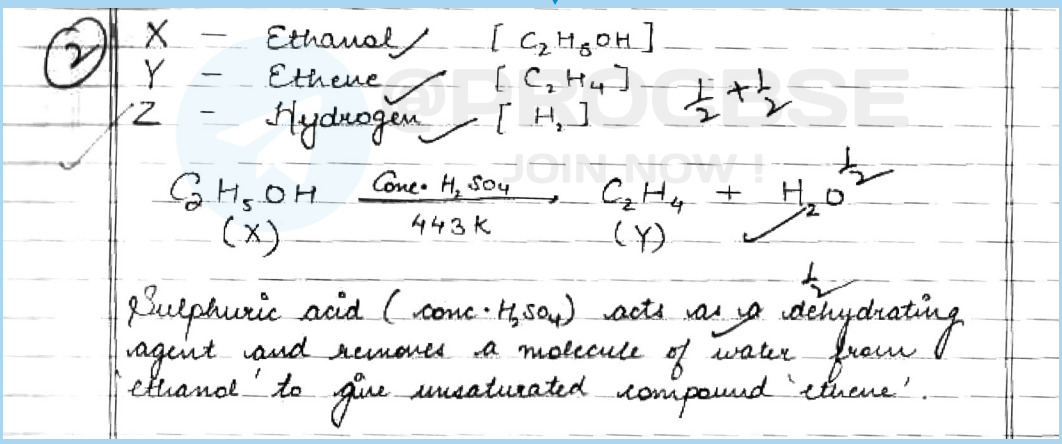
Here, sulphuric acid acts as dehydrating agent. When ethanol (X) reacts with sodium metal, a colourless gas is evolved known as hydrogen.

$$2CH_3CH_2OH + 2Na \rightarrow 2CH_3CH_2ONa + H_2$$

(Sodium ethoxide)

1 + 1 + 1 + 1 + 1

Topper Answer, 2018



Q. 3. A compound A ($C_2H_4O_2$) reacts with Na metal to form a compound 'B' and evolved a gas which burns with a pop sound. Compound 'A' on treatment with an alcohol 'C' in presence of an acid forms a Sweet smelling compound 'D' ($C_4H_8O_2$). On addition of NaOH to 'D' gives back B and C. Identify C and D write the reactions involved.

AE [SQP 2018]

Ans. $2CH_3COOH + 2Na \rightarrow 2CH_3COONa + H_2$.

(A) (B)

$$CH_3COOH + C_2H_5OH \rightarrow CH_3COOC_2H_5 + H_2O$$

(C) (D)

$$CH_3COOC_2H_5 + NaOH \rightarrow CH_3COONa + C_2H_5OH$$

(A) CH_3COOH

(B) CH_3COONa

(C) C_2H_5OH

(D) $CH_3COOC_2H_5$ [CBSE Marking Scheme, 2018] 5

Q. 4. Soaps and detergents are two types of salts. State the difference between the two. Write the mechanism of the cleansing action of soaps. Why do soaps not form lather (foam) with hard water ? Mention any two problems that arise due to the use of detergents instead of soaps.

U [Delhi 31/1/11 2017]

Ans. (i) Soaps are the sodium or potassium salts of long chain carboxylic acids while detergents are the ammonium or sulphonate salts of long chain carboxylic acids.

(ii) The dirt is oily in nature and when soap is added to water, its molecules form structures called micelles in which carbon chain of the molecules dissolves in the oil while the ionic end dissolves in water and faces outside. The micelles thus help in dissolving the dirt in water. (**Note: 1 mark to be awarded if only labelled diagram of micelle is given**)

@PROCBSE

Ca^{2+} and Mg^{2+} present in hard water form insoluble substance (scum) with soap.

Two problems:

(a) Non-biodegradable

(b) Water pollution / soil pollution

(Note: 1 mark to be awarded for any one of the problems.) [CBSE Marking Scheme, 2017]

Detailed Answer:

S.No.	Soap	Detergents
(i)	They are sodium or potassium salts of long chain fatty acids.	These are sodium or potassium salts of sulphonic acids of hydrocarbons.
(ii)	Soaps cannot be used with hard water.	Detergents work well with hard and soft water both.
(iii)	They are fully biodegradable.	They are non-biodegradable.
(iv)	They take time to dissolve in water.	They dissolve faster in water.

Cleansing Action of Soap: When soap is dissolved in water, it forms a colloidal suspension. In this colloidal suspension, the soap molecules cluster together to form micelles and remain radially suspended in water with the hydrocarbon end towards the centre and the ionic end directed outward. The dirt particles always adhere to the oily or greasy layer present on the skin or clothes. When a dirty cloth is dipped into a soap solution, its non-polar hydrocarbon end of micelles gets attached to the grease or oil present in dirt and polar end remains in water layer.

The mechanical action of rubbing subsequently dislodges the oily layer from the dirty surface shaping it into small globules. A stable emulsion of oil in water is formed. The emulsified oil or grease globules bearing the dirt can now be readily washed with water.

Soaps do not form lather when the water is hard. When soap is added to hard water, calcium and magnesium salts present in water displace sodium or potassium ions from the soap molecules forming an insoluble substance called scum.

Problems that aries due to use of detergents instead of soap:

(i) Detergents being non-biodegradable, they accumulate in the environment causing pollution.

(ii) In soil, the presence of detergents leads to pH changes making soil infertile.

(iii) The entry of detergents into food chain leads to bioaccumulation in living beings and leads to serious health issues. **(Any two) 5**

Q. 5. Explain esterification reaction with the help of a chemical equation. Describe an activity to show esterification.

Ans. ● **Esterification :** A process in which an alcohol and a carboxylic acid react in the presence of conc. H_2SO_4 to form an ester. ½

$$CH_3COOH + C_2H_5OH \xrightarrow{\text{Conc. } H_2SO_4} CH_3COOC_2H_5 + H_2O$$ **1**

Activity :

- Take 1 mL of ethanol mixed with 1 mL of acetic acid along with few drops of conc. H_2SO_4 in a test tube.
- Warm it for 5 min. in a water bath
- Pour the contents in a beaker containing 20 – 50 mL of water and smell the resulting mixture.
- It will give a fruity smell indicating the formation of ester. **1½**

[CBSE Marking Scheme, 2017]

AI **Q. 6. What are micelles ? Why does it form when soap is added to water ? Will a micelle be formed in other solvents such as ethanol also ? State briefly how the formation of micelles help to clean the clothes having oily spots.**

Ans. (i) Soap molecules have two ends– one end is the hydrocarbon chain which is water repellent, where as the other end is the ionic part that is water soluble end. When soap is dissolved in water it forms a group of many molecules, known as micelle. **1**

(ii) These micelles are formed because their hydrocarbon chains come together and the polar ends are projected outwards. **1**

(iii) Micelle formation in ethanol will not occur because the hydrocarbon chain end of the soap will dissolve in ethanol. **1**

(iv) Soaps in the form of micelle are able to clean dirty clothes having oily spots, as the oily dirt is collected in the centre of the micelle, which forms an emulsion in water and on rinsing, the water washes away the micelles with dirt attached to them. **2**

Q. 7. (i) You have three unlabelled test-tubes containing ethanol, ethanoic acid and soap solution. Explain the method you would use to identify the compounds in different test tubes by chemical tests using litmus paper and sodium metal.

(ii) Give the reason of formation of scum when soaps are used with hard water.

A [CBSE Foreign Set-I, 2016]

Ans. (i)

Solution	Blue Litmus Paper	Red Litmus Paper	Sodium Metal	
Ethanol	No change	No change	Hydrogen gas	1
Ethanoic acid	Turns red	No change	Hydrogen gas	1
Soap	No change	Turns blue	Hydrogen gas	1

(full credit may be given to the candidate with the answer showing test only with litmus paper)

(ii) Hard water contains calcium ions or magnesium ions or both. These ions on reacting with soap solution form insoluble substance called scum.

[CBSE Marking Scheme, 2016] **1 + 1**

@PROCBSE

Visual Case-based Questions — 4 marks each

Q. 1. Read the passage and answer any four questions (a) to (e).

A homologous series is a series of organic compounds which belong to the same family (i.e. possess same functional group) and show similar chemical properties. The members of this series are called homologous and differ from each other by the number of CH_2 units in the main carbon chain.

(a) The chemical properties of which of the following compounds is similar to the butane ?

(i) Butyne (ii) Propene
(iii) Propyne (iv) Pentane

(b) What is the difference between two consecutive members in a homologous series in alkanes in terms of molecular mass and number of atoms of elements is:

(i) 14 a.m.u and CH_2 respectively
(ii) 12 a.m.u and CH_3 respectively
(iii) 14 a.m.u and CH respectively
(iv) 12 a.m.u and CH_3 respectively

(c) The compound CH_3 CH (OH) CH_3 belongs to which of the following homologous series ?

(i) Aldehydes
(ii) Alcohols
(iii) Ketones
(iv) Carboxylic acid

(d) Which of the following is not the property of a homologous series ?

(i) They show similar chemical properties.
(ii) They differ by 14 units by mass.
(iii) They all contain double bond
(iv) They can be represented by a general formula.

(e) Which of the following represent the name and formula of the 2nd member of homologous series having general formula $C_n H_{2n+2}$?

(i) Methane CH_4
(ii) Ethane C_2H_6
(iii) Ethene C_2H_4
(iv) Ethyne C_2H_6

Ans. (a) (iv) Pentane
(b) (i) 14 a.m.u and CH_2 respectively
(c) (ii) Alcohols
(d) (iii) They all contain double bond
(e) (ii) Ethane , C_2H_6 1+1+1+1

Q. 2. Carbon has the unique property to form bonds with other atoms of carbon Answer any four questions (a) to (e) as given. U

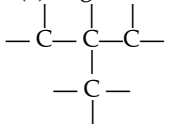


Fig.A

(a) Name the characteristic property of carbon as depicted in the fig. A

(i) Catenation (ii) Polymerisation
(iii) Isomerisation (iv)None of the above.

(b) Carbon forms large number of compounds due to :

(i) Catenation only
(ii) Tetravalency only
(iii) Both catenation and tetravalency
(iv) None of the above

(c) Write the name and structure of a saturated compound in which 6 carbon atoms are arranged in a ring.

(i) Hexane (ii) Cyclohexane
(iii) Pentane (iv) cyclopentane

(d) Give the number of single bonds present in the above mentioned compound.

(i) 16 (ii) 14
(iii) 6 (iv) 18

(e) Carbon is :

(i) Divalent (ii) Monovalent
(iii) tetravalent (iv)Trivalent

Ans. (a) (i) Catenation.
(b) (iii) Both catenation and tetra valency
(c) (ii) Cyclohexane
(d) (iv) 18
(e) (iii) tetravalent 1+1+1+1

Q. 3. Read the passage and answer any four questions (a) to (e).

An organic compound A of molecular formula C_2H_4 on reduction gives another compound B of molecular formula C_2H_6. B on reaction with chlorine in the presence of sunlight gives C of molecular formula C_2H_5Cl.

(a) Name the compounds A, B and C.

(i) A: ethene B : ethane C : chloroethane
(ii) A; ethane B : ethyne : chloromethane
(iii) A; ethyne B : ethane C : chloroethane
(iv) A: ethene B : A; ethyne C: chloroethane

(b) Name the type of reaction.

(i) Substitution (ii) Halogenation
(iii) Addition (iv)All of the above

(c) Essential conditions required for the addition reaction to occur :

(i) Addition of hydrogen does not require catalyst.
(ii) Multiple bonds (double and triple bonds) must be present between carbon atoms in the chain of hydrocarbon.
(iii) Multiple bonds are not required for the reaction to take place.
(iv) None of the above.

(d) The general formula for alkene is :

(i) $C_n H_{2n}$ (ii) $C_n H_{2n+2}$
(iii) $C_n H_{2n-2}$ (iv) $C_n H_{2n+1}$

@PROCBSE JOIN NOW !

@PROCBSE

(e) Choose the correct condition for conversion of ethene to ethane:

(i) Dehydrogenation at 450°C

(ii) Hydrogenation in presence of catalyst like nickel or platinum

(iii) Photolytic decomposition

(iv) All of the above

Ans. (a) (i) A: $CH_2 = CH_2$ Ethene

B : $CH_3 = CH_3$ Ethane

C : $CH_3 – CH_2 – Cl$ Chloroethane

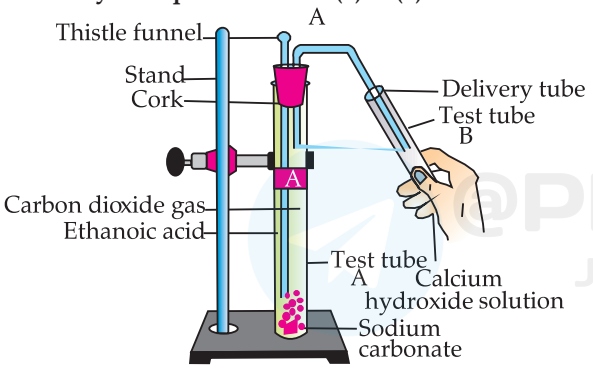
(b) (iii) Addition

(c) (ii) Multiple bonds (double and triple bonds) must be present between carbon atoms in the chain of hydrocarbon.

(d) (i) $C_n H_{2n}$

(e) (ii) Hydrogenation in presence of catalyst like nickel or Palladium. **1+1+1+1+1**

Q. 4. Study the given experimental set-up and answer any four questions from (a) to (e).



(a) Name the gas released in test tube B: R

(i) CO **(ii) CO_2**

(iii) H_2 **(iv) Cl_2**

(b) Name the salt produced in the above activity: C

(i) Sodium chloride

(ii) Ethyl acetate

(iii) Sodium acetate

(iv) Acetic acid

(c) What happens when ethanol is used instead of ethanoic acid: AE

(i) Same products are formed

(ii) No reaction

(iii) A different salt is produced

(iv) None of the above

(d) Choose the correct reaction which justifies the above activity: U

(i) $2CH_3COOH + Na_2CO_3 \rightarrow 2CH_3COONa + H_2O + CO2$

(ii) $Na_2CO_3 \rightarrow 2CH_3COONa + H_2O + CO_2$

(iii) $2CH_3CHO + Na_2CO_3 \rightarrow 2CH_3COONa + H_2O$

(iv) $2CH_3COOH + Na_2CO_3 \rightarrow H_2O + CO_2$

(e) Which gas turns lime water milky: C

(i) CO **(ii) CO_2**

(iii) H_2 **(iv) O_2**

Ans. (a) (ii) CO_2

(b) (iii) Sodium acetate

(c) (ii) No reaction

(d) (i) $2CH_3COOH + Na_2CO_3 \rightarrow 2CH_3COONa + H_2O + CO_2$

(e) (ii) CO_2 **1+1+1+1**

Q. 5. Read the below passage and answer any four question from (a) to (e).

An organic compound A is a constituent of many medicines and is used as antifreeze. Its molecular formula is C_2H_6O. Upon the reaction with alk. $KMnO_4$, the compound A is oxidized to another compound B with formula $C_2H_4O_2$.

(a) Identity the compounds A and B.

(i) Ethanol, ethanoic acid

(ii) ethanoic acid, Ethanol

(iii) ethane, ethanoic acid

(iv) ethanol , acetic acid

(b) What is the role of alk. $KMnO_4$.

(i) It is a reducing agent

(ii) It is an oxidising agent

(iii) It is a catalyst

(iv) It helps in precipitation .

(c) Choose the correct compound which can be used instead of alk. $KMnO_4$:

(i) Acidified potassium dichromate

(ii) Manganese dioxide

(iii) Platinum

(iv) Palladium with hydrogen

(d) Which of the following statement is true:

(i) Ethanol is more lethal than methanol.

(ii) Methanol is more lethal than ethanol

(iii) Both ethanol and methanol are equally poisonous.

(iv) Methanol when taken only cause little drowsiness.

(e) Which of the following statement is true for ethanol:

(i) It does not affect litmus paper.

(ii) It turns red litmus blue

(iii) It turns blue litmus red.

(iv) It is basic in nature.

Ans. (a) (i) A- Ethanol, B is Ethanoic acid

(b) (ii) Alk. $KMnO_4$ is used as oxidizing agent.

(c) (i) Acidified potassium dichromate

(d) (ii) Methanol is more lethal than ethanol

(e) (i) It does not affect litmus paper. **1+1+1+1**

Q.6. Read the given passage and answer any four questions from (a) to (e).

A sample of water which gives lather with soap with difficulty is known as hard water, while a sample of water which gives lather with soap easily is known as soft water.

Hardness of water is due to the presence of bicarbonates, sulphates and chlorides of calcium

@PROCBSE JOIN NOW !

@PROCBSE

and magnesium. Hardness of water is of two types, temporary and permanent hardness. When hardness of water is due to the presence of bicarbonates of magnesium and calcium, it is called temporary hardness. When hardness of water is due to the presence of sulphates and chlorides of magnesium and calcium, it is called permanent hardness.

The amount of hardness causing substances in a certain volume of water measures the extent of hardness or degree of hardness. Hardness of water is always calculated in terms of calcium carbonate although it is never responsible for causing hardness of water because of its insoluble nature. The reason for choosing calcium carbonate as the standard for calculating hardness of water is the ease in calculation as its molecular weight is exactly 100. Degree of hardness is usually expressed as parts per million (ppm).

(a) A student requires hard water for an experiment in his laboratory which is not available in the neighbouring area. In the laboratory there are some salts, which when dissolved in distilled water can convert it into hard water. Select from the following groups of salts, a group, and each salt of which when dissolved in distilled water will make it hard.

(i) Sodium chloride, Potassium chloride

(ii) Sodium sulphate, Potassium sulphate

(iii) Sodium sulphate, Calcium sulphate

(iv) Calcium sulphate, Calcium chloride

(b) Hardness of water is due to :

(i) Carbonates and sulphides of calcium only

(ii) sulphates and chlorides of magnesium only

(iii) bicarbonates of magnesium and calcium.

(iv) bicarbonates, sulphates and chlorides of calcium and magnesium

(c) Why do soaps not form lather (foam) with hard water?

(i) Ca^{2+} and Mg^{2+} present in hard water form insoluble substance with soap.

(ii) Ca^{2+} and Mg^{2+} present in hard water form soluble substance with soap

(iii) HCO_3^- present in hard water form insoluble substance with soap

(iv) SO_4^{2-} present in hard water form soluble substance with soap

(d) Hardness of water is calculated in terms of :

(i) Calcium oxide

(ii) Calcium hydroxide

(iii) Calcium carbonate

(iv) Calcium bicarbonate.

(e) Which statement is not true:

(i) Hard water does not form lather with soap

(ii) Hard water forms lather with soap

(iii) Permanent hardness can't be removed by boiling

(iv) Water obtained from rains is soft water

Ans. (a)(iv) Calcium sulphate, Calcium chloride

(b) (iv) bicarbonates, sulphates and chlorides of calcium and magnesium

(c) (i) Ca^{2+} and Mg^{2+} present in hard water form insoluble substance with soap

(d) (iii) Calcium carbonate

(e) (ii) Hard water forms lather with soap **1+1+1+1**

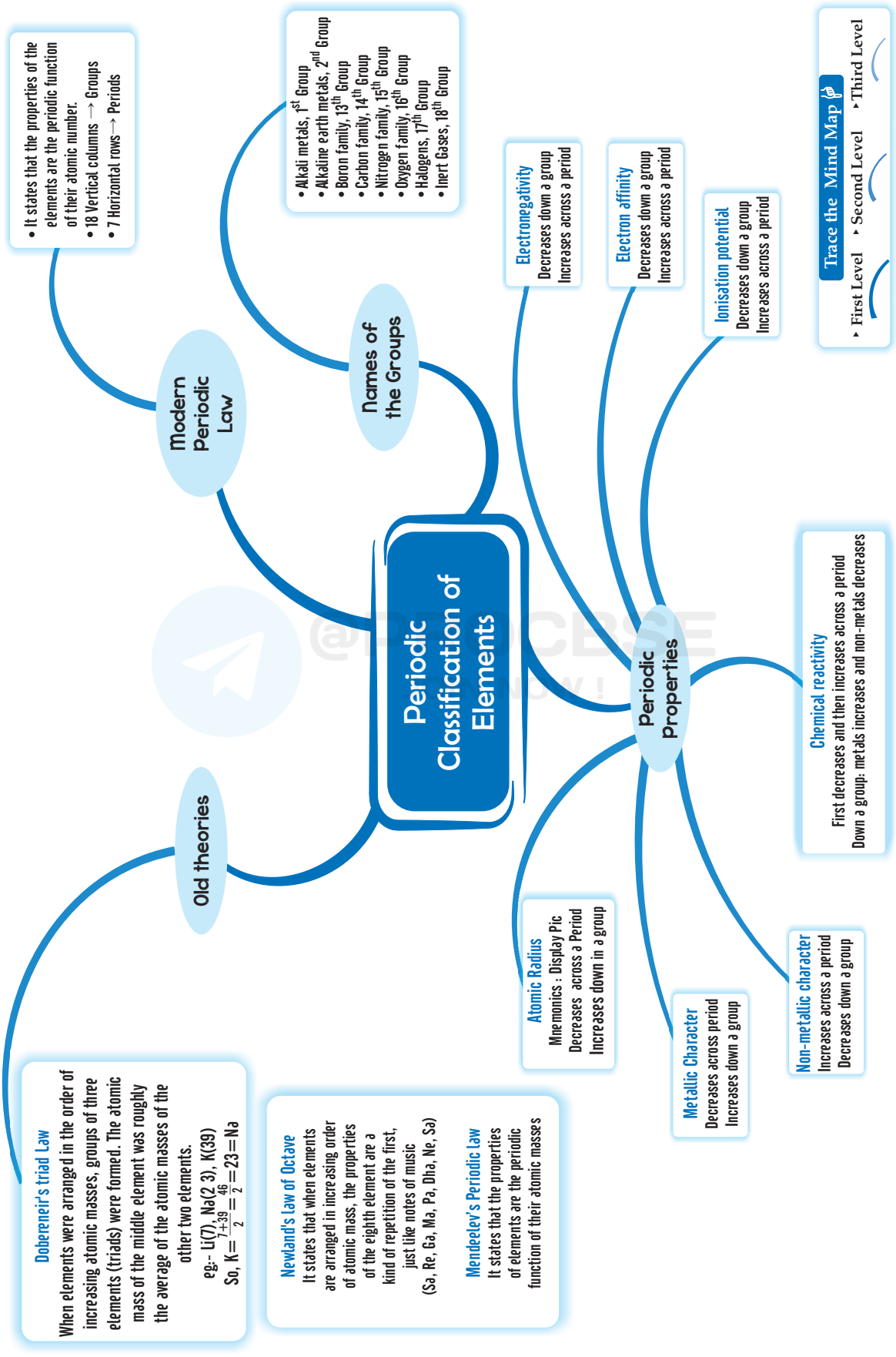
Know the Terms

- **Catenation:** The self linking property of carbon atoms through covalent bonds to form long chains and rings is called catenation.
- **Tetravalency:** Tetravalency is the state of an atom in which there are four electrons available with the atom for covalent chemical bonding.
- **Electronegativity:** It is the ability of an atom to attract a shared pairs of electrons towards itself.
- **Isomerism:** The compounds which possess the same molecular formula but different structural formulae, are called isomers, and the phenomenon is known as isomerism. For example, butane with a molecular formula C_4H_{10} has two isomers.
- **Esterification Reaction:** When an organic acid reacts with an alcohol in the presence of acid catalyst, it produces a sweet smelling (fruity smell) substance called ester. The reaction is known as esterification reaction.
- **Saponification Reaction:** Esters react in the presence of an acid or a base to give back the alcohol and the carboxylic acid. This reaction is known as saponification because it is used in the preparation of soap.

OSWAAL LEARNING TOOL
To learn from Oswaal Concept Video
Visit: http:qrgo.page.link OR Scan this code

❑❑❑

@PROCBSE


Periodic Classification of Elements
Old theories
Modern Periodic Law
• It states that the properties of the elements are the periodic function of their atomic number.
• 18 Vertical columns → Groups
• 7 Horizontal rows → Periods
Names of the Groups
• Alkali metals, 1st Group
• Alkaline earth metals, 2nd Group
• Boron family, 13th Group
• Carbon family, 14th Group
• Nitrogen family, 15th Group
• Oxygen family, 16th Group
• Halogens, 17th Group
• Inert Gases, 18th Group
Doberenier's triad Law
When elements were arranged in the order of increasing atomic masses, groups of three elements (triads) were formed. The atomic mass of the middle element was roughly the average of the atomic masses of the other two elements.
eg:- Li(7), Na(2 3), K(39)
So, K= 7+39/2 = 46/2 = 23=Na
Newland's law of Octave
It states that when elements are arranged in increasing order of atomic mass, the properties of the eighth element are a kind of repetition of the first, just like notes of music (Sa, Re, Ga, Ma, Pa, Dha, Ne, Sa)
Mendeelev's Periodic law
It states that the properties of elements are the periodic function of their atomic masses
Periodic Properties
Electronegativity
Decreases down a group
Increases across a period
Electron affinity
Decreases down a group
Increases across a period
Ionisation potential
Decreases down a group
Increases across a period
Chemical reactivity
First decreases and then increases across a period
Down a group: metals increases and non-metals decreases
Atomic Radius
Mnemonics : Display Pic
Decreases across a Period
Increases down in a group
Metallic Character
Decreases across period
Increases down a group
Non-metallic character
Increases across a period
Decreases down a group
Trace the Mind Map
First Level
Second Level
Third Level

@PROCBSE

CHAPTER

5

PERIODIC CLASSIFICATION OF ELEMENTS

Syllabus

Need for classification, early attempts at classification of elements (Dobereiner's Triads, Newland's Law of Octaves, Mendeleev's Periodic Table); Modern periodic table, gradation in properties, valency, atomic number, metallic and non-metallic properties.

Trend Analysis

List of Concepts	2018	2019		2020	
	OD/D	OD	D	OD	D
Periodic Classification and early attempts	1Q (5M)			1Q (3M)	1Q (5M)
Modern periodic table and gradation in properties	1Q (5 M)	1Q (5 M) 1Q (5 M)	1Q (2 M) 1Q (2 M) 1Q (3 M)	2Q (1M) 1Q (1M) 1Q (3M)	1Q (5M)

@PROCBSE JOIN NOW !

TOPIC - 1

Periodic Laws and their Limitations

Revision Notes

- **Need for Periodic Classification:** To make the study of elements easy, elements have been divided into few groups in such a way that elements in the same group have similar properties. Now, study of a large number of elements is reduced to a few groups of elements.
- **Dobereiner's Triads:** When elements are arranged in the order of increasing atomic masses, groups of three elements (known as triads), having similar chemical properties are obtained.

  The atomic mass of the middle element of the triad was roughly the average of the atomic masses of the other two elements.

TOPIC - 1
Periodic Laws and their Limitations
Page No. 95
TOPIC - 2
Periodic Elements and Periodic Properties
Page No. 105

@PROCBSE

Elements	Atomic Mass
Ca	40.1
Sr	87.6
Ba	137.3

Scan to know more about this topic

Dobereiner's Triads

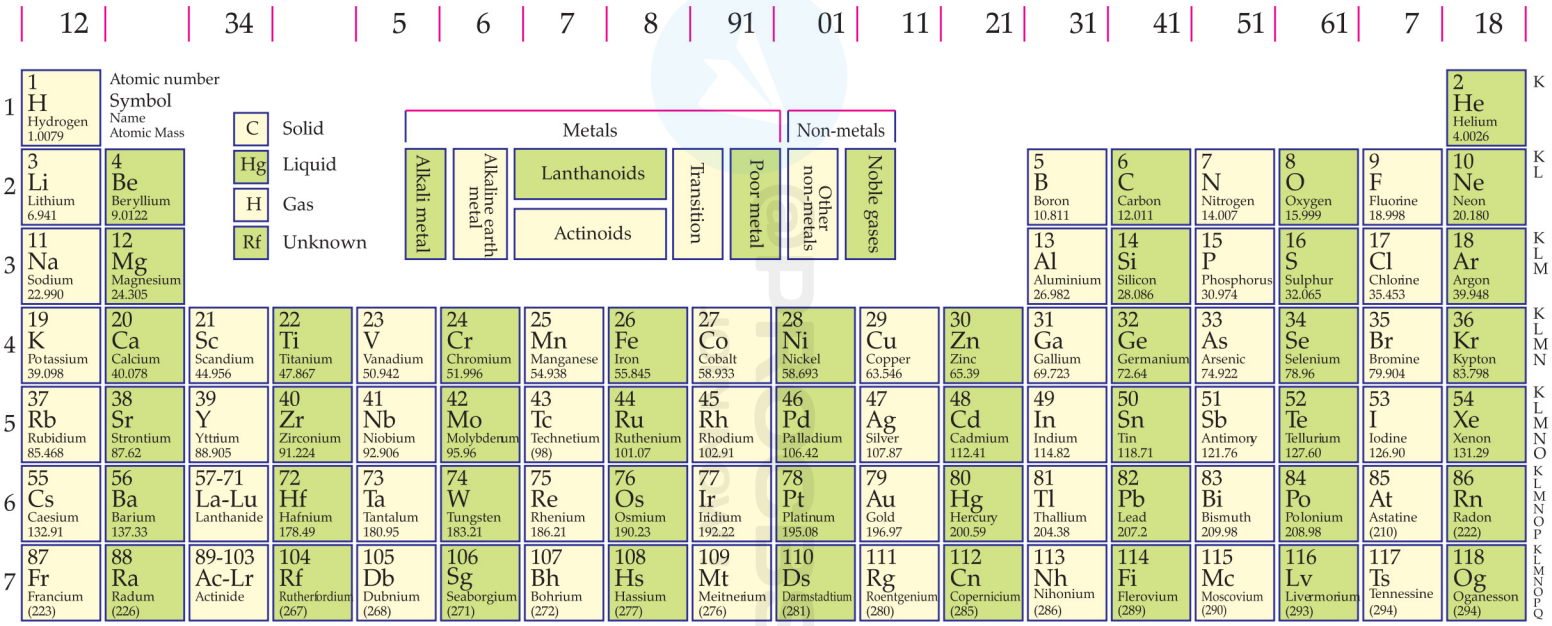
- **Limitation:** Dobereiner could identify only three triads. He was not able to prepare triads of all the known elements.
- **Newland's Law of Octaves:** John Newlands arranged the elements in the order of increasing atomic masses. It states that when the elements are arranged in increasing order of atomic masses, the properties of the eighth element are a kind of repetition of the first, just like notes of music.
- **Table showing Newland's Octaves:**

Sa (do)	re (re)	ga (mi)	ma (fa)	pa (so)	da (la)	ni (ti)
H	Li	Be	B	C	N	O
F	Na	Mg	Al	Si	P	S
Cl	K	Ca	Cr	Ti	Mn	Fe
Co and Ni	Cu	Zn	Y	In	As	Se
Br	Rb	Sr	Ce and La	Zr		

- **Limitations of Newland's law of octaves:**
  - **(i)** The law was applicable to elements up to calcium (Ca) only.
  - **(ii)** It contained only 56 elements. Further, it was assumed by Newlands that only 56 elements existed in nature and no more elements would be discovered in the future.
  - **(iii)** In order to fit elements into the table, Newland adjusted two elements in the same column as fluorine, chlorine and bromine which have very different properties than these elements. Iron, which resembles cobalt and nickel in properties, has been placed differently away from these elements.
- **Mendeleev's Periodic Table:** Dmitri Ivanovich Mendeleev, a Russian chemist, was the most important contributor to the early development of a periodic table of elements as in this the elements were arranged on the basis of their atomic mass and chemical properties.
- **Characteristics of Mendeleev's Periodic Table:**
  - **(i)** Mendeleev arranged all the 63 known elements in increasing order of their atomic masses.
  - **(ii)** The table consists of vertical columns called 'groups' and horizontal rows called 'periods'.
  - **(iii)** The elements with similar physical and chemical properties came under same groups.
- **Mendeleev's Periodic Law:** The properties of elements are the periodic functions of their atomic masses.
- **Merits of Mendeleev's Periodic Table:**
  - **(i)** Mendeleev left some blank spaces for undiscovered elements.
  - **(ii)** Mendeleev predicted the discovery of some elements and named them as eka boron, eka aluminium and eka silicon.
  - **(iii)** Noble gases discovered later could be placed without disturbing the existing order.
- **Limitations of Mendeleev's periodic table:**
  - **(i)** **Position of Hydrogen:** He could not assign a correct position to hydrogen as hydrogen resembles alkali metals as well as halogens.
  - **(ii)** **Position of Isotopes :** Isotopes are placed in same position though they have different atomic masses.
  - **(iii)** Separation of chemically similar elements while dissimilar elements are placed in the same group.
- **Modern Periodic Table:** Henry Moseley gave a new property of elements, 'atomic numbers' and this was adopted as the basis of Modern Periodic Table.
- **Modern Periodic Law:** Properties of elements are the periodic functions of their atomic numbers.

@PROCBSE

Periodic Table of Elements



For elements with no stable isotopes, the mass number of the isotope with the longest half-life is in parentheses.

58 Ce Cerium 140.12	59 Pr Praseodymium 140.91	60 Nd Neodymium 144.24	61 Pm Promethium (145)	62 Sm Samarium 150.36	63 Eu Europium 151.96	64 Gd Gadolinium 157.25	65 Tb Terbium 158.93	66 Dy Dysprosium 162.50	67 Ho Holmium 164.93	68 Er Erbium 167.26	69 Tm Thulium 168.93	70 Yb Ytterbium 173.05	71 Lu Lutetium 174.97
90 Th Thorium 232.04	91 Pa Protactinium 231.04	92 U Uranium 238.03	93 Np Neptunium (237)	94 Pu Plutonium (244)	95 Am Americium (243)	96 Cm Curium (247)	97 Bk Berkelium (247)	98 Cf Californium (251)	99 Es Einsteinium (252)	100 Fm Fermium (257)	101 Md Mendelevium (258)	102 No NObelium (259)	103 Lr Lawrencium (262)

@PROCBSE

Mnemonics

Concept: First 20 atomic number

Mnemonics:
Hi Helen, Listen B.B.C. News On Friday N(e)ight
Senior Maggie Always Sings Pop Songs. Casted All People Came

Interpretation: Hydrogen, Helium, Lithium, Beryllium, Boron, Carbon, Nitrogen, Oxygen, Fluorine, Neon, Sodium, Magnesium, Aluminium, Silicon, Phosphorus, Sulphur, Chlorine, Argon, Potassium, Calcium.

How is it done on the GREENBOARD?

Q. Based on the group valency of elements write the molecular formula of the following compounds giving justification for each:
(i) Oxide of first group elements.
(ii) Halide of the elements of group thirteen, and
(iii) Compound formed when an element, A of group 2 combines with an element B of group seventeen. A 3

Solution:

Step I: Valency of oxygen is 2.

Element	M	O	
Valency	1	2	$= M_2O$

So, the molecular formula of oxide of first group elements is M_2O where 2 is the group 1 element and O is oxygen. 1

Step II : Valency of group 13 elements is 3.

Valency of halogens 1.

Element	M	X	
Valency	3	1	$= MX_3$

So, the molecular formula of halide of group thirteen elements is MX_3 where M is the group 13 element and X is halogen. 1

Step III: Valency of group 2 elements is + 2.

Valency of group 17 elements is 1.

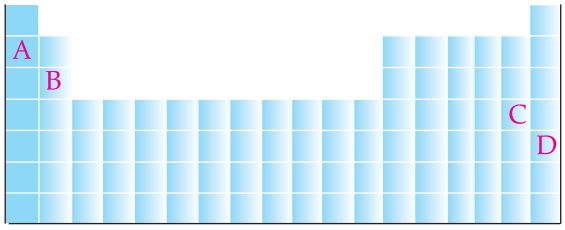
Element	A	B	
Valency	2	1	$= AB_2$

So, the molecular formula is AB_2. 1

Objective Type Questions — 1 mark each

A Multiple Choice Questions

Q. 1. The positions of four elements A, B, C and D in the modern periodic table are shown below. Which element is most likely to form an acidic oxide?
[Board SQP 2020]



@PROCBSE

(a) A (b) B
(b) C (d) D

Ans. **Correct option :** (c)
Explanation: Element C to form an acidic oxide because it lies in non-metal category.

Q. 2. Elements P, Q, R and S have atomic numbers 11, 15, 17 and 18 respectively. Which of them are reactive non-metals? [Board SQP 2020]
(a) P and Q (b) P and R
(c) Q and R (d) R and S

Ans. **Correct option :** (c)
Explanation: Element Q and R are reactive non-metals because they have great tendency to accept the electrons to occupy the stable state configuration.

Q. 3. Consider the following statements about an element 'X' with number of protons 13. [OD, 2020]
(A) It forms amphoteric oxide.
(B) Its valency is three.
(C) The formula of its chloride is XCl.
The correct statements(s) is/are:
(a) only (A) (b) only (B)
(c) (A) and (C) (d) (A), (B) and (C)

Ans. So option (A) and (B) are correct

Q. 4. Upto which element, the Law of Octaves was found to be applicable ?
(a) Oxygen (b) Calcium
(c) Cobalt (d) Potassium
[NCERT Exemp.]

Ans. **Correct option :** (b)
Explanation: It was found that the Law of Octaves was applicable only upto calcium, as after calcium every eighth element did not possess properties similar to that of the first.

Q. 5. According to Mendeleev's Periodic Law, the elements were arranged in the periodic table in the order of
(a) increasing atomic number
(b) decreasing atomic number
(c) increasing atomic masses
(d) decreasing atomic masses [NCERT Exemp.]

Ans. **Correct option :** (c)
Explanation: Mendeleev arranged the known elements according to increasing order of their atomic masses because according to him, fundamental property of an element was atomic mass.

Q. 6. In Mendeleev's periodic table, gaps were left for the elements to be discovered later. Which of the following elements found a place in the periodic table later ?
(a) Germanium (b) Chlorine
(c) Oxygen (d) Silicon
[NCERT Exemp.]

Ans. **Correct option :** (a)
Explanation: Many gaps for the undiscovered elements were left in the periodic table by Mendeleev. For instance, the elements scandium (Sc), gallium (Ga), and germanium (Ge) were not known at Mendeleev's time, but he had predicted their existence in advance of their discovery.

Q. 7. What type of oxide would Eka– aluminium form?
(a) EO_3 (b) E_2O_2
(c) E_2O_3 (d) EO [NCERT Exemp.]

Ans. Correct option : (c)
Explanation: Since, Aluminium forms its oxide as Al_2O_3. Hence, Formula of oxide is E_2O_3.

B Assertions and Reasons Type Questions

Directions: In the following questions, a statement of assertion (A) is followed by a statement of reason (R). Mark the correct choice as:
(a) **Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).**
(b) **Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).**
(c) **Assertion (A) is true but reason (R) is false.**
(d) **Assertion (A) is false but reason (R) is true.**

Q. 1. Assertion (A): Mendeleev arranged element in horizontal rows and vertical columns.
Reason (R): Mendeleev ignored the order of atomic weight thinking that the atomic measurements might be incorrect.

Ans. **Correct option :** (b)
Explanation: Mendeleev arranged elements in horizontal rows and vertical columns. He ignored the order of atomic weight thinking that the atomic measurements might be incorrect and placed the elements with similar properties. **1**

Q. 2. Assertion (A): Mendeleev left the gap under aluminium and silicon and called these Eka-aluminium and Eka-silicon, respectively.
Reason (R): Dobereiner arranged elements on the basis of increasing atomic number.

Ans. **Correct option :** (c)
Explanation: Dobereiner arranged elements on the basis of increasing atomic weights. **1**

Q. 3. Assertion (A): In triad, the three elements have same gaps of atomic masses.
Reason (R): Elements in a triad have similar properties.

Ans. **Correct option :** (d)
Explanation: In a triad, the atomic mass of the middle element is the mean of the atomic masses of the first and third elements. **1**

Q. 4. Assertion (A): According to Mendeleev, periodic properties of elements is a function of their atomic number.
Reason (R): Atomic number is equal to the number of protons.

Ans. **Correct option :** (d)
Explanation: According to Mendeleev, periodic properties of elements is a function of their atomic masses. **1**

@PROCBSE JOIN

@PROCBSE

C Very Short Answer Type Questions

Q. 1. How many horizontal rows are present in modern periodic table. What are they called?

Ans. There are seven horizontal rows in the modern periodic table. These rows are called periods. ½ + ½

Q. 2. How many vertical columns are present in modern periodic table. What are they called?

Ans. There are 18 vertical columns in the modern periodic table and these are known as groups. ½ + ½

Q. 3. State the formula to fill up the maximum number of electrons in a shell.

Ans. $2n^2$, where n is the number of shell. **1**

Q. 4. Write the total number of periods in modern periodic table. R [Board Term II, 2015]

Ans. The total number of periods in modern periodic table is seven. [CBSE Marking Scheme, 2015] **1**

AI **Q. 5. State one reason that explains the position of Hydrogen in group I ?**

Ans. Hydrogen should be placed in group I, since it has only one electron in its outermost shell. **1**

AI **Q. 6. Why noble gases are placed in a separate group in modern periodic table?**

Ans. It is because they resemble with each other but do not resemble with other group elements. **1**

Short Answer Type Questions-I — 2 marks each

Q. 1. How it can be proved that the basic structure of the Modern Periodic Table is based on the electronic configuration of atoms of different elements ?

U [Delhi, 2019]

Ans. Modern periodic table consists of groups and periods. Where number of valence electrons determines the group and number of shells determines the period.
[CBSE Marking Scheme, 2019] **1 + 1 = 2**

Q. 2. Write the name, symbol and electronic configuration of an element X whose atomic number is 11. R [Delhi 2019]

Ans. Name – Sodium ½
Symbol – Na ½
Electronic configuration – 2, 8, 1 1
[CBSE Marking Scheme, 2019] **2**

Q. 3. Can the following groups of elements be classified as Dobereiner's triad ?

(a) Na, Si, Cl

(b) Be, Mg, Ca

Atomic mass of Be-9; Na-23, Mg-24, Si-28, Cl 35, Ca-40.

Justify your answer in each case. C

Ans. **(a)** Na, Si, Cl – Average of atomic masses of Na and Cl is not equal to the atomic mass of Si. **1**
(b) Be, Mg, Ca – The average of atomic masses of Be and Ca is equal to the atomic mass of Mg.
Atomic mass of Mg =

$$\frac{\text{Atomic mass of Be} + \text{Atomic mass of Ca}}{2}$$

$$= \frac{9+40}{2} = \frac{49}{2} = 24.5$$

[CBSE Marking Scheme, 2019] **1**

Q. 4. An element 'X' has mass number 35 and 18 number of neutrons. Therefore, Electronic configuration of X= 2, 8, 7. Write atomic number and electronic configuration of 'X'. Also write group number, period number and valency of 'X'.

AE [CBSE OD, 2016]

Ans. Atomic number of X = Mass number of X – No of neutrons
35 –18 =17
Therefore, Electronic configuration of X= 2, 8, 7
Group number =17
Period no = 3
Valency = 8 – 7 = 1 **2**

Short Answer Type Questions-II — 3 marks each

Q. 1. Study the data of the following three categories A. B and C.

Category	Name of the element	Atomic mass
A	Li	7
	Na	23
	K	39
B	N	14
	P	31
	As	74
C	B	10.8
	Al	27
	Ga	69.7

[CBSE OD, 2020]

@PROCBSE JOIN NOW !

@PROCBSE

(i) From the given three categories A, B and C, pick the one which forms Dobereiner's Triads.
(ii) Why did Mendeleev placed elements of category A, B and C in three different groups ?
(iii) Is Newland law of octaves applicable to all the three categories?
Give reason to justify your answer.

Ans. (i) Category A (Li, Na, K) shows Dobereiner's triads.
(ii) Mendeleev arranged the elements in increasing order of atomic mass and grouped them as per similar chemical property. The elements in A, B and C are similar among themselves but have different chemical properties.
(iii) No, Newland law of Octaves is not applicable because in the three categories every eighth element will not show same property as first. Also, Newland Octaves law is applicable only upto calcium. **1+1+1**

Q. 2. Three elements 'X', 'Y' and 'Z' have atomic numbers 7, 8 and 9 respectively.
(a) State their positions (Group number and period number both) in the Modern Periodic Table.
(b) Arrange these elements in the decreasing order of their atomic radii.
(c) Write the formula of the compound formed when 'X' combines with 'Z'. [CBSE OD 2016/OD 2020]

Ans. (a) X (7) - 2,5 Group 15; Period 2
Y(8) - 2,6 Group 16; Period 2
Z(9) - 2,7 Group 17; Period 2 **1**
(b) X > Y > Z **1**
(c) XZ_3 **1**

AI **Q. 3. Two elements X and Y have atomic numbers 12 and 16 respectively. To which period of the modern periodic table do these two elements belong? What type of bond will be formed between them and why? Also give the chemical formula of the compound formed.** A [CBSE SQP, 2019]

Ans. Electronic configuration of X: 2, 8, 2, Y: 2, 8, 6
Both X and Y belongs to 3rd period.
Ionic bond will be formed.
Reason: X will lose 2 electrons and Y will gain 2 electrons to complete their octet and become stable.
Formula is XY.
[CBSE Marking Scheme, 2019] **1 + ½ + 1 + ½**

Q. 4. The electronic configuration of an element 'X' is 2, 8, 6. To which group and period of the modern periodic table does 'X' belong. State its valency and justify your answer in each case.
AE [CBSE SQP, 2018]

Ans. X: 2, 8, 6
(a) Since 'X' has three energy shells and period number of an element is equal to the number of energy shells. X belongs to 3rd period. **1**
(b X has 6 valence electrons it belongs to group 16. **1**
(c) Valency will be 2. To acquire noble gas configuration it will gain 2 electrons. **1**
[CBSE Marking Scheme, 2018]

COMMONLY MADE ERROR

- Usually students get confused with the group and period to which they belong to. They also get confused with the valency.

ANSWERING TIPS

- Understand the basic concepts involved in the separation of periods and groups in the modern periodic table.
- After writing the electronic configuration, check the number of energy shells which should be equal to the period number.
- Then check for how many outermost (valence) electrons are there and then write the Group to which it belongs.
- From the valence electrons we can write the valency of that element.

AI **Q.5. Write the electronic configuration of two elements P (atomic number 17) and Q (atomic number 19) and determine their group numbers and period numbers in the Modern Periodic Table.**
C [OD Comptt 31/1 2017]

Ans. Electronic Configuration of 'P' — 2, 8, 7
Group number — 17
Period number — 3^{rd}
Electronic Configuration of 'Q' — 2, 8, 8, 1
Group number — 1
Period number — 4^{th}
[CBSE Marking Scheme, 2017] **1 + 1 + 1**

Q. 6. Consider the following elements (atomic numbers are given in parenthesis)
Ca(20); K(19); F(9); Be(4) [OD Comptt 31/3 2017]
(a) Select:
(i) The elements having one electron in the outermost shell.
(ii) Two elements of the same group. Write the number of this group.
(b) Write the formula of the compound formed by the union of Ca(20) and the element X(2, 8, 7).
AE [OD Comptt 31/3 2017]

Ans. (a) (i) K (Potassium — 2, 8, 8, 1)
(ii) Be and Ca in same group because both have same number of valence electrons in their outermost shell. The number of this group is 2.
(b)

	Ca	X
Valency	2	1

Thus, the formula of the compound is Ca_1X_2 = CaX_2 **1+1+1**

Q. 7. An element P (atomic number 20) reacts with an element Q (atomic number 17) to form a compound. Answer the following questions by giving reason: Write the position of P and Q in the Modern Periodic Table and the molecular formula of the compound formed when P reacts with Q.
C [CBSE, Delhi Set, 2017]

@PROCBSE JOIN NOW

Ans.

Position of P	Group-2	Because it has 2 valence electrons/ 2, 8, 8, 2
	Period-4	Because it has 4 shells/2, 8, 8, 2
Position of Q	Group-17	Because it has 7 valence electrons/ 2, 8, 7
	Period-3	Because it has 3 shells/ 2, 8, 7
Formula	PQ_2	Because valency of P is 2 and that of Q is 1

[CBSE Marking Scheme, 2017] **3**

COMMONLY MADE ERROR

➲ Students often write vague answer. It seems they are unaware of the concept of calculating group and period of an element.

ANSWERING TIPS

➲ Follow the basic rule that the period number is equal to the number of shells in an atom and group number is equal to valence electrons for the first two groups.

Q.8. The atomic number of an element is 20.

(a) Write its electronic configuration and determine its valency.

(b) Is it a metal or a non-metal ?

(c) Write the formula of its chloride.

(d) Is it more reactive or less reactive than Mg (atomic number 12) ? Give reason for your answer.

C [Foreign Set 31/2/1 2017]

Ans. (a) $X_{(20)}$ – 2, 8, 8, 2 ½

Valence electrons- 2

Hence valency is 2 ½+½

(b) It is a metal ½

(c) XCl_2 ½

(d) It is more reactive than Mg as reactivity increases down the group. Mg- III Period and X_{20} (Ca)- IV Period. ½

Q. 9. Write the electronic configuration of two elements X and Y whose atomic numbers are 20 and 17 respectively. Write the molecular formula of the compound formed when element X reacts with element Y. Draw electron-dot structure of the product and also state the nature of the bond formed between both the elements.

[Outside Delhi 2017]

Ans. • X(20) – 2, 8, 8, 2 ½

• Y(17) – 2, 8, 7

• XY_2

• $X + 2 \cdot\ddot{Y}\cdot = X^{2+} [:\ddot{Y}:]^{2-}$ ½+½

• Ionic/eletrovalent bond. ½

[CBSE Marking Scheme, 2017]

Q. 10. An element 'M' has atomic number 12.

(i) Write its electronic configuration and valency.

(ii) Is 'M' a metal or a non-metal ? Give reason in support of your answer.

(iii) Write the formula and nature (acidic/basic) of the oxide of M. AE [Delhi 31/1/2017 Comptt.]

Ans. (i) Electronic Configuration — 2, 8, 2

Valency — 2.

(ii) Metal

There are two electrons in its outermost shell and it easily loses them to form a positive ion.

(iii) M O

2 2

$M_2O_2 = MO$

It is a basic oxide. **1+1+1**

Q. 11. An element 'X' with electronic configuration (2, 8, 2) combines separately with two radicals, $(NO_3)^-$ and $(SO_4)^{2-}$.

(i) Is 'X' a metal or a non-metal ? Write the nature of its oxide.

(ii) Write the formula of the compounds of 'X' formed by the combination of these radicals. Are these compounds covalent or electrovalent ?

U [CBSE OD Comptt. 2017]

Ans. (i) X is a metal. Nature of it is Basic.

(ii) $X(NO_3)_2$, XSO_4

These compounds are Ionic/electrovalent. **1+1+1**

AI **Q. 12. State the main aim of classifying elements. Which is more fundamental property of elements that is used in the development of Modern Periodic Table ? Name and state the law based on this fundamental property. On which side of the periodic table one can find metals, non-metals and metalloids ?**

U [Borad Term II, Foreign Set I, 2016]

OR

Write the main aim of classifying elements. Name the basic property of elements used in the development of Modern Periodic Table. State the Modern Periodic Law. On which side (part) of the Modern Periodic Table do you find metals, metalloids and non-metals ?

R [Board Term II, Delhi II, 2015]

Ans. (i) Aim of Classification: For systematic and simplified study of elements and their compounds. ½

(ii) Basic property: Atomic Number. ½

@PROCBSE

(iii) Modern periodic Law: The properties of elements are a periodic function of their atomic number. ½

(iv) Metals are found on the left side and centre of the Modern Periodic Table. ½

(v) Metalloids are found in a zig-zag manner between the metals and the non-metals. ½

(vi) Non-metals are found on the right side of the Modern Periodic Table. ½

[CBSE Marking Scheme, 2015]

Q. 13. An element 'X' belong to 3rd period and group13 of the Modern Periodic Table.

(a) Determine the valence electrons and the valency of 'X'.

(b) Molecular formula of the compound formed when 'X' reacts with an element 'Y'(atomic number = 8).

(c) Write the name and formula of the compound formed when 'X' combines with chlorine.

[CBSE OD, 2016]

Ans. (a) Group 13 means valence electrons 3 and valency 3. ½ + ½

(b) Y (8) – 2, 6 X = 2, 8, 3
Valency – 2 Valency – 3
Compound formed – X_2Y_3 /Al_2O_3 **1**

(c) X Chlorine Cl
Valency -3 valency -1
Compound formed XCl_3 /$AlCl_3$ **1**

Long Answer Type Questions — 5 marks each

Q. 1. The position of certain elements in the Modem Periodic Table are shown below:

Group → / ↓ Period	1	2	3 to 12	13	14	15	16	17	18
1	G								H
2	A			I			B		C
3		D			E				F

Using the above table answer the following questions giving reasons in each case:

(i) Which element will form only covalent compounds?

(ii) Which element is a non-metal with valency 2 ?

(iii) Which element is a metal with valency 2 ?

(iv) Out of H, C and F which has largest atomic size ?

(v) To which family does H, C and F belong ? U [CBSE SQP 2020]

Ans. (i) Element E is Silicon. It will form covalent bond only as it has four electrons in its outermost orbit and need only four more electrons to become stable.

(ii) Non-metal with valency 2 is B, which is oxygen.

(iii) Element D is a metal with valency 2. Element D is Magnesium. Due to its low electro negativity, it has a higher tendency to donate electrons.

(iv) Element F has the largest atomic size. Element F is argon. Argon occupies 3 energy shells compared to elements H and C, which occupies one and two energy shells. Due to this, the atomic radius of argon is the largest.

(v) Elements H, C and F belong to Group number 18, which means according to their electronic configuration, their octet is complete and thus these elements are stable. They have very low tendency to react with other elements. Group 18 elements belong to noble gas family. **5**

Q. 2. (a) What was the basis of Mendeleev's classification of elements ?

(b) List two achievements of Mendeleev's Periodic table.

(c) List any two observations which posed a challenge to Mendeleev's periodic law.

R [Comptt. Set I, II, III, 2018]

Ans. (a) Atomic mass **1**

(b) (i) He could classify all the 63 elements known at that time.

(ii) He left gaps for the yet to be discovered elements.

(iii) He predicted the properties of such elements. **(any two) 1 × 2**

(c) (i) Position of isotopes

(ii) Irregular increase in atomic masses in going from one element to the next, making the prediction of undiscovered elements difficult.

(iii) Position of Hydrogen. **(any two) 1 × 2**

[CBSE Marking Scheme, 2018]

@PROCBSE JOIN NOW !

@PROCBSE

COMMONLY MADE ERROR

- Students write irrelevant answers. Be specific. Read question carefully and write only what is asked.

ANSWERING TIPS

- Do not overlook any part of a question and avoid being in a hurry to conclude the answer.

Q. 3. (a) The modern periodic table has been evolved through the early attempts of Dobereiner, Newland and Mendeleev. List one advantage and one limitation of all the three attempts.

(b) Name the scientist who first of all showed that atomic number of an element is a more fundamental property than its atomic mass.

R [Delhi/Outside Delhi, 2018]

Ans. (a) (i) Dobereiner Periodic Table

Advantage: To predict the atomic mass of middle element in each triad.

Limitation: Dobereiner could identify only three triads.

(ii) Newland Periodic table

Advantage: Every eighth element had properties similar to that of first and co-related the properties of elements with their atomic mass.

Limitation: It was only applicable upto Calcium/ only 56 elements and no future element.

(iii) Mendeleev's Periodic Table

Advantage: Elements with similar properties could be grouped. He predicted the existence of new elements that had not been discovered at that time.

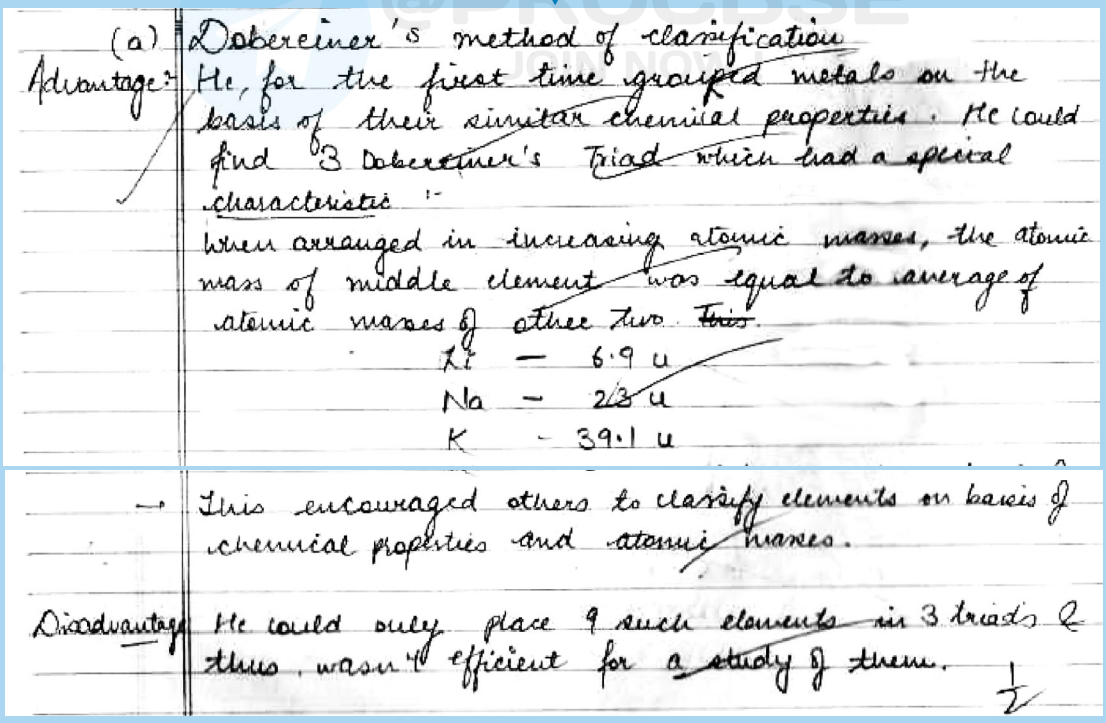
Limitation: No fixed position for hydrogen and isotopes. Atomic masses do not increase in a regular manner.

(b) Henry Moseley: Properties of elements are a periodic function of their atomic number. **3 + 1 + 1**

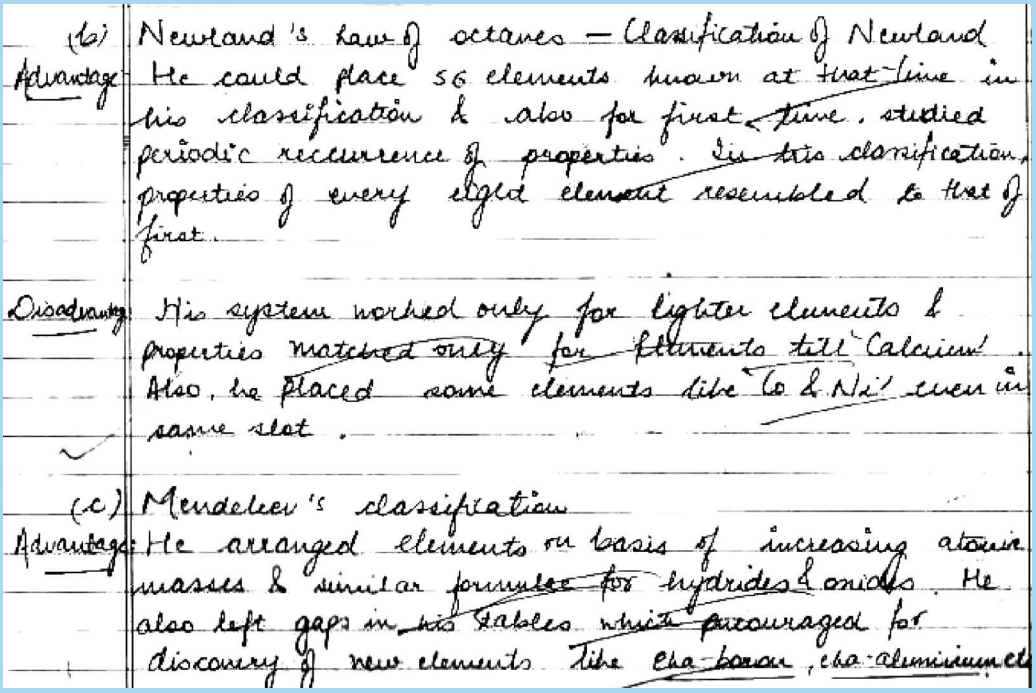
[CBSE Marking Scheme, 2018]

Topper Answer, 2018

Ans.


(a) Dobereiner's method of classification
Advantage: He, for the first time grouped metals on the basis of their similar chemical properties. He could find 3 Dobereiner's Triad which had a special characteristic :-
When arranged in increasing atomic masses, the atomic mass of middle element was equal to average of atomic masses of other two. this
Li – 6.9 u
Na – 23 u
K – 39.1 u
– This encouraged others to classify elements on basis of chemical properties and atomic masses.
Disadvantage: He could only place 9 such elements in 3 triads & thus, wasn't efficient for a study of them. ½

@PROCBSE


(b) Newland's law of octaves — Classification of Newland

Advantage: He could place 56 elements known at that time in his classification & also for first time, studied periodic recurrence of properties. In this classification, properties of every eight element resembled to that of first.

Disadvantage: His system worked only for lighter elements & properties matched only for elements till Calcium. Also, he placed some elements like Co & Ni even in same slot.

(c) Mendeleev's classification

Advantage: He arranged elements on basis of increasing atomic masses & similar formulae for hydrides & oxides. He also left gaps in his tables which encouraged for discovery of new elements like eka-boron, eka-aluminium etc

COMMONLY MADE ERROR

- Students get confused with the characteristics, merits and demerits of different periodic classifications.

ANSWERING TIPS

- Learn and understand the basic concepts of each periodic classification, the person's name who is responsible for that periodic classification and make a list of differences.

AI **Q. 4. (i) Why do we classify elements ?**

(ii) What are the two criteria used in the development of Modern Periodic Table ?

(iii) State the position of (a) metals, (b) non-metals and (c) metalloids in the periodic table.

(iv) Would you place two isotopes of chlorine; Cl–35 and Cl–37 in different slots of the periodic table because of their different atomic masses or in the same slot because their chemical properties are same ? Justify your answer. U

Ans. (i) To study the properties of elements and to keep the elements with similar properties together. **1**

(ii) Chemical properties of elements and atomic number. **1**

(iii) Metals lie on extreme left, metalloids lie in the middle and non-metals lie on the right side. **2**

(iv) They should be placed in the same slot. Since they have same numbers of electrons/atomic number and modern periodic Table is based on atomic number and not on atomic mass. **1**

TOPIC - 2

Periodic Elements and Periodic Properties

Revision Notes

Scan to know more about this topic

Modern Periodic Table

- **Position of elements in modern periodic table:**
  - **(i)** The Modern Periodic Table consists of 18 groups and 7 periods.
  - **(ii)** Elements present in any one group have the same number of valence electrons. Also, the number of shells increases as we go down the group.

@PROCBSE

(iii) Elements present in any one period, contain the same number of shells. Also, with increase in atomic number by one unit on moving from left to right, the valence shell electron increases by one unit.

(iv) Each period marks a new electronic shell getting filled.

- **Trends in the Modern Periodic Table:**

(i) **Periodicity in Properties:** The properties of elements depend upon the electronic configuration which changes along a period and down a group in the periodic table. The periodicity properties i.e. repetition of properties after a regular interval is due to similarity in electronic configuration.

(ii) **Tendency to lose or gain electron:** Chemical reactivity of an element depends upon the ability of its atoms to donate or accept electrons.

(iii) **Variations of tendency to lose electron down the group:** Tendency to lose electron goes on increasing down the group.

Reason: It is due to the increase in the distance between the valence electrons and the nucleus as the atomic size increases down the group, the force of attraction between the nucleus and the valence electrons decreases, therefore, tendency to lose electron also increases down the group.

(iv) **Variation of tendency to lose electron along a period:** It goes on decreasing generally along a period from left to right with decrease in atomic size.

Reason: Due to decrease in the atomic size, the force of attraction between the valence electrons and the nucleus increases and therefore, electrons cannot be removed easily.

(v) **Variation of tendency to gain electron down the group:** It goes on decreasing down the group in general.

Reason: Due to increase in atomic size, the force of attraction between the nucleus and the electron to be added becomes less.

(vi) **Variation of tendency to gain electron along a period:** It increases left to right in a period.

Reason: It is due to decrease in the atomic size which leads to an increase in the force of attraction between the nucleus and the electron to be added.

- **Metallic and non-metallic character:** Group 1 to 12 are metals. Group 13 to 18 comprises non-metals, metalloids and metals.
- **Properties of Metals:**

(i) They are malleable.

(ii) They are ductile.

(iii) They are good conductors of heat and electricity.

(iv) They have generally 1 to 3 valence electrons.

(v) They have the same or less number of electrons in their outermost shell than the number of shells.

(vi) They are mostly solids.

- **Properties of Non-metals:**

(i) They exist in solid, liquid or gaseous state.

(ii) Non-metals are generally brittle.

(iii) They are non-conductors.

(iv) They have 4 to 8 valence electrons.

- **Atomic radii increases down the group.**

Atomic number	Elements	Symbols	Electronic configuration	Valence electrons	Valency
1	Hydrogen	H	(1)	1	1
2	Helium	He	(2)	2	0
3	Lithium	Li	(2, 1)	1	1
4	Beryllium	Be	(2, 2)	2	2
5	Boron	B	(2, 3)	3	3
6	Carbon	C	(2, 4)	4	4
7	Nitrogen	N	(2, 5)	5	3
8	Oxygen	O	(2, 6)	6	2
9	Fluorine	F	(2, 7)	7	1

@PROCBSE JOIN NOW !

@PROCBSE

10	Neon	Ne	(2, 8)	8	0
11	Sodium	Na	(2, 8, 1)	1	1
12	Magnesium	Mg	(2, 8, 2)	2	2
13	Aluminium	Al	(2, 8, 3)	3	3
14	Silicon	Si	(2, 8, 4)	4	4
15	Phosphorus	P	(2, 8, 5)	5	3
16	Sulphur	S	(2, 8, 6)	6	2
17	Chlorine	Cl	(2, 8, 7)	7	1
18	Argon	Ar	(2, 8, 8)	8	0
19	Potassium	K	(2, 8, 8, 1)	1	1
20	Calcium	Ca	(2, 8, 8, 2)	2	2

Mnemonics

Concept: Trends in Atomic Radii:	Concept: gradation in properties
Mnemonics: Display Pic (DP)	**Mnemonics: Dear God IskoPoocho: EA IP EN**
Interpretation: Decreases across a period	**Interpretation:** **D**ecrease in groups **I**ncrease in periods In case of: **E**lectron **A**ffinity, **I**onization **P**otential And **E**lectro **N**egativity

@PROCBSE JOIN NOW !

How is it done on the GREENBOARD?

AI Q.What is meant by 'group' in the modern periodic table ? How do the following change on moving from top to bottom in a group?

(i) Number of valence electrons

(ii) Number of occupied shells

(iii) Size of atoms

(iv) Metallic character of element

(v)Effective nuclear charge experienced by valence electrons.

Solution:

Step I: Vertical columns of the periodic table are known as groups.

Step II : (i) The number of valence electrons remains constant when we move down the group.

Step III: (ii) The number of occupied shells increases down the group.

Step IV: (iii) The size of atom increases down the group.

Step V: (iv) The metallic character of elements increases down the group.

Step VI: (v) The effective nuclear charge decreases down the group. $\frac{1}{2}$x6=3

@PROCBSE

Objective Type Questions — 1 mark each

A Multiple Choice Questions

Q. 1. An element 'X' is forming an acidic oxide. Its position in modern periodic table will be:
(a) Group 1 and Period 3
(b) Group 2 and Period 3
(c) Group 13 and Period 3
(d) Group 16 and Period 3

Ans. Correct option : (d)
Explanation: Group 16 and Period 3. Non- metals form acidic oxides.

Q. 2. Where would you locate the element with electronic configuration 2, 8 in the Modern Periodic Table?
(a) Group 8 **(b) Group 2**
(c) Group 18 **(d) Group 10**
[NCERT Exemp.]

Ans. Correct option : (c)
Explanation: Element with electronic configuration 2, 8 has octet configuration, so must be placed in group 18.

Q. 3. Which of the following is the outermost shell for elements of period 2?
(a) K shell **(b) L shell**
(c) M shell **(d) N shell**
[NCERT Exemp.]

Ans. Correct option : (b)
Explanation: The elements of 2nd period contain two shells, K and L shell.

Q. 4. Arrange the following elements in the order of their decreasing metallic character: Na, Si, Cl, Mg, Al.
(a) Cl > Si >Al > Mg >Na
(b) Na >Mg >Al >Si > Cl
(c) Na > Al > Mg > Cl > Si
(d) Al > Na> Si > Ca> Mg [NCERT Exemp.]

Ans. Correct option : (b)
Explanation: As we move from left to right in periodic table, metallic characters a decreases and non-metallic characters a increases.

Q. 5. Which of the following elements will form an acidic oxide?
(a) An element with atomic number 7
(b) An element with atomic number 3
(c) An element with atomic number 12
(d) An element with atomic number 19
[NCERT Exemp.]

Ans. Correct option : (a)
Explanation: Formation of acidic oxides is a characteristic of non-metals. Here, element with atomic number 7 is a non-metal that is nitrogen. Rest three elements are metals and hence it forms basic oxide.

Q. 6. Which of the following set of elements is written in order of their increasing metallic character?
(a) Be, Mg, Ca **(b) Na, Li, K**
(c) Mg, Al, Si **(d) C, O, N**
[NCERT Exemp.]

Ans. Correct option : (a)
Explanation: As we move down in a group, metallic nature increases. Be, Mg and Ca belong to same group that is group 2 of Modern Periodic table.

B Assertions and Reasons Type Questions

Directions: In the following questions, a statement of assertion (A) is followed by a statement of reason (R). Mark the correct choice as:
(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).
(b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).
(c) Assertion (A) is true but reason (R) is false.
(d) Assertion (A) is false but reason (R) is true.

Q. 1. Assertion (A): Sixth and seventh periods in the periodic table contains 14 elements.
Reason (R): In the periodic table, 14 elements of sixth and seventh periods are known as lanthanoids and actinoids.

Ans. Correct option : (d)
Explanation: Sixth period contains 32 elements and seventh period is incomplete and like sixth, the period would have 32 elements.

Q. 2. Assertion (A): Be and Al show some similar properties.
Reason (R): The metallic radius of Be is less than the metallic radius of Al.

Ans. Correct option : (b)
Explanation: Be and Al show diagonal relationship because Be resembles in its properties with Al. Metallic radius of the Be (111 pm) is less than the metallic radius of Al (143 pm). Although smaller size is the reason for the anomalous behaviour of Be but not a reason for its diagonal relation with Al.

Q. 3. Assertion (A): The atomic and ionic radii generally decrease towards right in a period.
Reason (R): The ionisation enthalpy increases on moving towards left in a period.

Ans. Correct option : (c)
Explanation: The ionisation enthalpy increases on moving towards the extreme right element in period and atomic and ionic radii decreases in a period from left to right.

Q. 4. Assertion (A): Smaller the size of an atom, greater is the electronegativity.

@PROCBSE JOIN NOW

Reason (R): Electronegativity refers to the tendency of atom to share electrons with other atom.

Ans. Correct option : (c)

Explanation: Electronegativity refers to the tendency of an atom to attract bonding electrons.

Q. 5. Assertion (A): Noble gases are highly reactive.

Reason (R): Noble gases have stable closed shell electronic configuration.

Ans. Correct option : (d)

Explanation: Inert gases (noble gases) are very less reactive due to stable closed shell electronic configuration like ns^2, np^6 or ns^2.

C Very Short Answer Type Questions

AI **Q. 1. How does valency of an element vary across a period?** R [CBSE SQP, 2020]

Ans. The valency of an element first increases and then decreases across a period.

[CBSE Marking Scheme, 2020] **1**

Q. 2. Define electropositivity. R [OD 2020]

Ans. Electropositivity is the tendency of an element to lose electrons and form positive ions in a chemical reactions. **1**

Q. 3. The atomic radii of first group elements are given below: [OD 2020]

Group I element	Atomic radii (pm)
Na	86
K	231
Rb	244
Cs	282

State the reason behind the observed trend in the above elements. U

Ans. In a group, as we move from top to bottom, the number of shells increases. Hence, the atomic radius increases.

Q. 4. State one reason for placing Mg and Ca in the same group of the periodic table.

U [Board Term II, 2015]

Ans. Due to the presence of 2 electrons in the valence shell and similar chemical properties.

[CBSE Marking Scheme, 2015] **1**

Q. 5. How many elements are in 2nd and 5th period of Modern Periodic table.

Ans. 2^{nd} period has 8 elements, 5^{th} period has 18 elements. ½ + ½

Q. 6. Name any two elements that have two electrons in their valence shell. U

Ans. (i) Magnesium: 2, 8, 2 ½

(ii) Calcium : 2, 8, 8, 2. ½

Q. 7. If the atomic number of three element X, Y and Z are 3, 11 and 17 respectively. Which two elements will show similar chemical properties. Justify.

Ans. X and Y will show similar chemical properties as these have same valence electrons.

X = 2, (1)

Y = 2, 8, (1) ½ + ½

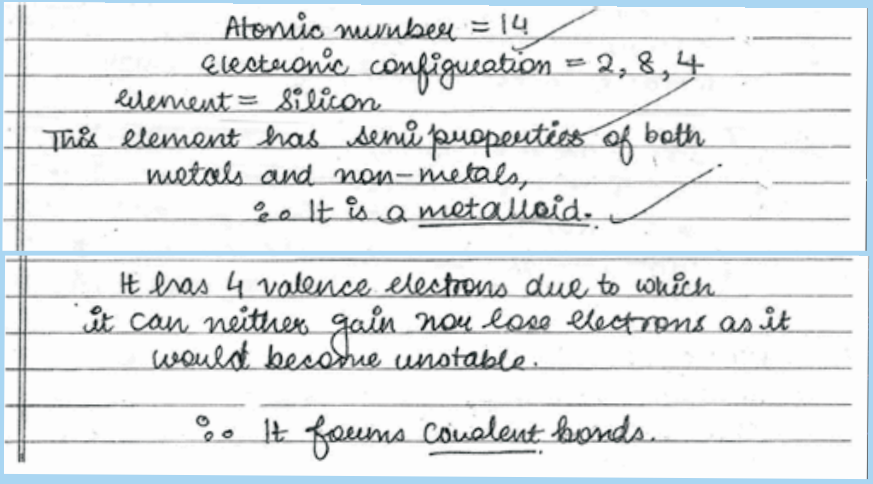
@PROCBSE JOIN NOW !

Short Answer Type Questions-I — 2 marks each

Q. 1. The atomic number of an element is 14. Examine if this element will have metallic properties or not. Give reason to justify your answer. C [CBSE 2019]

Topper Answer, 2019

Ans.



@PROCBSE

Q. 2. The electronic configuration of an element is 2, 8, 4. State its: (a) group and period in the Modern Periodic Table. (b) name and write its one physical property. AE [Delhi 2019]

Ans.(a) Group – 14, Period – 3 ½ + ½

(b) Silicon ½ Non – metallic / poor conductor of electricity ½ (or any other property)

[CBSE Marking Scheme, 2019] **2**

Q. 3. The electronic configuration of an element 'X' is 2, 8, 6. To which group and period of the modern periodic table does 'X' belong. State its valency. C

Ans. X: 2, 8, 6

(a) Since 'X' has three energy shells and period number of an element is equal to the number of energy shells. X belongs to 3rd period.

(b) X has 6 valence electrons it belongs to group 16.

(c) Valency will be 2. To acquire noble gas configuration it will gain 2 electrons.

Q. 4. Define the following terms ? (i) Valency, (ii) Atomic size. R

Ans. (i) Valency: The combining power or the combining capacity of an atom is called its valency.

(ii) Atomic size: Atomic size or atomic radius is the distance between the centre of the nucleus and the outermost shell of an isolated atom.

Short Answer Type Questions-II — 3 marks each

Q. 1. The following table shows the position of five elements A, B, C, D and E in the modern periodic table.

Group → / ↓ Period	1	2	3 to 12	13	14	15	16	17	18
2	A							B	C
3		D				E			

Answer the following giving reasons:

(i) Which element is a metal with valency two? **(ii) Which element is least reactive?**

(iii) Out of D and E which element has a smaller atomic radius?

Ans. (i) D, As it is on the left side of the table in group 2. **(ii)** C, as it is in the group 18/ Noble gas.

(iii) E, as we move from left to right across a period, atomic radius decreases.

Q. 2. Define atomic size. Give its unit of measurement. In the modern periodic table what trend is observed in the atomic radius in a group and a period and why is it so? [SQP-2020 Delhi]

Ans. Atomic Size: The distance from centre of nucleus to outermost shell of an atom is atomic radius.

Atomic size is measured in Angstroms,

where 1 Angstroms = 10^{-10} metres.

Along the period from left to right atomic radius decreases.

Reason: Nuclear charge increases which tends to pull the electrons closer to the nucleus.

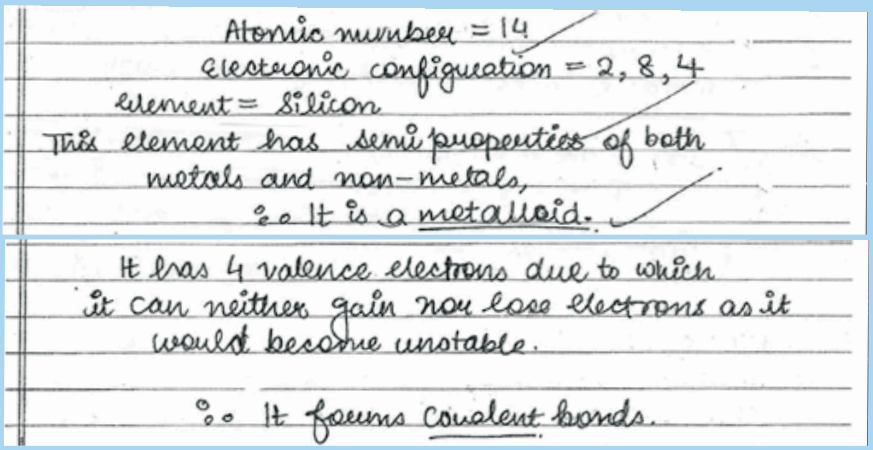
Down the group: Atomic radius increases

Reason: Number of shells increases on going down the group.

Q. 3. The atomic number of an element is 14. Examine if this element will have metallic properties or not. Give reason to justify your answer. [CBSE 2019 toppers answer]

Topper Answer, 2019

Ans.



@PROCBSE

Q. 4. Define groups in the Modern Periodic Table. How do valency, atomic size and metallic character vary in a group ? [2019]

Topper Answer, 2019

Ans.

9. (1) The vertical columns present in the modern periodic table having elements with similar valencies and chemical properties are called Groups.

(2) For eg. Alkali metals Group 1

H – Hydrogen
Li Lithium
Na Sodium
K Potassium
Rb Rubidium
Cs Cesium
Fr Francium

(3) Valency

As we move down a group, valency remains same. eg. all alkali metals are monovalent.

(4) Atomic size

Atomic size is the distance from the centre of nucleus to the last shell.

As we move down a group, the atomic size increases as number of shells increase.

eg. H → 1
Li → 2, 1
Na → 2, 8, 1 etc.

(5) Metallic Character

As we go down a group, the chemical reactivity of metals increases as it is easier for a bigger atom to lose electrons due to weaker electrostatic forces. eg. Francium is more metallic than Lithium.

But in non-metals, it decreases as it is easier for a smaller atom on top to gain electrons due to strong electrostatic forces than a bigger atom. eg. Flourine is more non-metallic than Astanine.

@PROCBSE

Q. 4. How does the atomic radius of the elements change on going
(i) from left to right in a period, and
(ii) down a group
in the Modern Periodic Table ? Give reason in support of your answer.
A [Delhi Comptt. 31/1/1 2017]

Ans. (i) Atomic radius decreases. ½
Reason: Nuclear charge increases which tends to pull the electrons closer to the nucleus. **1**
(ii) Atomic radius increases. ½
Reason: Number of shells increases on going down the group. **1**
[CBSE Marking Scheme, 2017]

Q. 5. Write the names given to the vertical columns and horizontal rows in the Modern Periodic Table. How does the metallic character of elements vary on moving down a vertical column ? How does the size of atomic radius vary on moving left to right in a horizontal row ? Give reason in support of your answer in the above two cases.
R [Delhi 31/1/1 2017]

Ans. Vertical Column — Groups ½
Horizontal Rows — Periods ½
(i) Metallic character increases.
Reason: Ability to lose electrons increases on moving down the group due to increase in distance between the nucleus and the valence electrons/
Ans. decrease in the attraction between the nucleus and the valence electrons. **1**
(ii) Atomic radius decreases.
Reason: The nuclear charge increases on moving from left to right across a period resulting in increase in the attraction between the nucleus and the valence electrons. **1**
[CBSE Marking Scheme, 2017]

Detailed Answer:

In the modern periodic table, there are 18 vertical columns known as Groups and 7 horizontal rows known as Periods.

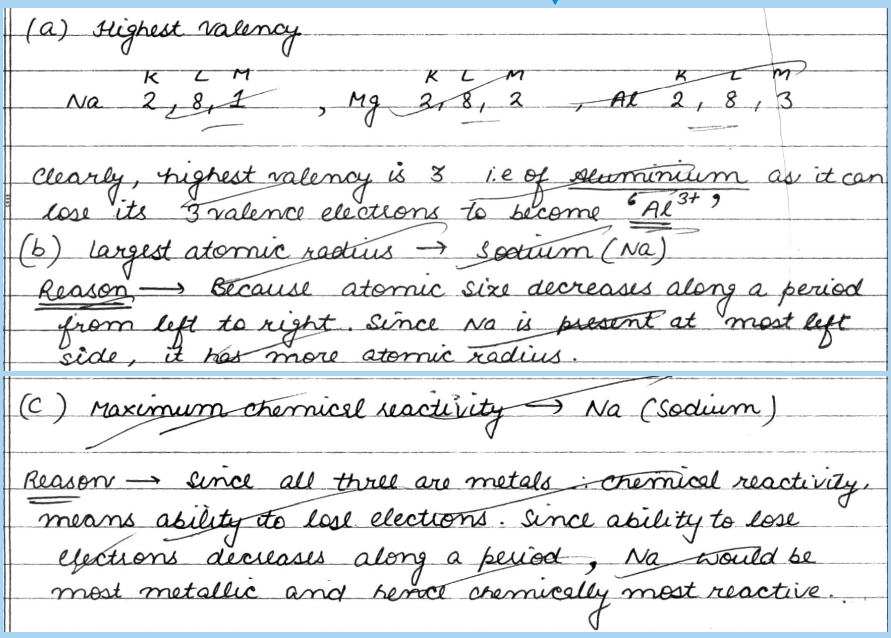
Metallic character increases on moving down a group in the Modern Periodic table. As we move down the group, the electrostatic attraction between the nucleus and the outermost electron decreases due to increase in the distance between them. This happens because; on moving down the group a new shell is added. So, the valence electron can be easily lost by the element, thereby metallic character increases on moving down a group.

The size of atomic radius decreases on moving left to right in a horizontal row. When, we move across a period, the number of electrons in the same shell increases. This leads to greater electrostatic attraction between the nucleus and the outermost electron. This increased attraction pulls the outermost electron closer to the nucleus, thereby decreasing the atomic size.

@PROCBSE JOIN NOW !

Q. 6. Na, Mg and Al are the elements of the 3rd period of the Modern Periodic Table having group number 1, 2 and 13 respectively. Which one of these elements has the (a) highest valency, (b) largest atomic radius, and (c) maximum chemical reactivity ? Justify your answer stating the reason for each. U [SA-II, OD. Set-I, 2017]

Topper Answer, 2017


(a) Highest valency

K L M
Na 2, 8, 1 , Mg 2, 8, 2 , Al 2, 8, 3

Clearly, highest valency is 3 i.e of Aluminium as it can lose its 3 valence electrons to become Al^{3+}

(b) largest atomic radius → Sodium (Na)

Reason → Because atomic size decreases along a period from left to right. Since Na is present at most left side, it has more atomic radius.

(c) Maximum chemical reactivity → Na (Sodium)

Reason → Since all three are metals ; chemical reactivity means ability to lose electrons. Since ability to lose electrons decreases along a period, Na would be most metallic and hence chemically most reactive.

@PROCBSE

Q. 7. What is periodicity in properties of elements with reference to the Modern Periodic Table? Why do all the elements of the same group have similar properties? How does the tendency of elements to gain electrons change as we move from left to right in a period? State the reason of this change.
[CBSE OD 2017]

Ans. • Repetition of similar properties of elements after regular intervals. 1
• Because of the same number of valence electrons.
• It increases due to increase in effective nuclear charge which pulls the electrons towards it.
[CBSE Marking Scheme, 2017]

Q. 8. Write the number of periods and groups in the Modern Periodic Table. How does the metallic character of elements vary on moving (i) from left to right in a period, and (ii) down a group ? Give reason to justify your answer.
[CBSE OD 2017]

Ans. • Periods – 7, Groups – 18
• Metallic character decreases along the period because effective nuclear charge increases on the valence electrons hence decrease in tendency to lose electrons.
• Metallic character increases down a group because effective nuclear charge experienced by valence electrons decrease, hence tendency to lose electron decreases. **[CBSE Marking Scheme, 2017]**

Topper Answer, 2017

Ans.

9. Modern Periodic Table has 7 periods and 18 groups.

(i) Metallic character decreases on moving from left to right in a period.

Reason : Along the period, from left to right, the effective nuclear charge increases due to increase in no. of protons due to which forces of attraction between nucleus & valence electrons increases and ability to lose electrons (i.e metallic character) decreases.

(ii) Metallic character increases down a group.

Reason : Because atomic size increases down a group, the force of attraction between nucleus & valence electron decrease & electrons losing tendency increases. Therefore metallic character increases.

Q. 9. How does the tendency of the elements to lose electrons change in the Modern Periodic Table in (i) a group, (ii) a period and why ?
U **[Board Term II, Foreign Set III, 2016]**

Ans. (i) Increases down a group. ½
Reason: At each succeeding element down a group, the number of shells increases, so the distance of the valence shell from the nucleus increases, the effective nuclear force of attraction decreases on the last shell, so it becomes easy for the atom to lose electrons. **1**
(ii) Decreases in a period from left to right. ½
Reason: As the effective nuclear charge on the valence electron increases, the attraction between the valence electron and nucleus increases, so it becomes difficult to lose electrons.
[CBSE Marking Scheme, 2016] **1**

Q. 10. (i) Name the element with atomic number 17.
(ii) To which period does it belong ?
(iii) To which group does it belong ?
(iv) Write its electronic configuration.
U **[Board Term II, Delhi, 2016]**

Ans. (i) Chlorine ½
(ii) 3rd period **1**

@PROCBSE

(iii) 17^{th} group **1**
(iv) 2, 8, 7. [CBSE Marking Scheme, 2016] ½

Q. 11. Two elements 'A' and 'B' belong to the 3rd period of Modern periodic table and are in group 2 and 13 respectively. Compare their following characteristics in tabular form:
(i) Number of electrons in their atoms
(ii) Size of their atoms
(iii) Their tendencies to lose electrons
(iv) The formula of their oxides
(v) Their metallic character
(vi) The formula of their chlorides.

C [Board Term II, Delhi Set III, 2016]

Ans.

Sr. No.	Characteristics	A	B
(i)	Number of electrons in their atoms	12	13
(ii)	Size of their atoms	Bigger	Smaller
(iii)	Their tendencies to lose electrons	More	Less
(iv)	The formula of their oxides	AO	B_2O_3
(v)	Their metallic character	More metallic	Less metallic
(vi)	The formula of their chlorides	ACl_2	BCl_3

[CBSE Marking Scheme, 2016] 6 × ½ = 3

Q. 12. Name any two elements of group one and write their electronic configurations. What similarity do you observe in their electronic configurations ? Write the formula of oxide for any of the above said element. R [Board Term II, Delhi Set II, 2016]

Ans. (i) Two elements of group 1 are Na, K / Sodium, potassium. **2×½**
Electronic configurations Na = 2,8,1; K = 2,8,8,1 **2×½**
(ii) Similarity: Both have one valence electron / One electron in outermost shell. ½
(iii) Oxide – Na_2O / K_2O. ½
[CBSE Marking Scheme, 2016]

Q. 13. An element 'X' has mass number 35 and number of neutrons 18. Write atomic number and electronic configuration of 'X'. Also write group number, period number and valency of 'X'.

U [Board Term II, O.D. Set I, 2016]

Ans. Atomic number of X = Mass number of X – No. of neutrons ½
= 35 – 18 = 17 ½
Therefore, Electronic configuration of
X = 2, 8, 7 ½
Group number = 17 ½
Period = 3
Valency = 8 – 7 = 1 ½ + ½
[CBSE Marking Scheme, 2016]

Q. 14. The position of eight elements in the modern periodic table is given below where atomic numbers of elements are given in the parenthesis.

Period No.	Elements	
2	Li(3)	Be(4)
3	Na(11)	Mg(12)
4	K(19)	Ca(20)
5	Rb(37)	Sr(38)

(i) State configuration of Ca.
(ii) Predict the number of valence electrons in Rb.
(iii) What is the number of shells in Sr ?
(iv) Predict whether K is a metal or a non-metal.
(v) Which one of these elements has the largest atom in size ?
(vi) Arrange Be, Ca, Mg and Rb in the increasing order of the size of their respective atoms.

A [Board Term II, O.D. Set III, 2016]

Ans. (i) Ca = 2, 8, 8, 2 ½
(ii) Valence electrons in Rb = 1 ½
(iii) Five ½
(iv) Metal ½
(v) Rb is biggest in size ½
(vi) Be < Mg < Ca < Rb. ½
[CBSE Marking Scheme, 2016]

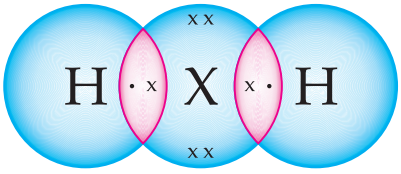
Q. 15. Four elements A, B, C and D have atomic numbers 12, 13, 14 and 15 respectively.
Answer the following questions giving reasons:
(i) What is the number of valence electrons and valency of D ?
(ii) Which of them will have largest atomic radii ?
(iii) Which of these elements will form the most basic oxide ? AE [Board Term II, SQP, 2016]

Ans. (i) Valence electrons in 'D' = 5 and Valency of 'D' = 3. **1**
(ii) 'A' will have largest atomic radii because atomic radius decreases across a period from left to right. **1**
(iii) 'A' will form the most basic oxide as it is most metallic. [CBSE Marking Scheme, 2016] **1**

Q. 16. An element 'X' belongs to 3rd period and group 16 of the Modern Periodic Table.
(a) Determine the number of valence electrons and the valency of 'X'.
(b) Molecular formula of the compound when 'X' reacts with hydrogen and write its electron dot structure.
(c) Name the element 'X' and state whether it is metallic or non-metallic. [CBSE OD 2016]

Ans. (a) Electronic Configuration of X -2,8,6
Valence electrons -6
Valency = 8 - 6 = 2
(b) Formula with hydrogen- H_2X or H_2S

@PROCBSE JOIN NOW



(c) Sulphur; Non-metal

Q. 17. An element 'M' with electronic configuration (2, 8, 2) combines separately with $(NO_3)^-$, $(SO_4)^{2-}$ and $(PO_4)^{3-}$ radicals. Write the formula of the three compounds so formed. To which group and period of the Modern Periodic Table does the elements 'M' belong ? Will 'M' form covalent or ionic compounds? Give reason to justify your answer.

[CBSE Delhi 2016]

Ans. The electronic configuration (2, 8, 2) of the element 'M' suggests that it belongs to group 2 and period 3 of the Modern Periodic Table and its valency is 2.
The chemical formula of the compounds are:
$M(NO_3)_2$ /$Mg(NO_3)_2$: MSO_4 / $MgSO_4$: $M_3(PO_4)_2$
'M' will form ionic compounds by losing two electrons

Q. 18. In the following table, the positions of six elements A, B, C, D, E and F are given as they are in the Modern Periodic Table:

Group→ Period↓	1	2	3–12	13	14	15	16	17	18
2	A			B		C			D
3					E				F

On the basis of the above table, answer the following questions:

(i) Name the element which forms only covalent compounds.

(ii) Name the element which is a metal with valency three.

(iii) Name the element which is a non-metal with valency three.

(iv) Out of B and C, whose atomic radius is bigger and why ?

(v) Write the common name for the family to which the elements D and F belong.

AE [Board Term II, Delhi Set III, 2015]

Ans. (i) E ½

(ii) B ½

(iii) C ½

(iv) B, because atomic radius decreases from left to right due to increase in the nuclear charge. **1**

(v) Noble gases. ½

AI **Q. 19. The elements $_4Be$, $_{12}Mg$ and $_{20}Ca$ each having two valence electrons in their valence shells are in periods 2, 3 and 4 respectively of the modern periodic table. Answer the following questions associated with these elements, giving reason in each case,**

(i) In which group should they be?

(ii) Which one of them is least reactive ?

(iii) Which one of them has the largest atomic size ?

U [Board Term II, O.D. Set-I, 2015]

Ans. (i) They all belong to group 2 because all three have 2 electrons in their outermost shell.

(ii) Be is least reactive because it has 2 shells and due to more nuclear change it is not easy to take electrons from it.

(iii) Ca is the element having largest atomic radius because it has 4 shells. **1+1+1**

[CBSE Marking Scheme, 2015]

COMMONLY MADE ERROR

- Usually students get confused with element arranged in groups and periods in the periodic table and their periodic properties.

ANSWERING TIPS

- Basically students should understand the basic concept of how the elements are arranged in the periodic table, across the period and down the group, their electronic configurations, stability, reactivity, family and other properties. Then they should recollect the element in the modern periodic table and answer the questions.

Long Answer Type Questions — 5 marks each

AI **Q. 1. (a) List any three observations which posed a challenge to Mendeleev's Periodic Law.**

(b) How does the metallic character of elements vary on moving from

(i) left to right in a period,

(ii) From top to bottom in a period of the Modern Periodic Table ? Given reason for your answer.

R [Board Outside Delhi, Set- I, 2019]

Ans. (a) (i) No fixed position of H in the periodic table. **1**

(ii) Position of isotopes not clear. **1**

(iii) Atomic mass does not increase in a regular manner. (or any other) **1**

(b) (i) Left to right metallic character decreases ½

@PROCBSE

Reason: Effective nuclear charge increases / tendency to loose electrons decrease / electropositivity decreases **(any one reason)** ½

(ii) Top to bottom metallic character increases ½

Reason: Size of atom increase/tendency to loose electron increases(any one reason) ½

[CBSE Marking Scheme, 2019]

AI **Q. 2. The electrons in the atoms of four elements A, B, C and D are distributed in three shells having 1, 3, 5 and 7 electrons respectively in their outermost shells. Write the group numbers in which these elements are placed in the Modern Periodic Table. configuration of the atoms of B and D and the molecular formula of the compound formed when B and D combine.**

A **[Board Outside Delhi, Set-I, 2019]**

Ans.

	A	B	C	D
	1	3	5	7
• Group no.	1^{st}	13^{th}	15^{th}	17^{th}

½ × 4

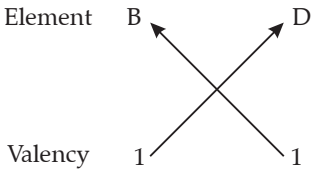
- B = 2, 8, 3 D = 2 , 8 , 7 **1 + 1**
- BD_3 **[CBSE Marking Scheme, 2019] 1**

Detailed Answer:

Elements	Valence electrons	Period	Group
A	1	3	1
B	3	3	3
C	5	3	5
D	7	3	7

Electronic configuration of B: 2, 8, 3

Electronic configuration of D: 2, 8, 7



So, the molecular formula will be BD_3. **5**

Q. 3. Explain giving justification the trends in the following properties of elements, on moving from left to right in a period, in the Modern periodic Table:

(a) Variation of valency.

(b) Change of atomic radius.

(c) Metallic to non-metallic character.

(d) Electronegative character.

(e) Nature of oxides.

R + U **[Comptt. Set I, II, III, 2018]**

Ans. (a) Valency first increases, then decreases

(b) Decreases

(c) Increase

(d) Increases

(e) Change from basic to acidic

[CBSE Marking Scheme, 2018] 5

Detailed Answer:

(a) Valency is the combining capacity of an element. Valence electrons are the number of electrons in the outermost shell. Valency and valence electrons are same till the number of outermost electrons is 4, but when it goes beyond 4, then the outermost electrons are subtracted from 8 and valency is determined. Thus valency first increases along the period and then decreases.

(b) Along the period, from left to right effective nuclear charge increases as the number of protons increase, due to which force of attraction between nucleus and the valence electron increases therefore, atomic radius decreases.

(c) Along the period, from left to right effective nuclear charge increases as the number of protons increases, due to which force of attraction between nucleus and the valence electron increases thus, it becomes difficult to lose electron across the period and metallic to non-metallic character increases.

(d) Along the period, from left to right effective nuclear charge increases as the number of protons increases, due to which force of attraction between nucleus and the valence electron increases. Hence the electron from the outermost orbit is difficult to remove, atomic size decreases therefore electronegativity increases.

(e) Along the period, from left to right effective nuclear charge increases as the number of protons increases, due to which force of attraction between nucleus and the valence electron increases, hence the electron from the outermost orbit is difficult to remove. Therefore,across the period the metallic to non-metallic character increases. So nature of oxide formation across the period changes from basic to acidic.

COMMONLY MADE ERROR

- Usually students get confused with variation in periodic properties across the period and down the group.

ANSWERING TIPS

- Students should understand the basic concept of how the elements are arranged in the periodic table, across the period and down the group, their electronic configurations etc. Then they should learn the variation of periodic properties and how it varies.

@PROCBSE

Visual Case-based Questions — 4 marks each

Q. 1. Read the passage and answer any four questions from (a) to (e).

Mendeleev was a Russian chemist, who contributed the most for the development of periodic table of elements wherein the elements were arranged on the basis of their fundamental property, the atomic mass and also on the similarity of chemical properties. Only 63 elements were known at his time. He arranged the 63 elements in the increasing order of their atomic masses and found that there was a periodic recurrence of elements with similar physical and chemical properties. He observed that elements with similar properties fall in the same vertical column. These vertical columns are called groups and horizontal rows of elements are called periods. Mendeleev predicted the existence of certain elements not known at that time and named two of them as Eka-silicon and Eka-aluminium.

(a) Mendeleev arranged the periodic table on the basis of their fundamental property:
- **(i) Atomic mass**
- **(ii) Atomic number**
- **(iii) Number of neutrons**
- **(iv) Valence electrons**

(b) Eka aluminium and eka silicon were later replaced respectively as :
- **(i) Germanium and gallium**
- **(ii) Gallium and scandium**
- **(iii) Gallium and germanium**
- **(iv) Germanium and scandium**

(c) The elements eka aluminium and eka silicon discovered by Mendeleev later found place in periodic table. Both of these elements belong to :
- **(i) Period 2** **(ii) Group 13**
- **(iii) Group 14** **(iv) Period 4**

(d) Mendeleev's periodic table has :
- **(i) 8 groups and 7 periods**
- **(ii) 7 groups and 8 periods**
- **(iii) 7 groups and 7 periods**
- **(iv) 8 groups and 8 periods**

(e) How do we classify these newly discovered elements (eka-aluminium and eka-silicon)?
- **(i) Metals** **(ii) Non metals**
- **(iii) Metalloids** **(iv) Inert gases**

Ans. (a) (i) atomic mass
(b) (iii) Gallium and germanium
(c) (iv) Period 4
(d) (i) 8 groups and 7 periods
(e) (iii) metalloids **1+1+1+1**

Q. 2. Using the given part of the periodic table, answer any four questions from (a) to (e).

Group → Period ↓	1	2	13	14	15	16	17	18
3	X		B	C	D	E		
4	Y							
5	Z							

(a) Which of these elements have smallest atomic size?
- **(i) B** **(ii) C**
- **(iii) D** **(iv) E**

(b) Write valency of element E.
- **(i) 1** **(ii) 3**
- **(iii) 2** **(iv) 0**

(c) Identify the elements which have similar chemical properties as the element X.
- **(i) Y and Z.** **(ii) Y and B**
- **(iii) All Y, Z and B** **(iv) None of the above**

(d) The number of period that the modern periodic table has
- **(i) Seven** **(ii) Eight**
- **(iii) Seventeen** **(iv) Eighteen**

(e) Which of them will have largest atomic radii:
- **(i) E** **(ii) X**
- **(iii) C** **(iv) D**

Ans. (a) (iv) Element: E
(b) (iii) 2
(c) (i) Y and Z
(d) (ii) Seven
(e) (ii) Atomic radii decrease across a period , so A will have largest atomic radius. **1+1+1+1**

Q. 3. Read the passage and answer any four questions from (a) to (e).

Atoms of eight elements A, B, C, D, E, F, G and H have the same number of electronic shells but are different in their outermost shells. It was found that elements A and G combine to form an ionic compound which can also be extracted from sea water. Oxides of the elements A and B are basic in nature while those of E and F are acidic. The oxide of elements D is almost neutral.

(a) Which of the following is likely to be halogen?
- **(i) D** **(ii) G**
- **(iii) H** **(iv) A**

(b) Which one of the following elements is likely to be a noble gas?
- **(i) A** **(ii) H**
- **(iii) D** **(iv) F**

(c) Which two elements amongst these are likely to be the non–metals ?
- **(i) A and G** **(ii) D and F**
- **(iii) E and F** **(iv) A and B**

(d) Which one of the following will have largest atomic radii?
- **(i) A** **(ii) H**
- **(iii) G** **(iv) B**

@PROCBSE JOIN NOW !

@PROCBSE

(e) To which period the listed elements belong?

(i) 2nd **(ii) 7th**

(iii) 8th **(iv) 3rd**

Ans. (a) (ii) G

(b) (ii) H

(c) (iii) E and F

(d) (i) A

(e) (iv) 3rd **1+1+1+1**

Q. 4. From the following part of the periodic table, answer any four from (a) to (e):

1 Lithium	2	13	14 Carbon	15	16 Oxygen	17 Fluorine
X			P			Q
Y						R
Z						T

(a) Which is the most reactive metal ?

(i) Lithium **(ii) X**

(iii) Y **(iv) Z**

(b) Name the family of fluorine Q, R, T:

(i) Alkali metals

(ii) Noble gas

(iii) Halogens

(iv) Alkaline metals

(c) Which of the following element belongs to group 2?

(i) Sodium **(ii) Magnesium**

(iii) Aluminium **(iv) Carbon**

(d) Which other element is likely to present in the group in which fluorine is present:

(i) Neon **(ii) Aluminium**

(iii) Chlorine **(iv) None of the above**

(e) Name the element P placed below Carbon in group 14:

(i) Aluminium **(ii) Silicon**

(iii) Phosphorus **(iv) Sulphur**

Ans. (a) (iv) Z

(b) (iii) Halogens

(c) (i) Magnesium

(d) (iii) Chlorine

(e) (ii) Silicon **1+1+1+1**

Know the Terms

- **Groups:** The 18 vertical columns in modern periodic table are known as groups.
- **Periods:** 7 horizontal rows in modern periodic table are called periods.
- **Periodicity:** When the elements are arranged in order of increasing atomic numbers, elements with similar chemical properties are repeated at definite intervals. This is known as periodicity.
- **Atomic Radius:** Atomic radius is defined as the distance from the centre of the nucleus of an atom to the outermost shell of electrons.
- **Covalent Radii:** It is defined as half of the distance between the centre of nuclei of two atoms (bond length) bonded by a single covalent bond *e.g.*, bond length in case of H—H is 74 pm.
- **Covalent radius:** It can be measured in case of diatomic molecules of non-metals.
- **Metallic Radii:** It is defined as half of the internuclear distance between the two metal ions in a metallic crystal.
- **Metalloids:** Those elements which resemble both metals and non-metals are called metalloids. They are also called semi-metals. *e.g.*, Boron, Silicon, Germanium, Arsenic, Antimony, Tellurium and Polonium.
- **Isotopes:** Elements which have same atomic number but different mass number are called isotopes.

OSWAAL LEARNING TOOL

To learn from Oswaal Concept Video

Visit: http:qrgo.page.link OR Scan this code

❑❑❑

@PROCBSE

SELF ASSESSMENT TEST - 1

Maximum Time: 1 hour **MM: 25**

Q. 1. Write two reasons responsible for late discovery of noble gases. **1**

Q. 2. The atomic masses of Lithium and potassium are 7 and 39 respectively. If Lithium ,sodium and potassium forms Dobereiner's triad, what will be the atomic mass of sodium. **1**

Q. 3. Name the scientist who first of all showed that atomic number of an element is a more fundamental property than its atomic mass? **1**

Q. 4. Directions :

For question numbers 14-16, two statements are given- one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below :

(a) Both A and R are true and R is correct explanation of the assertion.

(b) Both A and R are true but R is not the correct explanation of the assertion.

(c) A is true but R is false.

(d) A is false but R is true

Assertion: According to Mendeleev's periodic law, the properties of elements is the periodic function of their atomic numbers.

Reason : Mendeleev's periodic law could not explain the phenomena of anomalous pair. **1**

Q. 5. (a) What were the limitations of Dobereiner's triad?

(b) Why did Mendeleev leave some gaps in his periodic table? **2**

Q. 6. In the following table, six elements represented as A, B, C, D, E and F of the Modern Periodic Table with atomic numbers 3 to 18 are given: **2**

3	4	5	6	7	8	9	10
A					E		G
11	12	13	14	15	16	17	18
B	C		D			F	

Study the table and answer the questions followed:

Which of these (A to F) represents:

(a) Noble Gas and Halogen.

(b) If B combines with F , what will be the formula?

Q. 7. Mention any two trends exhibited by elements when we go from left to right across the period of periodic table. **2**

Q. 8. Name any two elements of group one and write their electronic configurations ? What similarity do you observe in their electronic configurations ? Write the formula of oxide for any of the above said element. **3**

Q. 9. State the main aim of classifying elements. Which is more fundamental property of elements that is used in the development of Modern Periodic Table ? Name and state the law based on this fundamental property. On which side of the periodic table one can find metals, non-metals and metalloids ? **3**

Q. 10. Using the given part of the periodic table, answer any four questions given below with reason: **(Any 4)**

Group → Period ↓	**1**	**2**	**13**	**14**	**15**	**16**	**17**	**18**
3	X		B	C	D	E		
4	Y							
5	Z							

(a) Which of these elements have smallest atomic size? **1**

(i) B **(ii)** C

(iii) D **(iv)** E

@PROCBSE JOIN NOW !

@PROCBSE

(b) Write valency of element E. **1**

(i) 1 **(ii)** 3

(iii) 2 **(iv)** 0

(c) Identify the elements which have similar chemical properties as the element X **1**

(i) Y and Z **(ii)** Y and B

(iii) All Y, Z and B **(iv)** None of the above

(d) The number of period that the modern periodic table has : **1**

(i) Eight **(ii)** Seven

(iii) Seventeen **(iv)** Eighteen

(e) Which of them will have largest atomic radii: **1**

(i) E **(ii)** X

(iii) C **(iv)** D

Q. 11. The Electronic configuration of element 'X' is 2, 8, 8, 2. **5**

(a) State the period and group of modern periodic table to which it belongs.

(b) What will be its valency?

(c) Is it a metal or non-metal?

(d) Write the formula of its oxide.

Justify all the answers given.



■■

@PROCBSE

Life Processes

Nutrition

- Autotrophic nutrition in plants.
- Process involved is Photosynthesis.

Heterotrophic nutrition in animals.
Steps included are :
- Ingestion
- Digestion
- Absorption
- Assimilation
- Egestion

Parts of Alimentary canal in humans
- Mouth (saliva)
- Pharynx
- Oesophagus
- Stomach (HCl, Gastric Juice)
- Small Intestine
- Large Intestine
- Rectum

Respiration in Animals (Human Beings)

Mechanism of Breathing :
- Inspiration
- Gaseous exchange
- Expiration

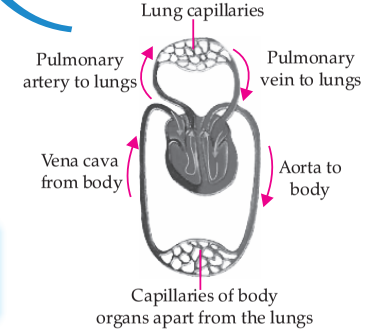
Parts of Human Respiratory System :
- Alveoli
- Lungs
- Bronchioles
- Bronchi
- Trachea
- Nostrils

Transportation and Circulation

Transportation in plants
- Phloem (Transport of water)
- Xylem (Transport of food)

Circulatory system in humans:
- Blood
- Heart
- Blood Vessels

Double Circulation in Human



Excretion

In plants : Process involved is transpiration

In humans, basic unit of kidney- Nephron
Parts of Nephron:
- Bowman's Capsule
- Glomerulus
- Proximal Convoluted Tubule
- Loop of Henle
- Distal Comvoluted Tubule
- Collecting duct

In humans, kidney helps in formation of urine

Trace the Mind Map

First Level · Second Level · Third Level

@PROCBSE

UNIT II: WORLD OF LIVING

CHAPTER 6

LIFE PROCESSES

Syllabus

Living Being'; Basic concept of nutrition, respiration, transport and excretion in plants and animals.

Trend Analysis

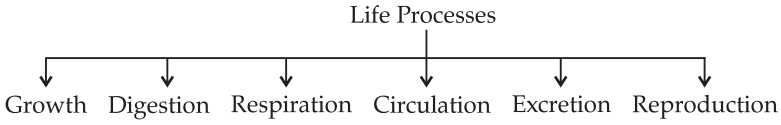
List of Concepts	2018	2019	2020
Nutrition		1Q (3 M)	1Q (3 M)
Circulation and Transportation	1Q (5 M)	1Q (3 M)	1Q (5 M)
Excretion	Or 1Q (5 M)	Or 1Q (3 M)	

@PROCBSE JOIN NOW !

TOPIC - 1
Nutrition

Revision Notes

- All living things perform certain life processes like growth, excretion, respiration, circulation and reproduction etc.
- The basic functions performed by living organisms for their survival and body maintenance are called life processes.
- **Basic life processes are:**



- Energy required to carry out the different life processes, is obtained from carbon-based food sources through nutrition.

TOPIC - 1
Nutrition Page No. 122
TOPIC - 2
Respiration Page No. 129
TOPIC - 3
Circulation and Transportation Page No. 134
TOPIC - 4
Excretion Page No. 140

@PROCBSE

- Depending on the mode of nutrition, organisms are classified as autotrophs and heterotrophs.
  - **(i) Autotrophs** can prepare their own food from simple inorganic sources like carbon dioxide and water. (e.g., green plants, some bacteria).
  - **(ii) Heterotrophs** cannot synthesise their own food and are dependent on the autotrophs for obtaining complex organic substances for nutrition. (*e.g.*, animals)
- Green plants manufacture their food by the process of **photosynthesis**. Here, they utilise CO_2 and H_2O in presence of sunlight, with the help of chlorophyll and gives out O_2 as a by-product.
- In the light reaction of photosynthesis, light energy is absorbed and converted into chemical energy in the form of ATP and NADPH. Also, water molecules split into hydrogen and oxygen.
- Carbon dioxide is reduced to carbohydrates in the dark phase of photosynthesis.
- Plants carry out exchange of gases with surrounding atmosphere through stomata.
- In humans, digestion of food takes place in the alimentary canal, made up of various organs and glands.
- Liver secretes bile, which emulsifies fat.

Scan to know more about this topic

Nutrition in Human beings

Mouth → Intake of whole food.

↓

Teeth → Chewing/grinding of food.

↓

Tongue → Rolling of food + Tasting of food + Swallowing/Pushing down of the food.

↓

Tongue → Secrete saliva + Mucus

↓

Starch —(Salivary amylase [Saliva])→ Sugar

Oesophagus → Taking food from mouth to stomach by peristaltic movements. [Contraction and expansion of muscles of the oesophagus]

↓

Stomach → Gastric glands —(Secrete)→ Gastric juice

Gastric juice:

- Pepsin (Enzyme that breaks down proteins)
- HCl (Makes medium acidic)
- Mucus (Protect inner lining of the stomach)

Small Intestine → (a) Intestinal enzyme ↓ convert

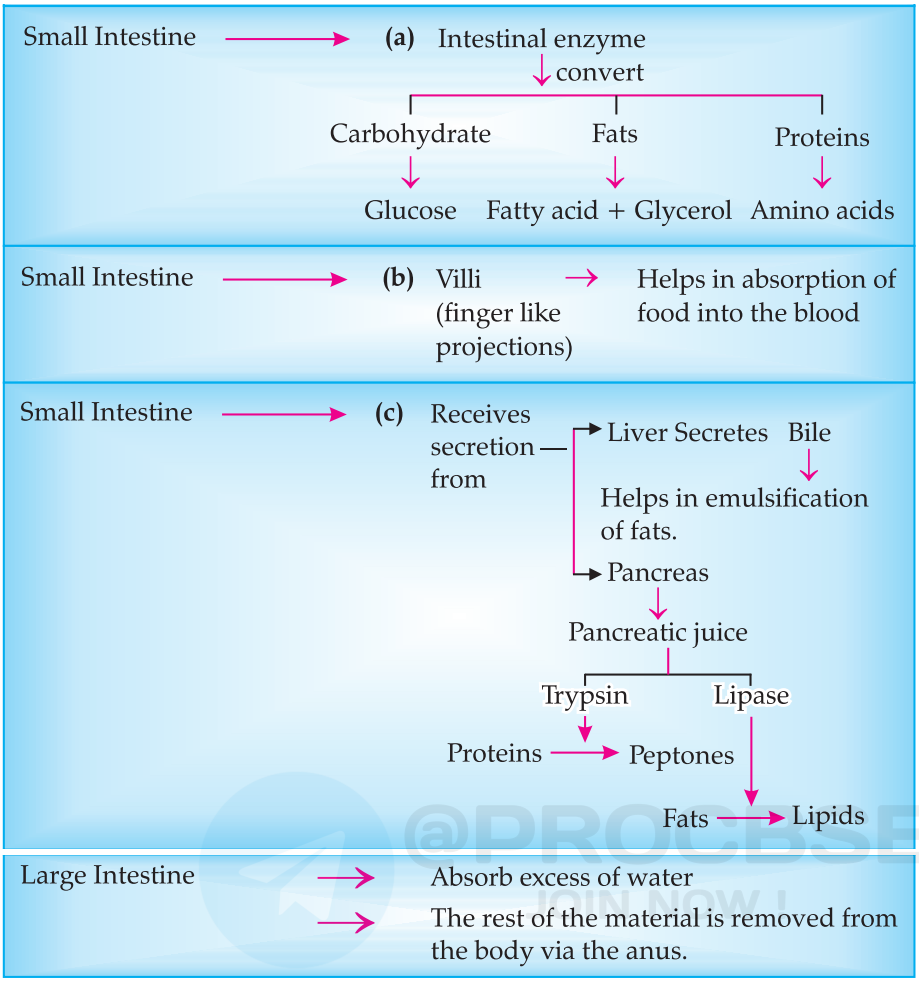
- Carbohydrate ↓ Glucose
- Fats ↓ Fatty acid + Glycerol
- Proteins ↓ Amino acids

Scan to know more about this topic

Digestive gland in stomach

@PROCBSE JOIN NOW !

@PROCBSE



Mnemonics

Concept: Parts of an alimentary canal in humans.

Mnemonics: MOSS DJ I LA – remember this as "Kate MOSS is a DJ In LA"

Interpretation:

M = **M**outh
O = **O**esophagus
S = **S**tomach
S = Small Intestine (made up of)
D = **D**uodenum
J = **J**ejunum
I = **I**leum
L = Large Intestine
A = **A**nus

@PROCBSE

How is it done on the GREENBOARD?

Q.1. Mention the organ and site of photosynthesis in green plants. What are the raw materials essential for this process ? How are they obtained ? Write complete balanced chemical equation for the process. Name the by-products. 5

Solution:

Step I: Photosynthesis takes place in the grana and stroma of the chloroplast (Plastid) in green parts of plants.

Step II: The raw materials required for this process are carbon dioxide and water in the presence of sunlight and chlorophyll.

Step III: Carbon dioxide enters the leaves through stomata and cells of the roots absorbs water from the soil.

Step IV: Balanced equation for photosynthesis is:

$$6CO_2 + 6H_2O \xrightarrow[\text{Sunlight}]{\text{Chlorophyll}} C_6H_{12}O_6 + 6O_2$$

Objective Type Questions — 1 mark each

A Multiple Choice Questions

Q. 1. Which of the following statements about the autotrophs is incorrect?

(a) They synthesise carbohydrates from carbon dioxide and water in the presence of sunlight and chlorophyll.

(b) They store carbohydrates in the form of starch.

(c) They convert carbon dioxide and water into carbohydrates in the absence of sunlight.

(d) They constitute the first trophic level in food chains

Ans. Correct option : (c)

Explanation : Autotrophs take in food from the outside world and convert them into stored forms of energy. This material is taken in the form of carbon dioxide and water which is converted into carbohydrates in the presence of sunlight and chlorophyll.

Q. 2. In which of the following groups of organisms, food material is broken down outside the body and absorbed?

(a) Mushroom, green plants, *Amoeba*

(b) Yeast, mushroom, bread mould

(c) *Paramecium, Amoeba, Cuscuta*

(d) *Cuscuta*, lice, tapeworm

Ans. Correct option : (b)

Explanation : These are saprotrophs and digestion in saprotrophs takes place before ingestion. They break down and convert complex organic molecules present in dead and decaying matter into simpler substances outside their body.

Q. 3. Which is the correct sequence of parts in human alimentary canal?

(a) Mouth → stomach → small intestine → oesophagus → large intestine

(b) Mouth → oesophagus → stomach → large intestine → small intestine

(c) Mouth → stomach → oesophagus → small intestine → large intestine

(d) Mouth → oesophagus → stomach → small intestine → large intestine [NCERT Exemp.]

Ans. Correct option : (d)

Explanation : The sequence of organs in human alimentary canal are mouth, oesophagus, stomach, small intestine, large intestine and anus.

Q. 4. If salivary amylase is lacking in the saliva, which of the following events in the mouth cavity will be affected?

(a) Proteins breaking down into amino acids

(b) Starch breaking down into sugars

(c) Fats breaking down into fatty acids and glycerol

(d) Absorption of vitamins

Ans. Correct option : (b)

Explanation : If salivary amylase is lacking in the saliva, the process of starch digestion will get disturb as salivary amylase helps in digestion of starch.

Q. 5. Select the correct statement.

(a) Heterotrophs do not synthesise their own food.

@PROCBSE JOIN NOW

@PROCBSE

(b) Heterotrophs utilise solar energy for photosynthesis.

(c) Heterotrophs synthesise their own food.

(d) Heterotrophs are capable of converting carbon dioxide and water into carbohydrates.

Ans. Correct option: (a)

Explanation: Heterotrophs are organisms which cannot make their own food from inorganic substances like CO_2 and water as they do not have chlorophyll to trap solar energy. They depend on other organisms for their food. Autotrophs synthesize their own food through photosynthesis by utilizing solar energy, e.g., green plants.

B Assertions and Reasons Type Questions

Directions: In the following questions, a statement of assertion (A) is followed by a statement of reason (R). Mark the correct choice as:

(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

(b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).

(c) Assertion (A) is true but reason (R) is false.

(d) Assertion (A) is false but reason (R) is true.

Q. 1. Assertion (A): HCl converts pepsinogen into active enzyme pepsin.

Reason (R): Pepsin converts protein into proteoses and peptones.

Ans. Correct option : (b)

Explanation: HCl creates an acidic medium, which facilitates activation of pepsinogen into pepsin. The active enzyme pepsin converts proteins into proteoses and peptones.

Q. 2. Assertion (A): Digestion breaks large complex molecules to simple smaller molecules which can be easily absorbed.

Reason (R): Digestion is necessary for the absorption of all molecules.

Ans. Correct option : (c)

Explanation: Digestion breaks large complex organic molecules to simple smaller ones which can be easily absorbed. However, certain molecules such as glucose, vitamin C etc, do not need any digestion before their absorption.

Q. 3. Assertion (A): Muscles of stomach wall possess thick layers of muscle fibers.

Reason (R): These muscles help in mixing the food with the enzymes present in the alimentary canal.

Ans. Correct option : (a)

Explanation: The lining of alimentary canal has muscles that contract rhythmically in order to push the food forward. This is known as *peristaltic movement*.

Q. 4. Assertion (A): Lipases help in emulsification of fats.

Reason (R): Lipases hydrolyses fats and oils.

Ans. Correct option : (d)

Explanation: Bile helps in emulsification of fats whereas lipases are the enzymes which hydrolyze fats and oils.

Q. 5. Assertion (A): Photosynthesis is an anabolic process.

Reason (R): The process of photosynthesis occurs in chlorophyll.

Ans. Correct option : (c)

Explanation: Photosynthesis is an anabolic process as it takes CO_2 and H_2O and then assembles them into glucose. The process of photosynthesis occurs in chloroplast.

C Very Short Answer Type Questions

Q.1. How is the wall of small intestine adapted for performing the function of absorption of food ? U [CBSE SQP, 2021]

Ans. The inner lining of the small intestine has numerous finger-like projections called villi which increase the surface area for absorption. **1**

Q.2. Out of a goat and a tiger, which one will have a longer small intestine? Justify your answer. A [CBSE SQP, 2021]

Ans. Goat, because herbivores eating grass need a longer small intestine to allow the cellulose to be digested. 1

Q.3. State the role of pancreas in digestion of food. R [CBSE SQP, 2021]

Ans. The pancreas secretes digestive juice which contains enzymes like trypsin for digesting proteins and lipase for breakdown of emulsified fats. **1**

Q. 4. Name a common nutrient that is absorbed in the small intestine and reabsorbed by the kidney tubules. R [CBSE SQP, 2018-19]

Ans. Glucose/Amino acid **1**
[CBSE Marking Scheme, 2018]

AI **Q. 5. What is the role of saliva in the digestion of food ?** U [DDE, 2017]

Ans. Saliva moistens the ingested food with mucus, sterilises it with lysozyme and partially digests starch part of food into sugar with the help of salivary amylase or ptyalin. **1**

Q. 6. What is the role of acid in our stomach ? A [DDE, 2017]

Ans. HCl of gastric juice disinfects the food and acidifies it for proper functioning and activation of proteolytic enzyme pepsin. **1**

@PROCBSE JOIN NOW !

@PROCBSE

Short Answer Type Questions-I — 2 marks each

Q. 1. Bile juice does not have any digestive enzyme but still plays a significant role in the process of digestion. Justify the statement.

U [CBSE SQP, 2020-21]

Ans. Bile juice makes the acidic food coming from the stomach alkaline for the action of pancreatic enzymes. Bile salts break the large globules of fat in the intestine to smaller globules increasing the efficiency of enzyme action. This is similar to the emulsifying action of soaps on dirt.

[CBSE SQP Marking Scheme, 2020-21] 2

Q. 2. State the events occurring during the process of photosynthesis. Is it essential that these steps take place one after the other immediately?

U [CBSE SQP, 2020-21] 2

Ans. $6CO_2 + 6H_2O \xrightarrow[\text{Chlorophyll}]{\text{Sunlight}} C_6H_{12}O_6 + 6O_2$

Carbon dioxide — Water — Carbo-hydrate — Oxygen

Absorption of light energy by chlorophyll.

- Conversion of light energy to chemical energy and splitting of water molecules into hydrogen and oxygen.
- Reduction of carbon dioxide to carbohydrates.

These steps need not take place one after the other immediately. For example, desert plants take up carbon dioxide at night and prepare an intermediate which is acted upon by the energy absorbed by the chlorophyll during the day. 2

[CBSE SQP Marking Scheme, 2020-21] 2

Q. 3. List the steps of preparation of temporary mount of a leaf peel to observe stomata.

A [CBSE, Delhi, O.D. 2018]

Ans. The steps are:

(i) Removal of peel from leaf

(ii) Stain with safranin

(iii) Mount it with glycerine and cover slip

[CBSE Marking Scheme, 2018]

Q. 4. What are final products of carbohydrates, proteins and fats after their digestion ? R

Ans. Carbohydrates: Glucose ½

Proteins: Amino acid ½

Fats: Glycerol + Fatty acid ½ + ½

@PROCBSE

Short Answer Type Questions-II — 3 marks each

Q.1 State the role played by the following in the process of digestion: (i) Enzyme trypsin (ii) Enzyme lipase List two functions of finger like projections present in the small intestine.

U [Outside Delhi, Set- I, 2020]

Ans. (a) (i) Trypsin acts upon proteins and converts it into peptids and amino acids (ii) Lipase is an enzyme that breaks down dietary fats into smaller molecules called fatty acids and glycerol.

(b) Functions of villi:

(i) Villi are richly supplied with blood vessels which take the absorbed food to each and every cell of the body.

(ii) It also absorb water.

(iii) They increase the surface area for the absorption of food. **(Any one) 2 + 1 = 3**

AI **Q. 2. What is photosynthesis ? Explain its mechanism.**

R [CBSE Board Delhi, Set-III, 2019]

Ans. A process in which green plants take carbon dioxide and water and convert it into carbohydrates /food in the presence of sunlight and chlorophyll. 1

Mechanism:

(i) Absorption of light energy by chlorophyll.

(ii) Conversion of light energy to chemical energy.

(iii) Splitting of water molecules into hydrogen and oxygen.

(iv) Reduction of carbon dioxide to carbohydrate.

[CBSE Marking Scheme, 2019] ½ × 4

AI **Q. 3. List in tabular form three distinguishing features between autotrophic nutrition and heterotrophic nutrition.** U [Board Outside Delhi, Set-I, 2019]

Ans.

	Autotrophic Nutrition	Heterotrophic Nutrition
1.	They can prepare their own food.	They cannot prepare their own food.
2.	They require raw materials like CO_2, H_2O in the presence of sunlight and chlorophyll to prepare their food.	They depend on other plants and animals for their food.
3.	They store the food in the form of starch.	They store the food in the form of glycogen.

(Any three point)

[CBSE Marking Scheme, 2019] 1 × 3

Q. 4. A variegated leaf with green and yellow patches is used for an experiment to prove that chlorophyll is required for photosynthesis. Before the experiment, the green portions (A), and the pale yellow portions (B), are observed. What will be the colour of 'A' just before and after the starch test? Also write the equation of photosynthesis and mark, as well as validate from which molecule the by-product is obtained. C [CBSE, SQP 2019]

@PROCBSE

Ans. Just before Starch test — Pale yellow

Just after Starch test – Blue black

$$6CO_2 + 6H_2O \xrightarrow[\text{Sunlight}]{\text{Chlorophyll}} C_6H_{12}O_6 + 6O_2$$

O_2 is obtained from water (H_2O), as splitting of water results in formation of hydrogen (used for making glucose) and oxygen (by-product).

[CBSE Marking Scheme, 2018-19] **3**

Q. 5. Where does digestion start in our alimentary canal? Name the enzyme secreted in that part and write its function. U [Board Term I, 2016]

Ans. Digestion starts in the buccal cavity in the mouth. The enzyme secreted in buccal cavity is salivary amylase. Salivary amylase helps in breakdown of starch into maltose and dextrin. **1 + 1 + 1**

AI **Q. 6. State the necessary conditions for autotrophic nutrition and name the by–product. Mention the source of this by-product.** U [Board Term I, 2015]

Ans. Conditions necessary for autotrophic nutrition are: Sunlight, chlorophyll, carbon dioxide and water. The by-product is oxygen. The source of by-product (oxygen) is water.

1+1+1

Long Answer Type Questions — 5 marks each

Q. 1. (a) A gas is released during photosynthesis. Name the gas and also state the way by which the gas is evolved.

(b) What are stomata? What governs the opening and closing of stomata? U [Delhi II, 2020]

Ans. (a) The gas released during the process of photosynthesis is oxygen. Oxygen is liberated during photosynthesis which comes from water.

During photosynthesis, plants absorb carbon dioxide and sunlight to produce carbohydrates. The solar energy trapped by chlorophyll breaks down water molecules by the process of photolysis. Photolysis of water releases oxygen.

(b) Stomata are tiny pores present on the surface of the leaves.

The opening and closing of stomatal pores are controlled by the turgidity of guard cells. When guard cells uptake water from surrounding cells, they swell to become a turgid body. This enlarges the pore in between and cause stomatal opening.

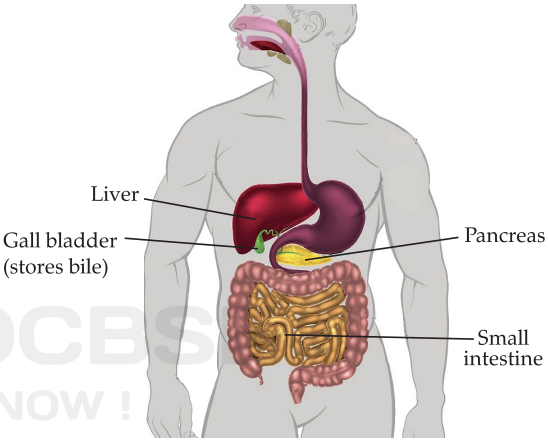
When water is released, they become flaccid. This closes the pore in between causing stomatal closing.

2 + 3=5

Q. 2. (a) Draw a diagram of human alimentary canal and label – gall bladder, pancreas, liver and small intestine on it.

(b) Give two reasons to explain why absorption of digested food occurs mainly in the small intestine. U [Delhi III, 2020]

Ans. (a)



(b) Absorption of digested food occurs mainly in the small intestine because it has finger like projections called villi which help in absorption of food into blood. Villus contains a lymph capillary called lacteal in the center. Lacteal in turn is surrounded by a network of thin and small blood vessels called blood capillaries close to its surface. As the food moves slowly between, over and around the villi, the surface of villi absorbs the digested food materials into blood flowing through them. Blood, in turn, carries the absorbed food materials to all the parts of the body. In the cells food is used for energy, repair and growth. The process is known as assimilation. **2+3=5**

AI **Q. 3.(i) Name the process and explain the type of nutrition found in green plants. List the raw materials required for this process. Give chemical equation for the mentioned process.**

(ii) Write three events that occur during this process. U [Board Term I, 2018]

Ans. (i) Process: Photosynthesis ½

Type of nutrition: Autotrophic

Explanation: Autotrophic nutrition is the process where plants prepare their own food, using inorganic materials such as CO_2 and H_2O in presence of Sunlight and Chlorophyll. ½+½

$$6CO_2 + 12H_2O \xrightarrow{\text{Chlorophyll, Sunlight}} \underset{\text{(Glucose)}}{C_6H_{12}O_6} + 6O_2 + 6H_2O$$ **1**

Raw material: CO_2, H_2O ½+½

(ii) (a) Absorption of light energy by chlorophyll.

(b) Conversion of light energy to chemical energy and splitting of water molecules into hydrogen and oxygen.

(c) Reduction of Carbon dioxide to Carbohydrates. [CBSE Marking Scheme, 2018] **1½**

@PROCBSE JOIN NOW !

@PROCBSE

AI **Q. 4. Mention the organ and site of photosynthesis in green plants. What are the raw materials essential for this process? How are they obtained? Write complete balanced chemical equation for the process. Name the by-products.**

U **[Board Term I, 2016]**

Ans. Photosynthesis takes place in the grana and stroma of the chloroplast (Plastid) in green parts of plants.

The raw materials required for this process are carbon dioxide and water in the presence of sunlight and chlorophyll.

Carbon dioxide enters the leaves through stomata and cells of the roots absorbs water from the soil.

Balanced equation for photosynthesis:

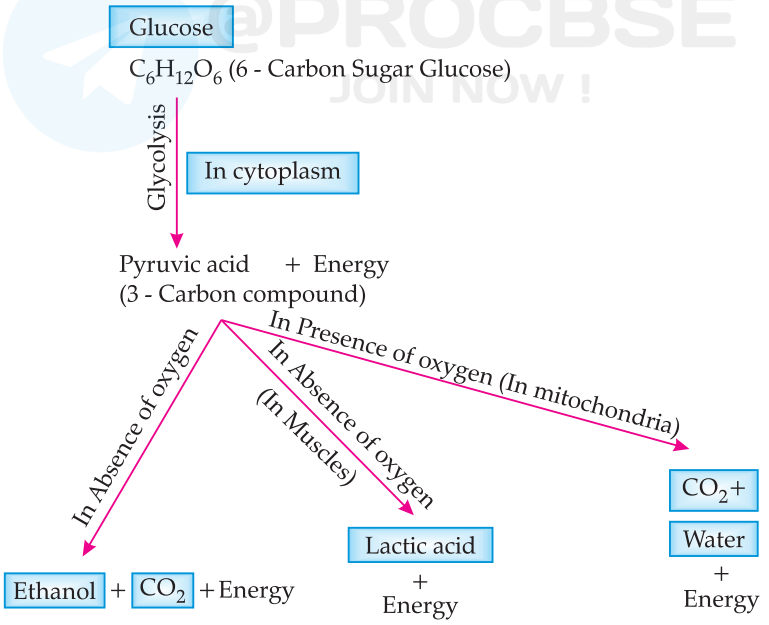
$$6CO_2 + 6H_2O \xrightarrow[\text{Sunlight}]{\text{Chlorophyll}} C_6H_{12}O_6 + 6O_2$$

Oxygen is the by-product in this process. **1 + 1 + 1 + 1 + 1**

TOPIC - 2
Respiration

Revision Notes

- Respiration is the process in living organisms, which involves:
  (i) **Gaseous exchange:** Intake of oxygen from the atmosphere and release of CO_2 → Breathing
  (ii) Breakdown of simple food in order to release energy inside the cell → Cellular respiration
- **Breakdown of Glucose by Various Pathways:**



Scan to know more about this topic — Respiration

Scan to know more about this topic — Respiration in Plants

- **Types of Respiration:**

Respiration	
Aerobic	**Anaerobic**
Takes place in the presence of oxygen	Takes place in the absence of oxygen
Occurs in mitochondria	Occurs in cytoplasm
End products are CO_2 and H_2O	End products are alcohol or lactic acid
More amount of energy is released	Less amount of energy is released
Examples: Most plants and animals	Examples: Muscles, bacteria, yeast and parasitic worm etc.

@PROCBSE JOIN NOW !

- **In humans, air takes the following path on entering the nostrils:**
  Nostrils → Nasal passage → Pharynx → Larynx → Trachea → Bronchus → Bronchiole → Alveolus.
- The alveoli of lungs are richly supplied with blood and are the sites where exchange of gases (O_2 and CO_2) occurs between blood and atmosphere.
- In humans, the respiratory pigment haemoglobin carries oxygen from lungs to different tissues of the body.
- In plants, gaseous exchange takes place through stomata in leaves, lenticels in stems, general surface of roots and transpiration.

How is it done on the GREENBOARD?

Q. (a) Write the reaction that occurs when glucose breaks down anaerobically in yeast.
(b) Write the mechanism by which fishes breathe in water.
(c) Name the balloon likes structures present in lungs. List its two functions.
(d) Name the respiratory pigment and write its role in human beings.5

Solution:

Step I: (a) Glucose $\xrightarrow{\text{In Cytoplasm}}$ Pyruvate $\xrightarrow{\text{In absence of oxygen}}$ Ethanol + CO_2 + Energy

Step II : (b) Fishes take in water through the mouth and force it past the gills where the dissolved oxygen is taken up by the blood.

Step III : (c) Alveoli

Step IV: Functions : They contain an extensive network of blood vessels which exchange gases.

Step V: They increase surface area of absorption of gases.

Step VI: (d) Haemoglobin

Step VII: Due to high affinity for O_2, it helps in its transport from alveoli to the tissue.

@PROCBSE JOIN NOW !

Objective Type Questions — 1 mark each

A Multiple Choice Questions

Q. 1. The breakdown of pyruvate to give carbon dioxide, water and energy takes place in

(a) cytoplasm **(b) mitochondria**
(c) chloroplast **(d) nucleus**

Ans. Correct option : (b)
Explanation : The breakdown of pyruvate to give carbon dioxide, water and energy takes place in mitochondria.

Q. 2. The correct sequence of anaerobic reactions in yeast is

(a) Glucose $\xrightarrow{\text{cytoplasm}}$ Pyruvate $\xrightarrow{\text{mitochondria}}$ Ethanol + Carbon dioxide

(b) Glucose $\xrightarrow{\text{cytoplasm}}$ Pyruvate $\xrightarrow{\text{cytoplasm}}$ Lactic acid

(c) Glucose $\xrightarrow{\text{cytoplasm}}$ Pyruvate $\xrightarrow{\text{mitochondria}}$ Lactic acid

(d) Glucose $\xrightarrow{\text{cytoplasm}}$ Pyruvate $\xrightarrow{\text{cytoplasm}}$ Ethanol + Carbon dioxide

Ans. Correct option : (d)
Explanation : Yeast is an unicellular eukaryote which carries out ethanol fermentation. In the first phase, glucose is converted into pyruvate (glycolysis) in the cytoplasm of the cell. Due to limited oxygen availability, pyruvate remains in cytoplasm where pyruvate decarboxylase and alcohol dehydrogenase enzymes carry out the second phase of anaerobic respiration and produce ethanol and carbon dioxide.

B Assertions and Reasons Type Questions

Directions: In the following questions, a statement of assertion (A) is followed by a statement of reason (R). Mark the correct choice as:

(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

@PROCBSE

(b) **Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).**
(c) **Assertion (A) is true but reason (R) is false.**
(d) **Assertion (A) is false but reason (R) is true.**

Q. 1. Assertion (A): Energy is used during the process of respiration.
Reason (R): Respiration stores energy in the form of ATP.

Ans. Correct option : (d)
Explanation: Respiration involves the oxidation of glucose inside the mitochondria to produce energy, which is stored in the high energy bonds of ATP molecules as biologically useful energy.

Q. 2. Assertion (A): Humans are not truly aerobic.
Reason (R): They produce lactic acid anaerobically.

Ans. Correct option : (b)
Explanation: Humans are aerobically respiring animals, but sometimes anaerobic respiration takes place in certain tissues like skeletal muscles, which do not get immediately as much oxygen as it requires. Therefore, the muscles respire anaerobically and produce lactic acid from glucose.

Q. 3. Assertion (A): In humans, there is a complex respiratory system.
Reason (R): Human skin is impermeable to gases.

Ans. Correct option : (b)
Explanation: Humans need more oxygen to maintain their high metabolic rates. Thus, a complex respiratory system has evolved so as to meet this need.

Q. 4. Assertion (A): Alveoli contain an extensive network of blood vessels.
Reason (R): Alveoli is the site where exchange of gases occurs.

Ans. Correct option : (a)
Explanation: The alveoli of lungs are richly supplied with blood and are the sites where exchange of gases (O_2 and CO_2) occurs between blood and atmosphere.

C Very Short Answer Type Questions

Q. 1. Name the respiratory pigment in human beings. Where is this pigment found? R

Ans. The respiratory pigment in human being is haemoglobin. Haemoglobin is present in RBC's of blood in humans. ½ + ½

Q. 2. Where does aerobic respiration occur in a cell? R

Ans. Aerobic respiration occurs in mitochondria of the cell. **1**

Q. 3. Name the energy currency in the living organisms. When and where is it produced?

Ans. Adenosine triphosphate (ATP). It is produced during respiration in living organisms in mitochondria. **1**

Short Answer Type Questions-I — 2 marks each

Q. 1. In the experimental set up on 'CO_2 is released during respiration', if one forgets to keep the vial with KOH in the conical flask, how will the result vary? Give details. U [CBSE SQP, 2018-19]

Ans. In absence of KOH, CO_2 released by germinating seeds is not absorbed, partial vacuum is not created in the conical flask, air pressure in the flask is not reduced, water level does not rise in the delivery tube. [CBSE Marking Scheme, 2018-19] **2**

Detailed Answer:
The rise in the level of water indicates that CO_2 is produced by germinating seeds during respiration. Actually, the germinating seeds respire and produce CO_2, which is absorbed by KOH solution. This creates a vacuum in the conical flask. The air present in the bent glass tube moves into the conical flask. This pulls the water in the bent tube further up.
So, if one forgets to keep the vial with KOH solution in conical flask during experiment, then the released CO_2 will not be absorbed due to which the level of water will not rise in the tube and the process of respiration will get very slow.

Q. 2. When a sportsman runs, he often gets muscle cramps. Why? U

Ans. In order to release more energy to perform sudden activity, pyruvate is converted into lactic acid in the lack of oxygen. Formation of lactic acid in muscles cause cramps or fatigue. **2**

Q. 3. Stomata of desert plants remain closed during day time. How do they take up CO_2 and perform photosynthesis? A

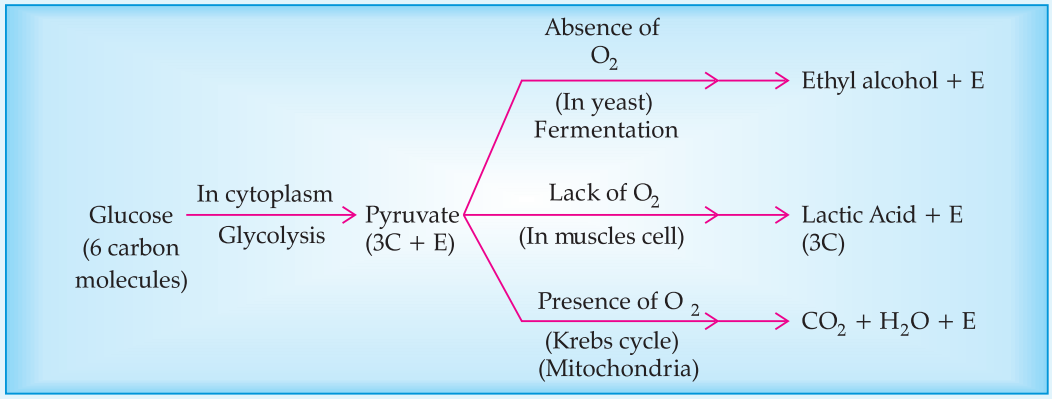
Ans. The desert plants are scotoactive i.e., their stomata open during night. Therefore, they take up CO_2 at night and produce intermediate organic acid which breaks up to release CO_2. The CO_2 so produced internally is used in photosynthesis during day when stomata are closed. **2**

Short Answer Type Questions-II — 3 marks each

Q. 1. Explain the processes of aerobic respiration in mitochondria of a cell and anaerobic respiration in yeast and muscle with the help of word equations. R [Board SQP, 2020]

@PROCBSE JOIN NOW !

Ans.



1 + 1+ 1

[CBSE Marking Scheme, 2020]

Q. 2. The rate of breathing in aquatic organisms is much faster than that seen in terrestrial organisms. Give reason. U [Board Term I, 2014] [DDE, 2017]

Ans. A terrestrial organism can obtain oxygen directly from the air and have slow breathing rate but aquatic organisms have to obtain oxygen for respiration which is dissolved in water. Since, the amount of oxygen dissolved in water is fairly low as compared to the amount of oxygen in air, the rate of breathing in aquatic organisms is much faster. **3**

COMMONLY MADE ERROR

- Students often write vague answer. It seems they are unaware of the concept of rate of breathing.

ANSWERING TIP

- Always be specific and give clear and complete answers. Incomplete and vague answers must be avoided.

AI **Q. 3. Define breathing. Explain the mechanism of breathing in human beings.**

U [Board Term I, 2016]

Ans. Breathing is the process of letting in oxygen from air into the lungs and CO_2 out of the lungs.

Mechanism: Involuntary, rate controlled by brain. Outward and inward movement of ribs increases or decreases the space of thoracic cavity, action assisted by diaphragm continues inhalation and exhalation of the air. **1+2**

[CBSE Marking Scheme, 2016]

Detailed Answer:

A physical process by which oxygen is taken in and carbon dioxide is given out is called *breathing*.

Breathing in humans involve three steps:

(i) Inspiration: When we breathe in, ribs move up and flatten the diaphragm due to which the chest cavity becomes larger. As a result air is sucked into the lungs and fills the expanded alveoli.

(ii) Gaseous exchange: Haemoglobin binds with the oxygen and carries it along the blood in the body. As blood passes through the tissues of the body, oxygen from the blood diffuses into the cell, whereas carbon dioxide which is produced during respiration diffuses into the blood and is carried to the lungs for expiration.

(iii) Expiration: Ribs move down and diaphragm becomes dome-shaped decreasing the chest cavity. Thus, pushing the air out from lungs. **3**

Q. 4. Explain the activity with diagram to show that carbon dioxide is essential for photosynthesis.

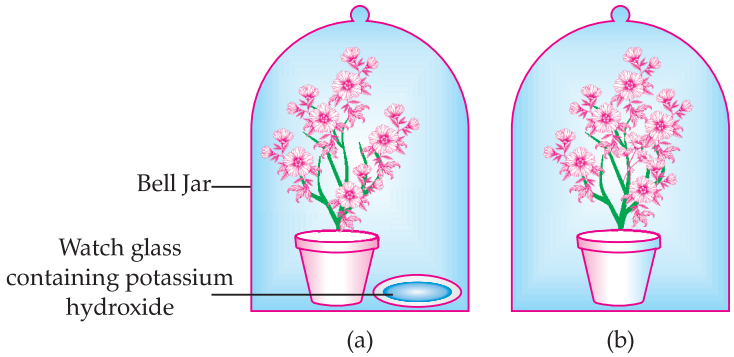
C [Board Term-I, 2015]

Ans. (i) Take two healthy potted plants which are nearly the same size.

(ii) Keep them in a dark room for three days.

(iii) Now place each plant on separate glass plates. Place a watch glass containing potassium hydroxide by the side of one of the plants. The potassium hydroxide is used to absorb carbon dioxide. When the leaves of both the plants were tested for starch, it was found that the leaves of the plant kept in bell jar (b), which is without potassium hydroxide gave the positive test of starch. This shows that CO_2 is essential for photosynthesis.

@PROCBSE



Experimental set up **(a)** With potassium hydroxide **(b)** Without potassium hydroxide. **3**

COMMONLY MADE ERROR

- Students write answer in essay form. Many of them get confused and write incorrect experimental steps.

ANSWERING TIPS

- Write answers point-wise rather than in the form of an essay.
- Steps should be written in the correct sequence.

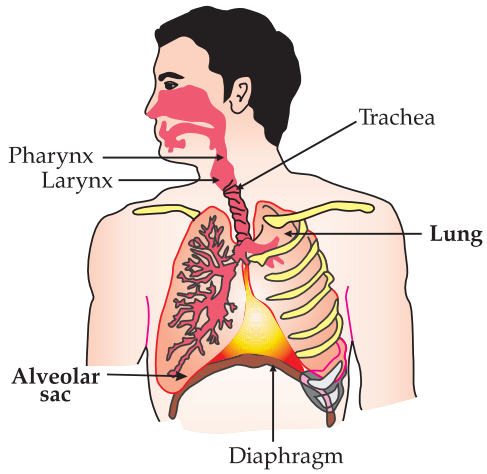
Long Answer Type Questions — 5 marks each

AI **Q. 1. (a) Why is there a difference in the rate of breathing between aquatic organisms and terrestrial organisms? Explain.** U

(b) Draw a diagram of human respiratory system and label - pharynx, trachea, lungs, diaphragm and alveolar sac on it. C **[Delhi I, 2020]**

Ans. (a) Terrestrial organisms can obtain oxygen directly from the air and have slow breathing rate but; aquatic organisms have to obtain oxygen for respiration which is dissolved in water. Since, the amount of oxygen dissolved in water is fairly low as compared to the amount of oxygen in air; the rate of breathing in aquatic organisms is much faster.

(b) **Diagram of human respiratory system:**



2+3=5

Q. 2.(a) Write the reaction that occurs when glucose breaks down anaerobically in yeast.

(b) Write the mechanism by which fishes breathe in water.

(c) Name the balloon likes structures present in lungs. List its two functions.

(d) Name the respiratory pigment and write its role in human beings.

U **[CBSE, Comptt. Set. I, II and III, 2018]**

Ans. (a) Glucose $\xrightarrow{\text{In Cytoplasm}}$ Pyruvate

$\xrightarrow{\text{In absence of oxygen}}$ Ethanol + CO_2 + Energy **1½**

(b) Fishes take in water through the mouth and force it past the gills where the dissolved oxygen is taken up by the blood. **1**

(c) Alveoli ½

Functions: They contain an extensive network of blood vessels which exchange gases. ½

They increase surface area of absorption of gases. ½

(d) Haemoglobin ½

Role: Due to high affinity for O_2, it helps in its transport from alveoli to the tissue ½

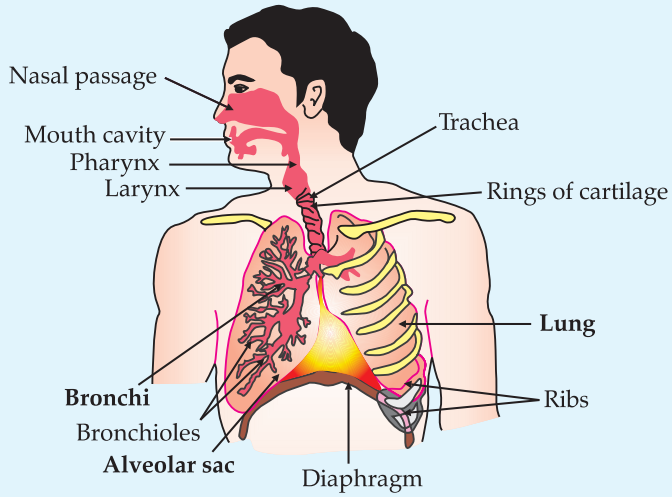
[CBSE Marking Scheme, 2018]

@PROCBSE

AI **Q. 3. (i) Draw the human respiratory system and label the following: lung, bronchi and alveolar sac.**
(ii) During breathing cycle, what is the advantage of residual volume of air in lungs ? Explain.

A [DDE, 2017]

Ans. (i)



4

(ii) So that there is sufficient time for oxygen to be absorbed and for CO_2 to be released. 1

[CBSE Marking Scheme, 2012]

COMMONLY MADE ERROR

- Students commit errors in labelling the diagram.

ANSWERING TIP

- Practice drawing the well-labelled diagram of human respiratory system. Don't forget to answer the second part of the question.

@PROCBSE JOIN NOW !

TOPIC - 3
Circulation and Transportation

Revision Notes

Human Circulatory System

- The circulatory system in human beings consists of: A circulatory medium (blood and lymph), blood vessels (veins, arteries and capillaries) and heart.
- Humans have double circulation system. Blood travels twice through the heart in one complete cycle of the body.
- **Pulmonary Circulation:** Blood moves from the heart to the lungs and back to the heart.
- **Systemic Circulation:** Blood moves from the heart to rest of the body and back to the heart.
- **Differences between arteries and veins:**

	Arteries		Veins
1.	Carry oxygenated blood from heart to different body parts except pulmonary artery.	1.	Carry deoxygenated blood from different body parts to the heart except pulmonary vein.
2.	Also called distributing vessel.	2.	Also called collecting vessel.
3.	Walls thick, elastic and muscular.	3.	Thin, non muscular and less elastic.
4.	Deep seated	4.	Superficial as compared to arteries.
5.	Have no valves	5.	Have valves, which prevent backward flow of blood.

Scan to know more about this topic

Circulation in humans

- There are two main conducting channels in vascular plants. These are Xylem and Phloem.

@PROCBSE

	Xylem		Phloem
1.	Transports water and minerals from the roots to upper parts of the plant.	1.	Transports product of photosynthesis from leaves to the non-photosynthesising parts of the plants such as root & stem.
2.	No energy is used for transport.	2.	Energy is used from ATP for transport.
3.	On maturity, the xylem becomes dead tissue and gives mechanical support to the plant.	3.	Phloem exists as living soft tissue.

Scan to know more about this topic

Transportation of water in plant cells

➤ **Transpiration:** It is the process of loss of water as vapours from aerial parts of the plant.

How is it done on the GREENBOARD?

Q. Define transpiration. State its two functions. 3

Solution:

Step I: The loss of water in the form of vapour from the aerial parts/leaves/stems is known as transpiration.

Its two functions are:

Step II : It helps in the absorption and upward movement of water.

Step III : Movement of dissolved minerals from root to leaves.

Objective Type Questions 1 mark each

A Multiple Choice Questions

Q. 1. What prevents back flow of blood inside the heart during contraction?

(a) Valves in heart
(b) Thick muscular walls of ventricles
(c) Thin walls of atria
(d) All of the above

Ans. Correct option : (a)

Explanation : Valves ensure that blood does not flow backwards when the atria or ventricles contract. Semilunar valves, the valves present between ventricles and their attached vessels, serve to prevent the backflow of blood to ventricles from their respective attached vessels. Likewise, atrioventricular (AV) valve between atrium and ventricle directs the flow of blood and prevents any backflow into atria.

Q. 2. Single circulation, *i.e.*, blood flows through the heart only once during one cycle of passage through the body, is exhibited by

(a) *Labeo, Chameleon, Salamander*
(b) *Hippocampus, Exocoetus, Anabas*
(c) *Hyla, Rana, Draco*
(d) Whale, Dolphin, Turtle

Ans. Correct option : (b)

Explanation : *Hippocampus, Exocoetus, Anabas* belong to class pisces. Fishes have two chambered heart and exhibit single circulation while three chambered heart of amphibians and reptiles and four chambered heart of birds and mammals exhibit double circulation.

Q. 3. The blood leaving the tissues becomes richer in

(a) carbon dioxide **(b) water**
(c) haemoglobin **(d) oxygen**

Ans. Correct option : (a)

Explanation : The anterior vena cava collects deoxygenated blood from the head, chest, and arms and enters the right atrium while the inferior vena cava collects blood from the lower body regions. Both venae cavae pass the deoxygenated blood to the right atrium. Therefore, blood from tissues is rich in carbon dioxide.

Q. 4. The xylem in plants are responsible for

(a) transport of water
(b) transport of food
(c) transport of amino acids
(d) transport of oxygen [NCERT Ex.]

Ans. Correct option : (a)

Explanation : In a plant, the xylem is responsible for transport of water.

@PROCBSE JOIN NOW !

@PROCBSE

B Assertions and Reasons Type Questions

Directions: In the following questions, a statement of assertion (A) is followed by a statement of reason (R). Mark the correct choice as:

(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

(b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).

(c) Assertion (A) is true but reason (R) is false.

(d) Assertion (A) is false but reason (R) is true.

Q. 1. Assertion (A): The muscular walls of ventricles are thicker than auricles.

Reason (R): This helps in preventing the back flow of blood.

Ans. Correct option : (c)

Explanation: Since ventricles have to pump blood into various organs, they have thicker muscular walls than atria do. Valves prevent back flow of blood.

Q. 2. Assertion (A): In human heart, there is no mixing of oxygenated and deoxygenated blood.

Reason (R): Valves are present in the heart which allows the movement of blood in one direction only.

Ans. Correct option : (b)

Explanation: There is no mixing of oxygenated and deoxygenated blood due to presence of inter-auricular and inter- ventricular septum. On the other hand, valves are present in the heart which allows the movement of blood in one direction only.

Q. 3. Assertion (A): Valves are present in the arteries.

Reason (R): Arteries carry oxygenated blood from heart to different body parts except pulmonary artery.

Ans. Correct option : (d)

Explanation: Valves are absent in arteries, whereas it is present in veins, which prevent back flow of blood.

Q. 4. Assertion (A): Plants have low energy needs.

Reason (R): Plant bodies have large proportion of dead cells.

Ans. Correct option : (a)

Explanation: Because plants have a large proportion of dead cells in many tissues. So, their energy needs are low and they can afford to have slow transport system.

C Very Short Answer Type Questions

Q. 1. Veins are thin walled and have valves. Justify.

U [Board SQP, 2021]

Ans. Veins have thin walls because the blood is no longer under pressure and they have valves to ensure blood flow in one direction.

[CBSE Marking Scheme , 2021] **1**

AI **Q. 2. Name the component of blood which transport:**

(i) Food, carbon dioxide and nitrogenous wastes

(ii) Oxygen. AE [Board Term I, 2016]

Ans. (i) Plasma

(ii) Haemoglobin present in RBCs. ½ + ½

Q. 3. Name the process of loss of water in the form of vapour from the aerial parts of the plants.

R [Board Term I, 2016]

Ans. Transpiration [CBSE Marking Scheme, 2016] **1**

AI **Q. 4. Name the tissues which (i) transport soluble products of photosynthesis in plants, (ii) transport water and minerals in a plant.**

R [Board Term I, 2014]

Ans. (i) Phloem **(ii)** Xylem. ½ + ½

Short Answer Type Questions-I — 2 marks each

Q. 1. In birds and mammals the left and right side of the heart are separated. Give reasons.

U [CBSE SQP, 2020] **2**

Ans. The separation keeps oxygenated and deoxygenated blood from mixing allowing a highly efficient supply of oxygen to the body. This is useful in animals that have high energy needs (birds and mammals) which constantly use energy to maintain their body temperature.

[CBSE Marking Scheme, 2020] **2**

Q. 2. Explain how water and minerals are transported in plants? U [Board Term I, 2015]

Ans. Water and minerals are transported through xylem cells from soil to the leaves. The xylem cells of root, stem and leaves are interconnected to form a conducting channel that reaches all parts of the plant. The root cells take ions from the soil. This creates a concentration difference between ions of roots and soil. Therefore, there is a steady movement of water into xylem. An osmotic pressure is created and water and minerals are transported from one cell to the other cell due to osmosis.

On the other hand, there is a continuous loss of water due to transpiration. This creates a suction pressure, which results in absorption of water into xylem cells of roots.

@PROCBSE JOIN NOW

Q. 3. Name the material transported by the following:
(i) Xylem
(ii) Pulmonary artery
(iii) Pulmonary veins
(iv) Phloem. A

Ans. (i) Xylem: Transport water and minerals in plants. ½

(ii) Pulmonary artery: Transport deoxygenated blood from heart to lungs. ½

(iii) Pulmonary veins: Transport oxygenated blood from lungs to heart. ½

(iv) Phloem: Transport synthesised food in plants. ½

Short Answer Type Questions-II — 3 marks each

AI **Q. 1. Write three types of blood vessels. Give one important feature of each.**

R [CBSE Board Delhi, Set- I, 2019]

Ans. (i) Arteries: No valves / thick walled / carry oxygenated blood / carry blood away from heart.

(ii) Veins: Presence of valves / thin walled / carry deoxygenated blood / carry blood towards heart.

(iii) Capillaries: Very fine / mixed blood / found in tissues / sites for material exchange. **1+1+1**

[CBSE Marking Scheme, 2019]

Q. 2. Define the term transpiration. Design an experiment to demonstrate this process.

R [CBSE Board, Delhi, Set- I, 2019]

Ans. Transpiration: Loss of water in vapour form through the surface of leaf / stomata of leaf / aerial parts of the plant. **1**

Experiment setup:

- Take a potted plant and water it.
- Cover the plant / branch with a transparent plastic sheet.
- Place it in bright sunlight for half an hour.
- Moisture in the form of droplets is observed inside the plastic sheet.

[CBSE Marking Scheme, 2019] ½ × 4

Detailed Answer:

The loss of water in the form of vapour from the aerial parts of the plant is known as *transpiration*.

Experiment to demonstrate transpiration:

Requirements: Two small pots, soil, a green plant, a stick of same height as of green plant and plastic sheets.

Method:

(i) Take two small pots of approximately equal size having equal amount of soil.

(ii) One should have a plant and place a stick in another pot.

(iii) Cover the soil in both the pots with a plastic sheet so that moisture cannot escape by evaporation.

(iv) Cover both the sets with a separate plastic sheet and place in bright sunlight for half an hour.

Observation: Drop of water appear on the inner side of polythene sheet in the pot with a green plant. Whereas no such drops appear in the pot with a stick.

Result: As water drops appear only in the pot with a green plant, it can be concluded that water drops appeared due to transpiration. While the pot with stick does not have any drop as no plant was present. **1+2**

COMMONLY MADE ERROR

➲ Sometimes it is hard for examiner to figure out that what student is trying to say in their answers as students use complex language.

ANSWERING TIP

➲ Always be specific and give clear and complete answers. Incomplete and vague answers must be pointed out.

Q. 3. List two types of the transport system in human beings and write the functions of any one of these.

R [Board Outside Delhi, Set- II, 2019]

Ans. (i) Blood circulatory system ½

(ii) Lymphatic system / lymph or tissue fluid ½

Functions of blood circulatory system:

(i) Transport of oxygen

(ii) Transport of digested food

(iii) Transport of carbon dioxide

(iv) Transport of nitrogeneous waste

(v) Transport of salts

Functions of lymphatic system:

(i) Carries digested and absorbed fat

(ii) Drains extra fluid from tissue (extra cellular space) back into the blood. **1 × 2**

Note: Two functions of any one of the transport system to be given.

[CBSE Marking Scheme, 2019]

@PROCBSE

AI **Q. 5. Define transpiration. State its two functions.**

R [Board Outside Delhi Set, 2019]

Ans. The loss of water in the form of vapour from the aerial parts/leaves/stems is known as *transpiration*. **1**

Functions:

(i) It helps in the absorption and upward movement of water.

(ii) Movement of dissolved minerals from root to leaves.

(iii) It helps in the temperature regulation or cooling of the plant. **(Any two points)1 + 1**

[CBSE Marking Scheme, 2019]

Q. 6. (a) What is translocation? Why is it essential for plants?

(b) Where do the substances in plants reach as a result of translocation?

R [Board Outside Delhi, Set-I, 2019]

Ans. (a) The transport of soluble products of photosynthesis (food or glucose) from one part to the other parts of the plant. To provide food to all parts of the plant.

(b) Root, fruits, seeds and other growing organs/parts of the plant. **(Any two)**

[CBSE Marking Scheme, 2019] **2**

Detailed Answer:

(a) Translocation is the process of movement of materials from leaves to all other parts of the plant body. It is essential for the transfer of products of metabolic processes, particularly photosynthesis from leaves to other parts of the plant.

(b) As a result of translocation, the substances in plants reach to the storage organs such as roots, fruits and seeds and to growing organs. **2 + 1**

AI **Q. 7. Write three points of differences between artery and vein.** R [Board Term I, 2016]

Ans.

S. No.	Artery	Vein
(i)	Wall is thick.	Wall is thin.
(ii)	Valves absent.	Valves present.
(iii)	Blood flows from heart to different organs.	Blood flows from different organs to heart.
(iv)	The flow of blood is fast, jerky and with great pressure.	The flow of blood is slow, steady and with less pressure.

(Any three) 1 + 1 + 1

[CBSE Marking Scheme, 2016]

Q. 8. (i) Mention the site of exchange of material between the blood and surrounding cells.

(ii) Draw a schematic representation of transport and exchange of oxygen and carbon dioxide.

C [Board Term I, 2016]

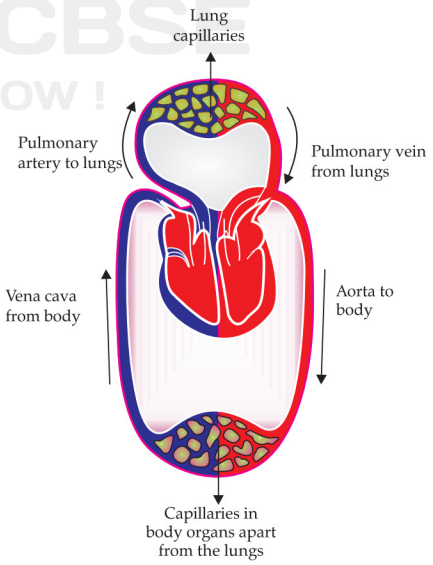
Ans. (i) Capillaries

(ii) Diagram. [CBSE Marking Scheme, 2016] **3**

Detailed Answer:

(i) Capillaries.

(ii)



Schematic representation of transport of exchange of oxygen & carbon dioxide

Long Answer Type Questions — 5 marks each

Q. 1. (a) Write the correct sequence of steps followed during journey of oxygen rich blood from lungs to various organs of human body.

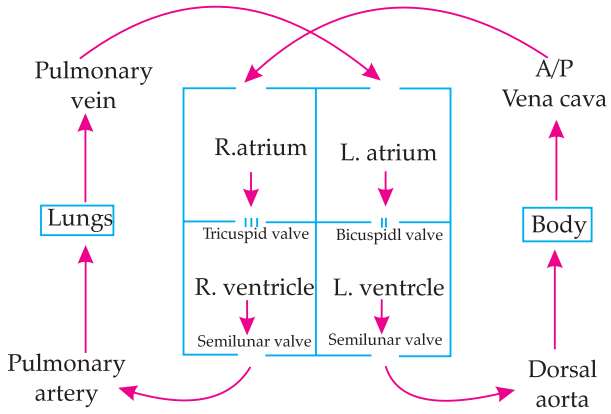
(b) What happens when the system of blood vessels develop a leak? A [O.D., Delhi I, 2020]

Ans. (a)

Lungs → (Pulmonary vein) → Left sides of the heart atrium → Ventricle → Aorta → Body organs

@PROCBSE JOIN NOW !

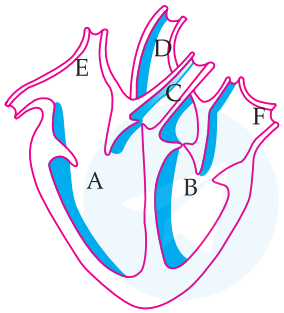
@PROCBSE



(b) The leaked blood flows into surrounding tissues leading to accumulation of blood. This condition is known as hematoma. **3+2=5**

AI **Q. 2. (i) Identify any two parts from the above diagram which carry oxygenated and deoxygenated blood.**

(ii) Explain the process of double circulation with the help of a flow chart.



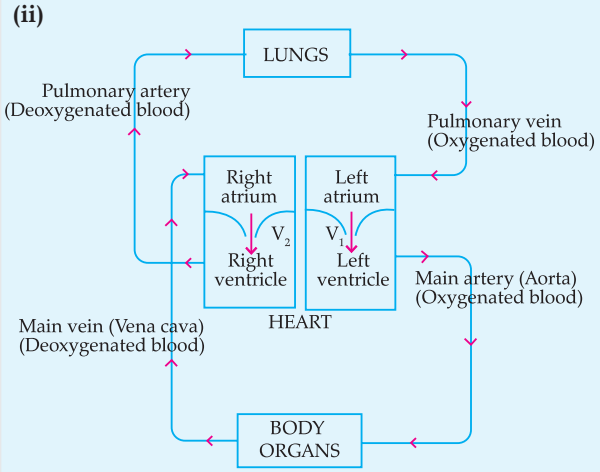
R [Board SQP, 2020]

Ans. (i) Oxygenated: B/D/F [B= left ventricle/D=Aorta/F=left auricle/Pulmonary vein]

Deoxygenated: A / C / E [A= Right ventricle / C= Pulmonary artery/E=Right auricle/Vena cava]

½ + ½+ ½ + ½

(ii)



V_1 = Bicuspid valve/Mitral valve

V_2 = Tricuspid valve

(1 mark should be deducted if the arrows are not correctly marked) [CBSE Marking Scheme, 2020] **2 + 3**

COMMONLY MADE ERROR

- Some students forget labelling after drawing the diagram.

ANSWERING TIP

- Practice drawing neat, and well-labelled diagram of human heart. Incorrect labelling may deduct your marks.

Q. 3. (a) Mention any two components of blood.

(b) Trace the movement of oxygenated blood in the body.

(c) Write the function of valves present in between atria and ventricles.

(d) Write the structural difference between the composition of artery and veins.

U [CBSE Delhi & O.D. Set 2018]

Ans. (a) Plasma, red blood cells, white blood cells, platelets **(Any two) 2**

(b) Lungs → Left side of the heart → aorta → body organs **1**

(c) Prevent back flow of blood. **1**

(d) Artery has thick elastic wall and vein is thin walled/ valves are present in the veins and not in arteries.

[CBSE Marking Scheme, 2018] **1**

Q. 5. (a) Mention any two components of blood.

(b) Trace the movement of oxygenated blood in the body.

(c) Write the function of valves present in between atria and ventricles.

(d) Write one structural difference between the artery and veins.

R [CBSE Delhi & O.D. Set, 2018]

Ans. (a) Blood components :

(i) Plasma consists mostly of water, with proteins, ions, nutrients, and wastes mixed in.

(ii) Red blood cells are responsible for carrying oxygen and carbon dioxide.

(iii) Platelets are responsible for blood clotting.

(iv) White blood cells are part of the immune system and defence system of body. **(Any two) 1**

(b) Path of movement of oxygenated blood in the body:

(i) Pulmonary Vein (oxygenated blood)

(ii) Left Atrium (oxygenated blood)

@PROCBSE JOIN NOW !

@PROCBSE

(iii) Left Ventricle (oxygenated blood)
(iv) Aorta (oxygenated blood)
(v) Arteries → Arterioles → Capillaries (oxygenated blood)
(vi) Tissues and cells (oxygen is released and carbon dioxide is picked up) **2**

(c) A heart valve normally allows blood to flow in only one direction through the heart. **1**

(d) Arteries have thick, elastic, muscular walls whereas veins have thin walls with few elastic fibres. Veins have one-way valves whereas arteries do not have any valves. **1**

TOPIC - 4
Excretion

Revision Notes

Scan to know more about this topic
Excretion in Plants

Excretion in Human

- During excretion, the harmful metabolic nitrogenous wastes generated are removed from the body.
- Nephrons are the basic filtration units of kidneys. They carry out filtration, selective reabsorption and tubular secretion to form urine in kidney, which is then passed out through the urethra, via the ureters and urinary bladder.
- Each kidney contains many filtration units called as *nephrons*.
- Nephrons are made up of a cluster of thin walled capillaries called *glomerulus* which is associated with a cup like structure called as *Bowman's capsule* and the long tube which terminates through this capsule.
- The renal artery brings oxygenated blood to the kidneys along with the nitrogenous wastes like urea and uric acid and many other substances.
- The blood gets filtered through the glomerulus and this filtrate enters the tubular part of nephron.
- As this filtrate moves down the tubular part, glucose, amino acids, salts and excess of water gets selectively reabsorbed by the blood vessels surrounding tubules.
- **The amount of water re-absorbed depends upon:**
  (a) How much excess of water is there in the body and,
  (b) How much nitrogenous wastes need to be excreted out.
- The fluid now flowing in the tubular part is urine, which gets collected in collecting ducts of nephrons.
- These collecting ducts together leave the kidney at a common point by forming the ureter.
- Each ureter drains the urine in the urinary bladder where it is stored until the pressure of expanded bladder leads to an urge to pass it out through urethra.
- This bladder is a muscular structure which is under nervous control.
- 180 litres of filtrate is formed daily but only 2 litres is excreted out as urine so the rest is reabsorbed in the body.
- In case of kidney failure, haemodialysis is the process of purifying blood by an artificial kidney.
- **Excretion in plants:** In plants, excretion of oxygen, CO_2 and water takes place through stomata by the process of transpiration.

Scan to know more about this topic
Excretion in Human

Mnemonics

Concept: Kidneys functions WET BREAD

Mnemonics: WET BREAD

Interpretation:

W – maintaining **W**ATER balance
T – TOXIN removal
R - Renin Formation
A – maintaining **A**CID-base balance
E – ELECTROLYTE balance
B – BLOOD Pressure control
E – ERYTHROPOIETIN making
D – Vitamin **D** metabolism.

@PROCBSE

How is it done on the GREENBOARD?

Q.1. Name one nitrogenous waste present in urine. What is the basic filtration unit of kidney called? How is the amount of urine produced regulated ? 3

Solution:

Step I: Nitrogenous waste present in urine is uric acid or urea.

Step II : The basic filtration unit of kidney is nephron.

Urine production is regulated by :

Step III : Amount of excess water in the body.

Step IV: Amount of dissolved wastes that need to be excreted.

Objective Type Questions — 1 mark each

A Multiple Choice Questions

Q. 1. The filtration units of kidneys are called

(a) ureter **(b) urethra**

(c) neurons **(d) nephrons**

Ans. Correct option : (d)

Explanation : Nephrons are the structural and functional unit of kidney that serve in filtration, reabsorption and secretion. Ureters are small muscular tubes that extend from the kidney and carry urine into the urinary bladder. The urethra is a canal that carries urine from bladder and expels it out of body. Neurons are structural and functional unit of nervous system.

Q. 2. The kidneys in human beings are a part of the system for

(a) nutrition **(b) respiration**

(c) excretion **(d) transportation.**

Ans. Correct option : (c)

Explanation : In human beings, the kidneys are a part of the system for excretion.

Q. 3. Match the words of Column (A) with that of Column (B)

S. No.	Column (A)		Column (B)
A	Phloem	(i)	Excretion
B	Nephron	(ii)	Translocation of food
C	Veins	(iii)	Clotting of blood
D	Platelets	(iv)	Deoxygenated blood

Ans.

S. No.	Column (A)	Column (B)	Explanation
A	Phloem	(ii)	Phloem helps in translocation of food
B	Nephron	(i)	Nephron helps in excretion
C	Veins	(iv)	Veins carry deoxygenated blood
D	Platelets	(iii)	Platelets helps in clotting of blood

B Assertions and Reasons Type Questions

Directions: In the following questions, a statement of assertion (A) is followed by a statement of reason (R). Mark the correct choice as:

(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

(b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).

(c) Assertion (A) is true but reason (R) is false.

(d) Assertion (A) is false but reason (R) is true.

Q. 1. Assertion (A): Human body produces highly toxic substances, which if not eliminated may cause the death.

Reason (R): Excretory substance removes nitrogenous waste from the body.

Ans. Correct option : (b)

Explanation: The biological process which involves the removal of harmful metabolic wastes from the body is called *excretion*. If these harmful wastes are not removed from the body, then it may cause the death of the organism.

Q. 2. Assertion (A): Excretory unit of kidneys are nephrons.

@PROCBSE JOIN NOW !

@PROCBSE

Reason (R): It has no role in secretion of urine.

Ans. Correct option : (c)

Explanation: Nephrons are the basic filtration unit of kidneys. They carry out filtration, selective reabsorption and tubular secretion to from urine in kidneys, which is then passed out through the urethra, via the ureters and urinary bladder.

Q. 3. Assertion (A): Haemodialysis can save the life of patients with kidney failure.

Reason (R): Waste products like urea can be removed from the blood by haemodialysis.

Ans. Correct option : (a)

Explanation: In case of kidney failure, haemodialysis is the process of purifying blood (or removing waste products like urea) by an artificial kidney. This can save the life of the patient.

Q. 4. Assertion (A): In humans, major amount of water is absorbed by the tubular part of nephron.

Reason (R): Absorption of water depends on the dissolved waste to be excreted from the body.

Ans. Correct option : (b)

Explanation: Major amount of water is selectively re-absorbed by the tubular part of nephron in humans. It depends on the amount of excess water present in the body and dissolved waste to be excreted from the body.

C Very Short Answer Type Questions

Q. 1. Mention the respiratory unit of lungs and excretory unit of kidneys. R **[Board Term I, 2015] [DDE, 2017]**

Ans. Respiratory unit of lungs — Alveoli

Excretory unit of kidneys — Nephrons ½+½

Q. 2. How is the amount of urine produced regulated? **[NCERT]**

Ans. The amount of urine produced depends on the amount of excess water and dissolved wastes present in the body. Some other factors such as habitat of an organism and hormone such as Antidiuretic hormone (ADH) also regulates the amount of urine produced. **1**

AI **Q. 3. What is micturition?**

Ans. It is the expulsion of urine from the body. **1**

Short Answer Type Questions-I — 2 marks each

Q. 1. What is excretion? How do unicellular organisms remove their wastes? U

Ans. The biological process which involves the removal of harmful metabolic wastes from the body is called excretion. **1**

Unicellular organisms remove their waste by simple diffusion. **1**

Q. 2. List two major steps involved in the formation of urine and state in brief their functions. U

Ans. Filtration: Nitrogenous waste such as urea or uric acid are removed from the blood (capillaries).

Reabsorption: Glucose, amino acids, salts and major amount of water are selectively re-absorbed. **1 + 1**

Q. 3. Write two major components of human urine. R

Ans. The two major component of human urine are:

(i) Urea, **(ii)** Uric acid. **1 + 1**

Short Answer Type Questions-II — 3 marks each

Q. 1. Mention the pathway of urine starting from the organ of its formation. Name four substances which are re-absorbed from the initial filtrate in the tubular part of the nephron. AE **[Board Term I, 2016]**

Ans. Kidney → Ureters → Urinary bladder → Urethra. Glucose, amino acids, salts and major amount of water. **[CBSE Marking Scheme 2016] 1 + 2**

Detailed Answer:

The pathway of urine starting from the organ of its formation is:

Kidney → Ureters → Urinary bladder → Urethra.

The four substances re-absorbed from initial filtrate are:

(i) Amino acid **(ii)** glucose **(iii)** salts **(iv)** major amount of water. **1 + 2**

AI **Q. 2. Name one nitrogenous waste present in urine. What is the basic filtration unit of kidney called? How is the amount of urine produced regulated?** U **[Board Term I, 2016]**

Ans. Nitrogenous waste present in urine is uric acid or urea.

The basic filtration unit of kidney is nephron.

Urine production is regulated by:

(i) amount of excess water in the body.

(ii) amount of dissolved wastes that need to be excreted. **1 + 1 + 1**

Q. 3. How do leaves of plants help in excretion? U

Ans. (i) Many plants store waste materials in the vacuoles of mesophyll cells and epidermal cells. When old

@PROCBSE JOIN NOW

@PROCBSE

leaves fall, the waste materials are excreted along with the leaves.

(ii) Gaseous waste is removed through stomata in leaves.

(iii) Excess of water is also excreted from the plant body through the stomatal pores. The process of elimination of water is called transpiration. **3**

Long Answer Type Questions — 5 marks each

Q. 1. (a) Name the organs that form the excretory system in human beings.

(b) **Describe in brief how urine is produced in human body.** U [Delhi I, 2020]

Ans. (a) Human excretory system comprises: a pair of kidneys, a pair of ureters, a urinary bladder and a urethra.

(b) **Urine formation involves three steps:**

(i) Glomerular filtration: Nitrogenous wastes, glucose, water, amino acids filter from the blood into Bowman's capsule of the nephron.

(ii) Tubular reabsorption: Useful substances from the filtrate are re-absorbed back by capillaries surrounding the nephron.

(iii) Secretion: Urea, extra water and salts are secreted in the tubule which open up into the collecting duct and then into the ureter. **2+3**

Q. 2. (a) How do leaves of plants help in excretion? Explain briefly.

(b) Describe the structure and function of a nephron. U [O.D. II, 2020]

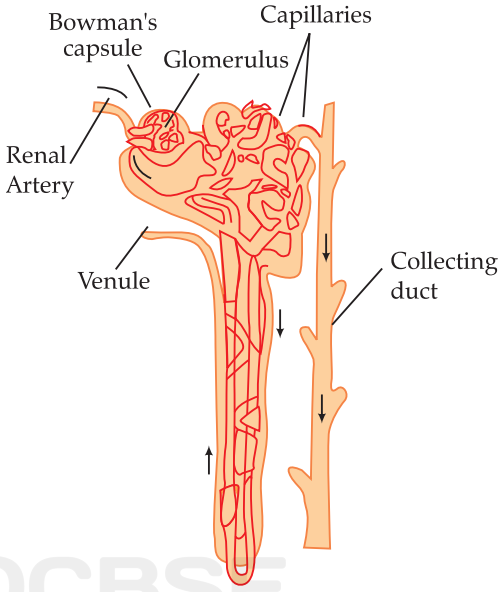
Ans. (a) Leaves of plants helps in excretion in many ways:

(i) Excess of water in plants is removed by the process of transpiration and guttation.

(ii) Carbon dioxide and oxygen that can be considered as waste products of respiration and photosynthesis respectively are excreted out with the help of stomata present on leaves.

(iii) Leaves help in excretion through a process called abscission that is falling of yellow leaves. By the help of this process, plants get rid off toxins etc.

(b) Structure of a Nephron: Each kidney contains many filtration units called as nephrons. Nephrons are made up of cluster of thin walled capillaries called glomerulus which is associated with a cup like structure called Bowman's capsule and the long tube which terminates through this capsule. The artery which takes blood to the glomerulus is called afferent arteriole and the one receiving blood from the glomerulus is called efferent arteriole.



Functioning of a Nephron:

- The blood enters the kidney through the renal artery, which branches into many capillaries associated with glomerulus.
- The water and solute are transferred to the nephron at Bowman's capsule.
- In the proximal tubule, some substances such as amino acids, glucose, and salts are selectively re-absorbed and unwanted molecules are added in the urine.
- The filtrate then moves down into the loop of Henle, where more water is absorbed.
- From here, the filtrate moves upwards into the distal tubule and finally to the collecting duct. Collecting duct collects urine from many nephrons.
- The urine formed in each kidney enters a long tube called ureter. From ureter, it gets transported to the urinary bladder and then into the urethra. **2+3=5**

AI **Q. 3. (a) Define excretion.**

(b) Name the basic filtration unit present in the kidney.

(c) Draw excretory system in human being and label the following organs of excretory system which perform following functions:
(i) form urine
(ii) is a long tube which collects urine from kidney
(iii) store urine until it is passed out.

C [CBSE Delhi, O.D., Set 2018]

@PROCBSE

Ans. (a) Process involved in removal of harmful nitrogenous wastes from the body. **1**

(b) Nephron. **1**

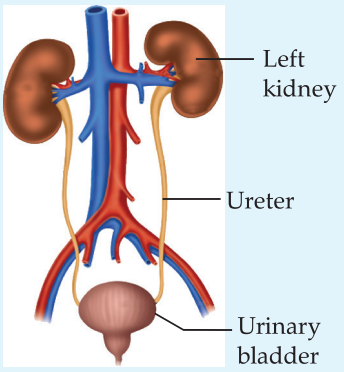
(c) Diagram of Human Excretory System.

Labelling of the following parts:

(i) Kidney

(ii) Ureter

(iii) Urinary bladder



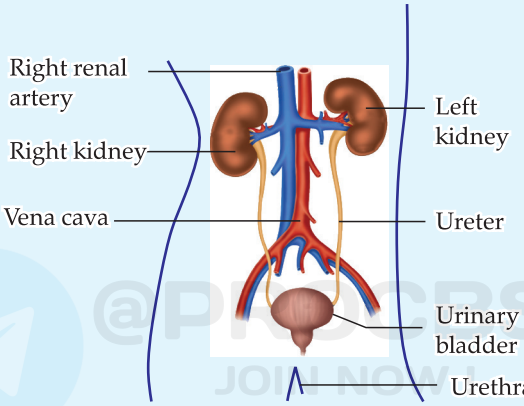
[CBSE Marking Scheme, 2018] **3**

Q. 4. (a) Draw a diagram of human excretory system and label the following parts on it:

(i) Right Renal Artery (ii) Vena cava. (iii) Urinary bladder (iv) Left kidney

(b) List two vital functions of kidney. C [Board Term I, 2015; Board Term I, 2016]

Ans. (a)



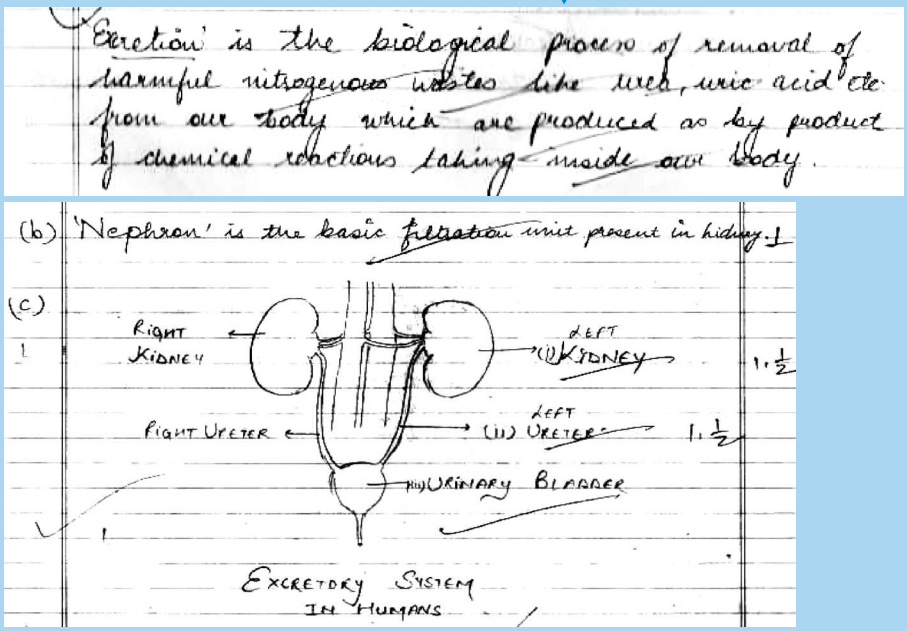
3

(b) Vital functions of kidney:

(i) To regulate right amount of water in body.

(ii) Helps in filtering out nitrogenous waste like urea from blood. [CBSE Marking Scheme, 2016] **2**

Topper Answer, 2018



@PROCBSE

Visual Case-based Questions — 4 marks each

Q. 1. Read the given passage and answer any of the four questions from (a) to (e).

Sanjana is suffering from a frequent stomach pain and vomiting. She went to the Doctor. The doctor asked her to go for an ultrasound. In the report, a stone was found in her gall bladder. Doctor asked her to remove the gall bladder by operation. But she was reluctant to go for the operation.

(a) The role played by gall bladder in human body is
- **(i) To store bile** **(ii) To secrete bile**
- **(iii) To emulsify fats** **(iv) To digest fats**

(b) Removal of gall bladder
- **(i) affects the person's health**
- **(ii) Has no effect on the person's health**
- **(iii) Effects the secretion of bile**
- **(iv) Effects the digestion of proteins**

(c) Which of the following statement is correct about bile?
- **(i) It helps in emulsification of fat.**
- **(ii) It helps in digestion of carbohydrates**
- **(iii) It helps in absorption of digested food.**
- **(iv) It helps in egestion of undigested food.**

(d) Which part of alimentary canal receives bile from the liver?
- **(i) Stomach** **(ii) Small intestine**
- **(iii) Large intestine** **(iv) Oesophagus**

(e) What is the function of bile salt in the intestine?
- **(i) Activator of lipase**
- **(ii) Emulsifier**
- **(iii) Co factor of cholesteryl esterase**
- **(iv) Inhibitor of lipid absorption**

Ans. (a) (i) Gall bladder stores bile.

(b) (ii) The removal of gall bladder has no effect on person's health.

(c) (i) It helps in emulsification of fat.

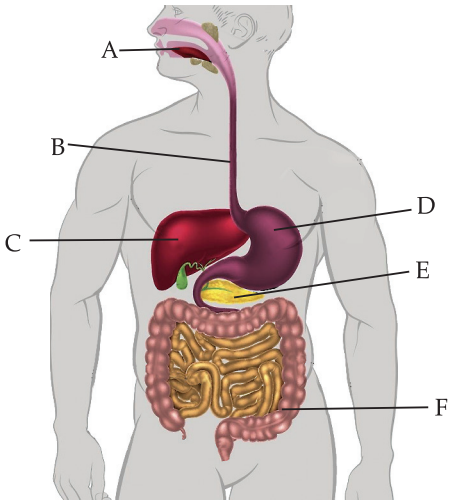
(d) (ii) Bile is dark green or a yellowish brown fluid which is produced by the liver and comes to the small intestine through hepato-pancreatic duct.

1+1+1+1

(e) (ii) The food coming from the stomach is acidic and has to be made alkaline for the pancreatic enzyme to act. Bile juice accomplishes this. Bile salts breakdown larger globules of fats into smaller globules increasing the efficiency of enzyme action.

1+1+1+1

Q. 2. The given diagram is of human digestive human. Study the diagram and answer any of the four questions from (a) to (e).



(a) Which of these correctly represent the labels B, C, D and E?
- **(i) B- Oesophagus, C- Liver, D- Stomach, E- pancreas**
- **(ii) B- Pancreas, C- Oesophagus, D- Liver, E- Stomach**
- **(iii) B- Stomach, C- Pancreas, D- Oesophagus, E- Liver**
- **(iv) B- Liver, C- Stomach, D- Pancreas, E- Oesophagus**

(b) The secretion that is released by label C is:
- **(i) Bile** **(ii) Pepsin**
- **(iii) Saliva** **(iv) Gastric juice**

(c) How it helps in fat digestion ?

(d) The digestion of food starts in
- **(i) A** **(ii) D**
- **(iii) E** **(iv) F**

(e) In case of diarrhoea, which major process does not takes place normally in region F?
- **(i) Absorption of food**
- **(ii) Absorption of water**
- **(iii) Secretion of hormones**
- **(iv) Removal of waste material**

Ans. (a) (i) B- Oesophagus, C- Liver, D- Stomach, E- pancreas

(b) (i) Label C represents liver. Liver secretes bile, which is stored in gall bladder.

(c) Role of bile in fat digestion: (i) It makes the acidic food alkaline to facilitate the action of enzyme lipase on it. (ii) Bile salts breakdown fats present in food into small globules for enzymes to act.

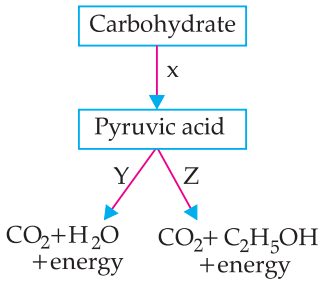
(d) (i) The digestion of food starts in A *i.e.* mouth.

(e) (ii) Absorption of water is not occurring normally in region F (Large intestine). **1+1+1+1**

Q. 3. Study the given flow chart and answer any of the four questions from (a) to (e).

@PROCBSE JOIN NOW !

@PROCBSE



(a) Identify X, Y and Z.
(i) X-Glycolysis, Y-Anaerobic, Z-Aerobic
(ii) X-Krebs's cycle, Y-Aerobic, Z-Anaerobic
(iii) X-Glycolysis, Y-Aerobic, Z-Anaerobic
(iv) X-Glycolysis, Y-Aerobic, Z-Krebs's cycle

(b) The process X occurs in _____ and Y occurs in _____ part of cell.
(i) Mitochondria and cytoplasm respectively
(ii) Cytoplasm and mitochondria respectively
(iii) Both takes place in cytoplasm
(iv) Both takes place in mitochondria

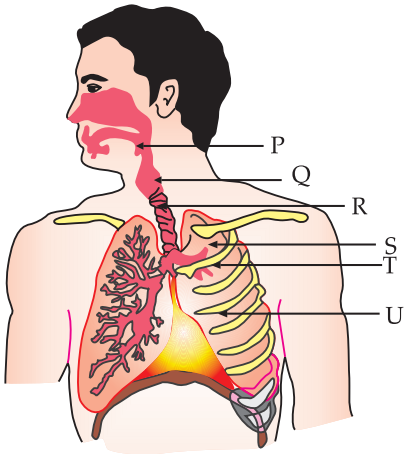
(c) In which of these organisms the process Z takes place?
(i) Bacteria **(ii) Humans**
(iii) Yeast **(iv) *Spirogyra***

(d) In which part of human body do the process Z takes place?
(i) In muscle cells **(ii) In kidneys**
(iii) In liver cells **(iv) In leydig's cell**

(e) Where does aerobic respiration occur in a cell ?
(i) Mitochondria **(ii) Cytoplasm**
(iii) Nucleus **(iv) Plastid**

Ans. (a) (iii) X - Glycolysis, Y - Aerobic, Z – Anaerobic
(b) (ii) Cytoplasm, mitochondria respectively.
(c) (iii) Yeast
(d) (i) In muscle cells
(e) (i) Aerobic respiration occurs in mitochondria of the cell. **(Any four) 1+1+1+1**

Q.4. Study the diagram of human respiratory system and answer any of the four questions (a) to (e).



(a) The balloon like structures present in 'S' is:
(i) Nephron **(ii) Alveoli**
(iii) Bronchi **(iv) Bronchiole**

(b) Which of these organ is surrounded by cartilaginous rings?
(i) P **(ii) Q**
(iii) R **(iv) S**

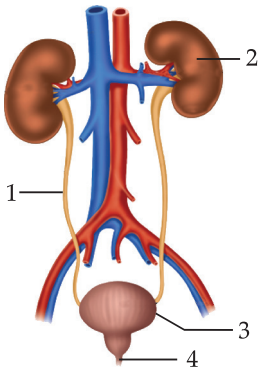
(c) Which of these statements is incorrect regarding human lungs?
(i) It is the secondary organ for respiration.
(ii) It is located on the two sides of heart.
(iii) The membrane that encloses lungs is pleural membrane.
(iv) The alveolar epithelium of lungs is non-ciliated epithelium.

(d) Trachea is divided into two smaller tubes called _____.
(i) Bronchi **(ii) Bronchioles**
(iii) Larynx **(iv) Alveoli**

(e) Which of these is the function of balloon like structure present in lungs?
(i) Exchange of gases
(ii) Absorption of nutrients
(iii) Transport of food
(iv) Removal of waste materials

Ans. (a) (ii) Alveoli
(b) (iii) R (Trachea)
(c) (i) It is not the secondary organ for respiration.
(d) (i) Trachea is divided into two smaller tubes called bronchi.
(e) (i) Alveoli contain an extensive network of blood vessels which exchange gases. They increase surface area of absorption of gases. **(Any four) 1+1+1+1+1**

Q. 5. The given diagram represents the structure of a human excretory system. Study the diagram and answer any of the four questions from (a) to (e).



(a) Identify the part 1 in excretion.
(i) Kidney **(ii) Ureter**
(iii) Urethra **(iv) Nephron**

(b) Which of these is the structural and functional unit of part 2?
(i) Alveoli **(ii) Nephron**
(iii) Neuron **(iv) None of these**

(c) What will happen, if one kidney of a person is removed?

(d) The urge to urinate can be controlled. Give reason.

(e) Choose the correct path of urine in our body:
(i) kidney → ureter → urethra → urinary bladder
(ii) kidney → urinary bladder → urethra → ureter
(iii) kidney → ureters → urinary bladder → urethra
(iv) urinary bladder → kidney → ureter → urethra

@PROCBSE JOIN NOW

Ans. (a) (ii) Part 1 is ureter. It transports urine from kidney to urinary bladder.

(b) (ii) Nephron.

(c) If one kidney of a person is removed, he can still survive and remain normal because of same function performed by the other kidney.

(d) As the bladder is muscular, it is under the control of nervous system. Hence, we can control the urge to urinate.

(e) (iii) Kidneys are the paired organs where urine formation takes place. Small muscular tube, called as ureter, extend from kidneys and carries urine to urinary bladder. The urethra is a small tube that extends from the urinary bladder to an external opening. (Any four)**1+1+1+1**

Q. 6. Read the given passage and answer any of the four questions from (a) to (e).

Oxygen-rich blood from the lungs comes to the thin-walled upper chamber of the heart on the left. The left upper chamber (A) then relaxes. It then contracts and the blood is allowed to enter the next chamber (B), as it expands. When the muscular left lower chamber of heart contracts the blood is pumped out to the body via aorta.

Deoxygenated blood reaches from the body to the upper chamber on the right side of heart (C) and it expands. As this part contracts, the corresponding lower chamber (D) dilates. This transfers the blood to right ventricle, which in turn pumps it to the lungs for oxygenated.

(a) Which of these correctly represents the label A, B, C and D in the above passage?

(i) A- Left atrium, B- Left Ventricle, C- Right atrium, D- Right ventricle

(ii) A- Right ventricle, B- Left atrium, C- Left Ventricle, D- Right atrium

(iii) A- Right atrium, B- Right ventricle, C- Left atrium, D- Left ventricle

(iv) A- Left ventricle, B- Right atrium, C- Right ventricle, D- Left atrium

(b) Which chambers of human heart contain blood?

(i) A and B **(ii) A and C**

(iii) C and B **(iv) C and D**

(c) What is the correct route of blood in a human?

(i) A → B → Lungs → C → D

(ii) A → B → D → C → Lungs

(iii) C → D → B → A → Lungs

(iv) C → D → Lung → A → B

(d) What prevents backflow of blood inside the heart during contraction?

(i) Valves in heart

(ii) Thick muscular walls of ventricles

(iii) Thin walls of atria

(iv) All of the above

(e) Assertion (A): Human heart does not allow mixing of oxygen rich blood with carbon dioxide rich blood.

Reason (R): Human heart has different chambers.

(i) Both A and R are true and R is correct explanation of the assertion.

(ii) Both A and R are true but R is not the correct explanation of the assertion.

(iii) A is true but R is false.

(iv) A is false but R is true.

Ans. (a) A- Left atrium, B- Left Ventricle, C- Right atrium, D- Right ventricle

(b) (i) A (Left atrium) and B (Left ventricle) contain oxygenated blood from lungs.

(c) (iv) C (Right atrium) → D (Right ventricle) → Lungs → A (Left atrium) → B (Left ventricle).

(d) False. Valves prevent the back flow of blood inside the heart during contraction of heart chambers (atria or ventricles). **(Any four) 1+1+1+1**

Q. 7. Read the passage and answer any of the four questions from (a) to (e).

Some experiments were carried out using *Croton* sp. plants to understand the process of photosynthesis. It was observed that the leaves of the plant exposed to light for longer duration accumulated more starch. However, due to presence of pre-formed starch in the leaves, it was difficult to find the net productivity on a fixed exposure to light source. Therefore, it was necessary to obtain starch free leaves in the plant before starting the experiment.

(a) Which of the following would help obtain starch free leaves in the plant?

(i) Expose the leaves to blue light for 48 hours before starting the experiment.

(ii) Keep the plant in dark for about 48 hours before starting the experiment.

(iii) Remove starch from the leaves by exosmosis, 48 hours before starting the experiment.

(iv) Keep the leaves to red light for 48 hours before starting the experiment.

(b) After a period of illumination, the leaves were boiled in alcohol to make them colourless. Which of the following could be used to test the end product stored in the leaves?

(i) Cobalt chloride paper

(ii) Litmus paper

(iii) Iodine solution

(iv) Copper sulphate solution

(c) Some of the starch free leaves were coated with wax on both the surfaces. The plant was maintained under normal environmental conditions. At the end of the experiment, the wax coated leaves are likely to show _____.

(i) Accumulation of more water.

(ii) Wilting of the wax coated leaves.

(iii) Increase in sucrose accumulation.

(iv) Decrease in number of chloroplasts

(d) During the morning hours, using a fine blade, an incision was made to the leaves such that the phloem tissue was cut open. Analysis of the liquid oozing out was found to contain high amount of:

(i) Xylose **(ii) Ribose**

(iii) Sucrose **(iv) Galactose**

(e) Why plants coated with vaseline or wax do not remain healthy for a long time? Give any two reasons.

Ans. (a) (ii) The starch free leaves can be obtained by keeping the plant in dark, so that already present starch is utilized in 48 hrs.

@PROCBSE JOIN NOW!

@PROCBSE

(b) (iii) Starch presence can be tested by adding iodine solution which gives bluish black colour of starch – iodine mixture.

(c) (ii) Wilting occurs due to wax blocks the transpiration so water transportation inhibits.

(d) (iii) The transport of glucose, occurs in the form of sucrose, in phloem therefore, when cell sap oozes out, liquid contains sucrose.

(e) These plants will not remain healthy for a long time because:

(i) They will not get oxygen for respiration.

(ii) They will not get carbon dioxide for photosynthesis.

(iii) Upward movement of water and minerals would be hampered due to lack of transpiration. (Any four) **1+1+1+1**

Know the Terms

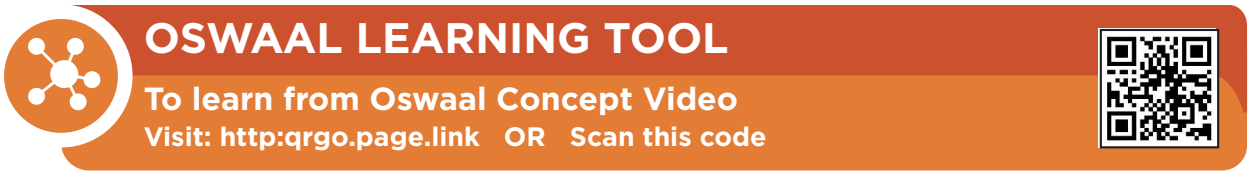
- **Metabolism**: It is the sum total of all the chemical reactions which occur in a living being due to interaction amongst its molecules. It has two components: Anabolism (build-up reactions) and Catabolism (breakdown reactions).
- **Photosynthesis**: It is the process of synthesis of organic food from inorganic raw materials like CO_2 + H_2O with the help of light energy, inside chlorophyll containing cells.
- **Photolysis**: Photolysis of water is photocatalytic splitting of water into its components, hydrogen and oxygen.

$$2H_2O \longrightarrow 4H^+ + 4e^- + O_2$$

- **Peristalsis:** It is a wave of contraction behind the food and expansion in the region of contained food that occurs in the alimentary canal for pushing the food from anterior to posterior ends.
- **Succus Entericus:** It is the name of digestive juice of small intestine, also known as intestinal juice.
- **Emulsification:** Emulsification of fats is conversion of large fat pieces into very fine fat globules.
- **Phagocytosis:** It is the process of ingestion of solid food particle by a cell or unicellular organism.
- **Circumvallation:** This is the method of intake of food when *Amoeba* comes in contact with a food particle or prey, it throws pseudopodia all around the prey. The tips of encircling pseudopodia fuse and the prey comes to lie in a vesicle or phagosome.
- **Cutaneous Respiration:** It is the mode of exchange of respiratory gases that occurs through skin.
- **Branchial Respiration:** It is the respiration performed with the help of gills.
- **Aerobic respiration:** It is the step-wise complete oxidative breakdown of respiratory substrate into carbon dioxide and water with the help of oxygen that act as terminal oxidant.
- **Glycolysis (EMP pathway):** It is the first step of breakdown of respiratory substrate which occurs in cytoplasm and produces two molecules of pyruvate from a molecule of glucose.
- **Kreb's Cycle:** It is a cyclic series of metabolic reactions of aerobic respiration that occur inside mitochondria.
- **Haemolysis:** It is the process of destruction of RBC's.
- **Serum:** It is a whitish watery fluid that is squeezed out from contracting blood clot.
- **Diapedesis:** It is the crawling of white blood corpuscles out of blood capillaries into surrounding tissues.
- **Pulse:** It is a repeated throb felt in a superficial artery of the body due to forceful pumping of the blood. It depends on the rate of heart beat.
- **Ascent of Sap:** It is the upward movement of absorbed water or sap from root to the top of the plant. It occurs through xylem.
- **Excretion:** It is the process of throwing out of waste products and other harmful chemicals from the body.
- **Nephric Filtrate:** It is the fluid passed out of glomerulus due to ultrafiltration in the malpighian capsule of a nephron.
- **Ultrafiltration:** It is the filtration under pressure of small particles, solutes and solvents, through a finely porous membrane.

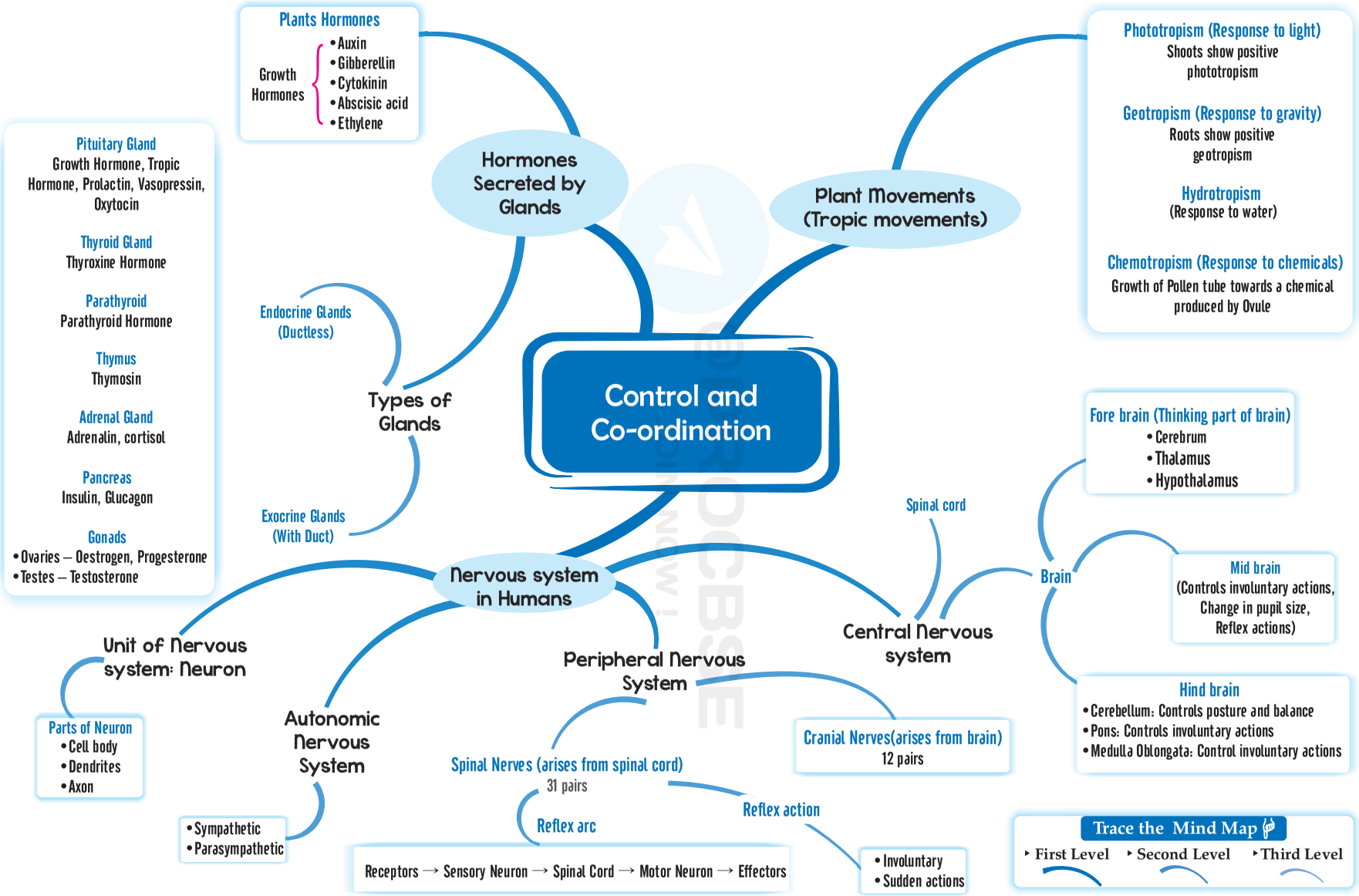
@PROCBSE

- **Glomerulus:** It is a bunch of fine blood vessels or capillaries present in the depression of Bowman's capsule where ultrafiltration occurs.
- **Micturition:** It is the expulsion of urine from the body.
- **Bowman's Capsule:** It is a broad, blind, cup-shaped, proximal end of a nephron in which glomerulus is located for ultrafiltration.
- **Osmoregulation:** It is the maintenance of a fixed osmotic concentration of body fluids by controlling the amount of water and salts.



@PROCBSE
JOIN NOW !

@PROCBSE


Control and Co-ordination
Hormones Secreted by Glands
Plants Hormones
Growth Hormones
• Auxin
• Gibberellin
• Cytokinin
• Abscisic acid
• Ethylene
Types of Glands
Endocrine Glands (Ductless)
Pituitary Gland
Growth Hormone, Tropic Hormone, Prolactin, Vasopressin, Oxytocin
Thyroid Gland
Thyroxine Hormone
Parathyroid
Parathyroid Hormone
Thymus
Thymosin
Adrenal Gland
Adrenalin, cortisol
Pancreas
Insulin, Glucagon
Gonads
• Ovaries – Oestrogen, Progesterone
• Testes – Testosterone
Exocrine Glands (With Duct)
Plant Movements (Tropic movements)
Phototropism (Response to light)
Shoots show positive phototropism
Geotropism (Response to gravity)
Roots show positive geotropism
Hydrotropism
(Response to water)
Chemotropism (Response to chemicals)
Growth of Pollen tube towards a chemical produced by Ovule
Nervous system in Humans
Unit of Nervous system: Neuron
Parts of Neuron
• Cell body
• Dendrites
• Axon
Autonomic Nervous System
• Sympathetic
• Parasympathetic
Peripheral Nervous System
Spinal Nerves (arises from spinal cord)
31 pairs
Reflex arc
Receptors → Sensory Neuron → Spinal Cord → Motor Neuron → Effectors
Reflex action
• Involuntary
• Sudden actions
Cranial Nerves(arises from brain)
12 pairs
Central Nervous system
Spinal cord
Brain
Fore brain (Thinking part of brain)
• Cerebrum
• Thalamus
• Hypothalamus
Mid brain
(Controls involuntary actions, Change in pupil size, Reflex actions)
Hind brain
• Cerebellum: Controls posture and balance
• Pons: Controls involuntary actions
• Medulla Oblongata: Control involuntary actions
Trace the Mind Map
First Level
Second Level
Third Level

@PROCBSE

CHAPTER

7

CONTROL AND CO-ORDINATION

Syllabus

Tropic movements in plants; Introduction of plant hormones; Control and co-ordination in animals; Nervous system; Voluntary, involuntary and reflex action; Chemical co-ordination: Animal hormones.

Trend Analysis

List of Concepts	2018	2019	2020
Tropic movements and introduction of plant hormones	1 Q (2 M)	1 Q (5 M)	
Control and coordination in animals	1 Q (3 M)	Or 1 Q (5 M)	1 Q (4 M)

@PROCBSE JOIN NOW !

TOPIC - 1
Control and Co-ordination in Plants

Revision Notes

TOPIC - 1
Control and Co-ordination in Plants
Page No. 151

TOPIC - 2
Control and Co-ordination in Animals
Page No. 156

Introduction

- All the living organisms respond and react to the changes that happen in the environment around them.
- The changes in the environment to which the organisms respond and react are called stimuli such as light, heat, cold, smell, touch etc.
- Both plants and animals respond to stimuli but in a different manner.
- **Plant Movements:** The movements of the individual plant parts or organs of a plant like shoot, root, etc, are due to some external stimuli like light, force of gravity, chemical substance, water, etc.
- **Tropic Movement:** It is the directional growth movement of a plant organ in response to an external stimulus. Growth towards the stimulus is positive tropism and growth away from the stimulus is negative tropism.

Scan to know more about this topic

Co-ordination in plants

@PROCBSE

- **Hormones:** They are the chemical substances which co-ordinate and control the activities of living organisms and also their growth. They are functional in small concentration at the site remote from their production.
- **Plant Hormones:** They are the chemical compounds produced naturally in plants which control the growth and other physiological functions at a site, far away from the place of secretion. They are required in very small amount and help to coordinate growth, development and responses to the environment.
- **Main plant hormones are:**

Scan to know more about this topic

Movement in plants

(a)	**Auxins**	Synthesized at shoot tip. Helps the cells to grow longer. Involved in tropic movements of plants.
(b)	**Gibberellin**	Helps in the growth of the stem.
(c)	**Cytokinins**	Promotes cell division. Present in greater concentration in fruits and seeds.
(d)	**Abscisic Acid**	Inhibits growth. Cause wilting of leaves. Also called as Stress hormone.
(e)	**Ethylene ($H_2C=CH_2$)**	A gaseous hormone which helps in artificial ripening of fruits.

Scan to know more about this topic

Plant hormones

Mnemonics

Concept: Plant Hormone

Mnemonics: A CAGE

Interpretation:
A - Auxins
C - Cytokinins
A - ABA
G - Gibberellins
E - Ethylene

How is it done on the GREENBOARD?

Q. What are plant hormones? Name the plant hormones responsible for the following :
(a) Growth of stem
(b) Promotion of cell division
(c) Inhibition of growth
(d) Elongation of cells 3

Solution:

Step I: Chemical substances which help the plant to coordinate growth and development are known as plant hormones.

Step II: Auxin/Gibberellins

Step III: Cytokinins

Step IV: Abscissic acid

Step V: Auxins / Gibberellins

@PROCBSE JOIN NOW !

@PROCBSE

Objective Type Questions — 1 mark each

A Multiple Choice Questions

Q. 1. Which of the following is a plant hormone?

(a) Insulin **(b) Oestrogen**

(c) Thyroxine **(d) Cytokinin**

[NCERT Exemp.]

Ans. Correct option: (d)

Explanation: Cytokinin is a plant hormone. It is primarily involved in performing cell division in plant roots, shoot system. Insulin, oestrogen, and thyroxine are animal hormones secreted from pancreas, ovary, and thyroid gland, respectively.

Q. 2. The growth of tendril in pea plants is due to:

(a) effect of light

(b) effect of gravity

(c) rapid cell divisions in tendrillar cells that are away from the support

(d) rapid cell divisions in tendrillar cells in contact with the support

Ans. Correct option: (c)

Explanation: When a tendril touches an object, then the side in contact with object grows slowly than its other side, (*i.e.*, rapid cell divisions in cells that are away from the support). This causes the tendril to bend towards the object by growing towards it, wind around object and cling to it.

Q. 3. The movement of sunflower in accordance with the path of sun is due to

(a) phototropism **(b) geotropism**

(c) chemotropism **(d) hydrotropism**

Ans. Correct option: (a)

Explanation: The movement of a plant part in response to light is called phototropism.

Q. 4. The growth of pollen tubes towards ovules is due to

(a) hydrotropism **(b) chemotropism**

(c) geotropism **(d) phototropism**

[NCERT Exemp.]

Ans. Correct option: (b)

Explanation: The growth of pollen tubes towards ovules is due to chemotropism. Chemotropism is the movement of a plant part towards a chemical. **For example:** During the process of fertilization, the movement of pollen tube towards ovule occurs due to secretion of a sugary chemical in the ovary.

B Assertions and Reasons Type Questions

Directions: In the following questions, a statement of assertion (A) is followed by a statement of reason (R). Mark the correct choice as:

(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

(b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).

(c) Assertion (A) is true but reason (R) is false.

(d) Assertion (A) is false but reason (R) is true.

Q. 1. Assertion (A): Plant hormones are growth regulator.

Reason (R): Growth regulators promote or inhibit the growth.

Ans. Correct option: (a)

Explanation: Plant hormones are chemical compound produced naturally in plants which control the growth and other physiological functions at a site far away from the place of secretion. It is required in very small amount. It can have promoting or inhibiting effect on a process and hence, it is a growth regulator. **1**

Q. 2. Assertion (A): Auxins are synthesised in the growing tips of the plant.

Reason (R): Auxin concentration is highest at the tip of the root.

Ans. Correct option: (c)

Explanation: Auxin, a plant hormone is synthesized at the growing tips of the plant i.e. tip of coleoptile. in buds and in growing tips of leaves and roots. The concentration of auxin found at the tip of the root is significantly lower than the concentration found at the tip of coleoptiles. **1**

Q. 3. Assertion (A): Phototropism is caused by auxin.

Reason (R): When light is coming from one side of the plant, auxin diffuses towards the shady side of the shoot.

Ans. Correct option: (a)

Explanation: Auxin promotes phototropism. When light is coming from one side of the plant, auxin diffuses towards the shady side of the shoot. This concentration of auxin stimulates the cells to grow longer on the side of the shoot which is away from light. Thus, the plant appears to bend towards light while growing. **1**

Q. 4. Assertion (A): Abscisic acid is a stress hormone.

Reason (R): Stimulation of ABA occurs in adverse conditions.

Ans. Correct option: (a)

Explanation: Abscisic is a stress hormone as its production is stimulated by drought, water logging and other adverse (stressful) conditions. **1**

Q. 5. Assertion (A): Gibberellins induce internodal growth in dwarf plant varieties.

Reason (R): Gibberellins when applied to normal plants, it increases the length of the plant.

@PROCBSE JOIN NOW

Ans. Correct option: (c)

Explanation: Gibberellin induces internodal growth and overcome the phenotypic expression of dwarfism in certain plants. It has little or no effect when they are applied to the normal plant. **1**

Q. 6. Assertion (A): Phototropism is a directional growth movement.

Reason (R): It occurs in the direction of light.

Ans. Correct option: (a)

Explanation: Phototropism is the movement or bending of light towards light. Hence, it is known as directional growth movement. **1**

C Very Short Answer Type Questions

Q. 1. What is meant by tropic movement? R

Ans. Plant growth movements in response to stimuli from a particular direction are called tropic movements. The direction of movement is always related to the direction of stimulus. **1**

AI **Q. 2. Define phototropism.** R

Ans. Movement or bending of the shoot towards the direction of light is called phototropism. **1**

Q. 3. Give one example of chemotropism. R

Ans. The growth of pollen tube towards ovule. **1**

Q. 4. State the main functions of abscisic acid in plants. R

Ans. Abscisic acid inhibits the growth of plants. **1**

Short Answer Type Questions-I — 2 marks each

Q. 1. How does auxin promote phototropism? U [CBSE, 2016]

Ans. Auxin, a plant hormone synthesised at the shoot tips, helps the cells to grow longer. When light is coming from one side of the plant, auxin diffuses towards the shady side of the shoot.

This concentration of auxin stimulates the cells to grow longer on the side of the shoot which is away from light. Thus, the plant appears to bend

towards light while growing. This phenomenon is called phototropism. **1+1**

[CBSE Marking Scheme, 2016]

Detailed Answer:

Auxin is the hormone which is usually synthesised in the young tip of roots and shoots. When light is coming from one side of the plant, it diffuses away from light towards the shady side of the shoot which stimulates the cells to grow longer, resulting in the bending of shoot towards light, thus auxin promotes phototropism. **2**

Q. 2. Name the plant hormone that promotes growth. How do these hormones bring about phototropism in the shoots of a plant? U

Ans. Plant hormone that promotes growth is Auxin.

Light falls on one side of the plant, auxin diffuse towards shady side of the shoot.

Auxin stimulates the cells to grow longer on shady side.

Plant appears to bend towards light. **1 + 1**

Q. 3. How do the shoot and roots of a plant respond to the pull of earth's gravity? A

Ans. In geotropism, the roots of the plant always grow downwards while the shoots always grow upwards, away from the earth. **1+1**

Short Answer Type Questions-II — 3 marks each

Q. 1. (a) What is tropism?

(b) How do auxins promote the growth of a tendril around a support? U [Delhi, Set- III, 2020]

Ans. (a) Tropism: It is the directional growth movement of a plant organ in response to an external stimulus.

(b) Auxins produced in the shoot tip move downwards in the plant. These auxins cause cell elongation in the growing tissues. In the tendrils, auxins move away from the point of contact with the supporting object. More growth occurs on the side away from the support. As a result of unequal growth on the two sides, the tendril coils around the support. **1+2=3**

Q. 2. What are plant hormones? Name the plant hormones responsible for the following:

(a) Growth of stem

(b) Promotion of cell division

(c) Inhibition of growth

(d) Elongation of cells R [Board Delhi, Set- I, 2019]

Ans. Plant hormones – Chemical substances which help the plant to coordinate growth and development. **1**

(a) Auxins/ Gibberellins

(b) Cytokinins

(c) Abscisic Acid / ABA

(d) Auxins/ Gibberellins **½ × 4**

[CBSE Marking Scheme, 2019]

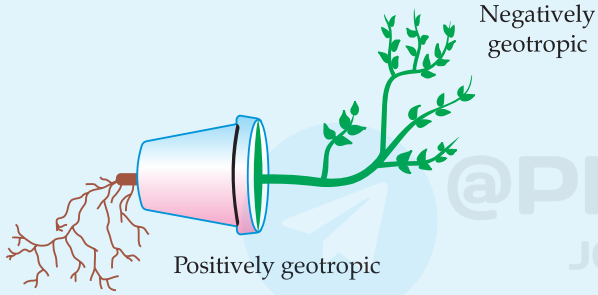
Q. 3. Explain giving reasons the bending of the shoot tip of a plant towards light source coming from one side of the plant. R [CBSE SQP, 2019]

@PROCBSE JOIN NOW !

Ans. When growing plant shoot tip detects light a hormone called auxin is synthesised in the shoot tip which is sensitive to light.
Auxin diffuses towards the shady side of the stem. It stimulates the growth of cells on the shady side of the plant which causes bending of the plant to the other side.
This gives the appearance that the stem of the plant bends in the direction of light. **3**
[CBSE Marking Scheme, 2019]

AI **Q. 4. What is geotropism? Draw a labelled diagram of a potted plant showing positive geotropism and negative geotropism.**
U [CBSE Comptt. Set-I, II, III-2018]
OR
Define positive geotropism and negative geotropism. Give one example of each.
R [CBSE Term I, 2016]

Ans. The upward growth of shoots and downward growth of roots in response to the pull of earth's gravity is called geotropism.



[CBSE Marking Scheme, 2018] [3]

Detailed Answer:
The movement of plant part in response to gravity is called geotropic movement and the phenomenon involved is called geotropism.
When the tip of the stem grows away from the earth's gravitational forces, it is known as negative geotropism and when the root tips grow towards gravity, it is known as positive geotropism.
In the above figure, stem shows negative geotropism while roots show positive geotropism.

COMMONLY MADE ERROR

- Students often draw rough diagram without proper labelling.

ANSWERING TIP

- Lay stress on drawing correct and labelled diagrams. Make sure the lines are properly marked. Lines which are not properly marked will deduct your marks.

Q. 5. Give one example of following plants:
(a) Which is (i) positively phototropic and (ii) negatively geotropic.
(b) Which is positively hydrotropic as well as positively geotropic?
(c) Which synthesises auxin? R [CBSE Term I, 2015]

Ans. (a) (i) Positively phototrophic: Shoot
(ii) Negatively geotropic: Shoot
(b) Root
(c) Shoot tip [CBSE Marking Scheme, 2015] **a+1+1**

Long Answer Type Questions — 5 marks each

Q. 1. What is hydrotropism? Design an experiment to demonstrate this phenomenon.
U [CBSE Outside Delhi, Set-I, 2019]

Ans. The movement/response of part of plant (root) towards water 1
Experiment:
(i) Soak the seeds in water overnight. ½
(ii) Place moist cotton in a perforated petridish. ½
(iii) Put the soaked seeds in the petridish & place it on a beaker. **1**
(iv) Roots pass through pores and grow downwards. **1**
(v) After sometime roots will bend towards base of petridish having moisture. **1**
[CBSE Marking Scheme, 2019]

Detailed Answer:
Hydrotropism is the movement of a plant towards or away from water. *Example*: Plant roots bend towards the source of water.

Experiment to demonstrate hydrotropism:
Requirements: Bean seeds, a deep tray, sand water and a porous flower pot.
Procedure:
(i) Fill the tray (big enough to accommodate porous pot) with sand and insert some seeds in it.
(ii) Make a pit in the sand and place the porous pot in it.
(iii) Fill water in the porous pot.
(iv) Leave the arrangement for about a week.
Observation: After about a week, when seeds are taken out, it is observed that roots grow in the direction of the porous pot. This shows hydrotropism in roots. **1 + 4**

COMMONLY MADE ERROR

- Sometimes, students skip steps in writing the experiment.

@PROCBSE

ANSWERING TIP

➲ It is necessary to write all the steps of experiment in proper sequence.

AI **Q. 2. What are plant hormones? Give four different types of plant hormones and state their functions briefly.** [DDE 2017]
R [CBSE Term I, 2016]

Ans. The chemical compounds released by stimulated cells for control and coordination in plants are called plant hormones or phytohormones.

Auxin — Controls growth
Gibberellins — Helps growth in stem
Cytokinin — Promotes cell division
Abscisic acid — Inhibits growth, wilting of leaves

[CBSE Marking Scheme 2016] **1 + 4**

Q. 3. (a) Write the names and one function of each of any three growth hormones in plants.

(b) In the absence of muscle cells, how do plant cells show movement? U [CBSE Term-I, 2014]

Ans. (a) Three growth hormones in plants are:

(i) Auxin: It is synthesized in the young tip of roots and shoots. It promotes elongation and division of cell and root formation.

(ii) Gibberellins: They help in the growth of the stem.

(iii) Cytokinins: They promote cell division and delay leaf ageing.

(b) Plant cells shows two types of movements:

(i) Tropic movements are growth movements in response to an environment stimulus. This type of movement may occur in response to gravity (geotropism), light (phototropism), water (hydrotropism), chemical (chemotropism), etc.

(ii) Nastic movement are independent of the direction of stimulus. This type of movement may occur in response to chemicals, temperature, touch etc.

This shows that plant cell can show movements in response to different stimuli although they do not have muscle cells. **3 + 2**

TOPIC - 2
Control and Co-ordination in Animals

@PROCBSE JOIN NOW !

Revision Notes

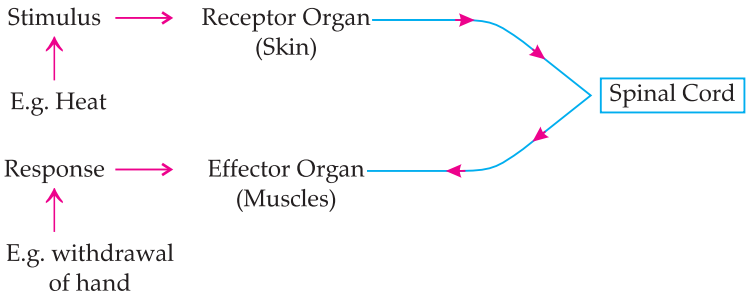
- Control and coordination is brought about in all animals with the help of two main systems: nervous system and endocrine system.
- **Nervous system:** It is the system of conducting tissues that receives the stimulus and transmits it to other parts of the body forming a network of nerves. It is involved in receiving information (sensation) and generating responses to that information (motor response).
- The units which make up the nervous system are called **nerve cells or neurons**.
- The **receptors** pass the information to the brain through a type of nerve cells called sensory neurons.
- Motor neurons transmits the information from the brain to the effector organs, mainly muscles and glands.
- **Nerve Impulse:** It is the information in the form of chemical and electrical signals passing through neurons. These impulses are carried by dendrites towards the cell body.
- **Synapse:** The point of contact between the terminal branches of axon of one neuron with the dendrite of another neuron is called synapse.
- **Voluntary Action:** These are the actions which need thinking and are performed knowingly *i.e.* these are controlled by conscious thought. *e.g.*,: Speaking to a friend, writing a letter etc.
- **Involuntary Action:** These are not under the control of the will of an individual and are automatic response to a stimulus which is not under the voluntary control of the brain. It occurs without the conscious choice of an organism. *e.g.*,: Touching a hot plate unknowingly.
- **Reflex action:** It is quick, sudden and immediate response of the body to a stimulus. e.g., Knee jerk, withdrawal of hand on touching hot object.
- **Reflex arc:** The pathway through which nerve impulse passes during reflex action is called reflex arc. *i.e.* it is pathway through which the reflex action occurs.

Scan to know more about this topic
Hormones

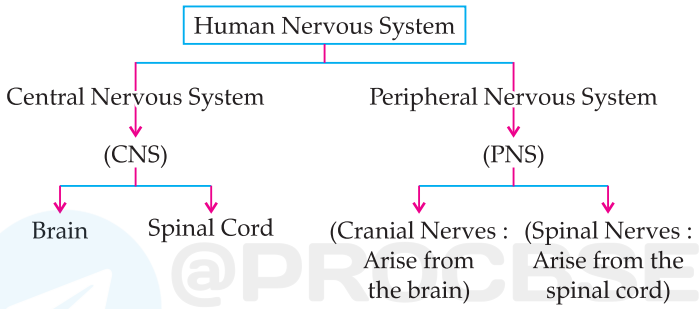
Scan to know more about this topic
Brain

Scan to know more about this topic
Reflex action

@PROCBSE



- **Response:** Responses are of three main types:
  - **(a) Voluntary:** Controlled by fore brain. e.g., talking, writing.
  - **(b) Involuntary:** Controlled by mid and hind brain. e.g., heartbeat, vomiting, respiration.
  - **(c) Reflex action:** Controlled by spinal cord. e.g., withdrawal of hand on touching a hot object.
- **Need of Reflex Actions:** In some situations such as touching a hot object, pinching etc. we need to act quickly, otherwise our body would be harmed. Hence, this response is generated from spinal cord instead of brain.
- **Human nervous system:** The nervous system of vertebrates (including humans) is divided into the central nervous system (CNS) and the peripheral nervous system (PNS).



- Human brain is the main coordinating centre of the body. It has three major parts: Forebrain, midbrain and hind brain.
  - **(a) Fore-brain:** It is the most complex or specialized part of the brain. It consists of cerebrum. The main functions of forebrain are as follows:
    - **(i)** Main thinking part of the brain.
    - **(ii)** Control the voluntary actions.
    - **(iii)** Store information (memory).
    - **(iv)** Receives sensory impulses from various parts of the body and integrate it.
    - **(v)** It is the centre associated with hunger.
  - **(b) Mid-brain:** Controls involuntary actions.
  - **(c) Hind-brain:** It has three parts:
    - **(i) Cerebellum:** Controls posture and balance, precision of voluntary actions. e.g., picking pen.
    - **(ii) Medulla:** Controls involuntary actions. e.g., blood pressure, salivation, vomiting.
    - **(iii) Pons:** Controls voluntary actions and helps in regulation of respiration.
- Spinal cord is a cylindrical structure and a part of the central nervous system. It is made up of nervous tissue that extends from medulla oblongata in the brain stem to the lumbar region of vertebral column. It functions primarily in the transmission of nerve signals.
- **Glands and hormones secreted by them:**

No.	Gland	Hormones	Functions	Target Site
1.	Hypothalamus	(i) Releasing hormones (RH) (ii) Growth inhibiting hormones	Regulates secretion of pituitary hormones.	Pituitary gland
2.	Pituitary Gland	(i) Growth hormone (GH)	Controls growth-dwarfism and gigantism.	Various body cells which undergo growth
3.	Thyroid Gland	(i) Thyroxin (ii) Triiodothyronine (iii) Thyrocalcitonin (TCT)	Regulate basal metabolic rate, RBC formation. Regulate Ca level.	Body tissues

@PROCBSE

4.	Adrenal Gland	(i) Adrenaline (ii) Nor adrenaline (iii) Corticoids	Increase alertness, pupillary dilation, piloerection, sweating and heart beat.	Body tissues
5.	Pancreas	(i) Insulin (ii) Glucagon	Regulates glucose homeostasis, stimulates glycogenesis, controls carbohydrate metabolism. Maintains glucose levels, stimulates gluconeogenesis.	Tissues
6.	Testis	(i) Testosterone (ii) Androgens	Plays a role in development of male reproductive tissues and promotes secondary sexual characters in male.	Male body tissues
7.	Ovary	(i) Estrogen (ii) Progesterone	Helps in development of female secondary sexual characters. Support pregnancy.	Female body tissues

Mnemonics

Concept: Reflex Arc

Mnemonics: RACEE forms Reflex Arc

Interpretation:
R-Receptor
A-Afferent or Sensory Nerve
C-Centre (Brain or Spinal cord)
E-Efferent or Motor Curve
E-Effector

@PROCBSE JOIN NOW !

How is it done on the GREENBOARD?

Q. Name the hormones by the following endocrine glands and specify one function of each :
(a) Thyroid (b) Pituitary
(c) Pancreas 3

Solution:

Step I: Thyroxine regulates carbohydrate, protein and fat metabolism.

Step II: Growth hormone regulates growth and development of body.

Step III: Insulin regulates/ decreases blood sugar level Or Glucagon, regulates / increases blood sugar.

Objective Type Questions — 1 mark each

A Multiple Choice Questions

Q. 1. In humans, the life processes are controlled and regulated by
(a) reproductive and endocrine system
(b) respiratory and nervous system
(c) endocrine and digestive system
(d) nervous and endocrine system [NCERT Exemp.]

Ans. Correct option: (d)

@PROCBSE

Explanation: In humans, the life processes are controlled and regulated by nervous and endocrine system. Both the systems work together to maintain the homeostasis.

Q. 2. Junction between two neurons is called
(a) cell junction.
(b) neuro muscular junction.
(c) neural joint.
(d) synapse. [NCERT Exemp.]

Ans. Correct option: (d)
Explanation: Synapse is a junction or gap across which a nerve cell can send an impulse to another neuron. Impulse is the signal that travels along the length of a nerve fibre and ends in the release of neuro-transmitters.

Q. 3. In a neuron, conversion of electrical signal to a chemical signal occurs at/in
(a) cell body. **(b) axonal end.**
(c) dendritic end. **(d) axon.**
[NCERT Exemp.]

Ans. Correct option: (b)
Explanation: In a neuron, conversion of electrical signal to a chemical signal occurs at axonal end. When an electrical signal reaches the axonal end of a neuron, it releases a chemical substance. This chemical diffuses towards the dendritic end of next neuron where it generates an electrical impulse or signal. Hence, the electrical signal is converted into a chemical signal at the axonal end. Since these chemicals are absent at the dendrite end of the neuron, the electrical signal cannot be converted into chemical signal.

Q. 4. In a synapse, chemical signal is transmitted from
(a) dendritic end of one neuron to axonal end of another neuron.
(b) axon to cell body of the same neuron.
(c) cell body to axonal end of the same neuron.
(d) axonal end of one neuron to dendritic end of another neuron. [NCERT Exemp.]

Ans. Correct option: (d)
Explanation: Synapse is a microscopic gap between two neurons where chemical signal is transmitted from axonal end of one neuron to dendritic end of another neuron.

Q. 5. Electrical impulse travels in a neuron from
(a) Dendrite → axon → axonal end → cell body.
(b) Cell body → dendrite → axon → axonal end.
(c) Dendrite → cell body → axon → axonal end.
(d) Axonal end → axon → cell body → dendrite.
[NCERT Exemp.]

Ans. Correct option: (c)
Explanation: Electrical impulse travels in a neuron from dendrites to axonal end. The dendrites pick up the impulses from receptor and pass them to the cell body and then along the axon to its end. At the axonal end, these impulses release neuro-transmitter that crosses the synapse and start a similar impulse in dendrite of the next neuron.

Q. 6. The brain is responsible for
(a) thinking.
(b) regulating the heart beat.
(c) balancing the body.
(d) all of the above. [NCERT Exemp.]

Ans. Correct option: (d)
Explanation: Brain is a part of central nervous system. It functions as a control centre of the nervous system.

B Assertions and Reasons Type Questions

Directions: In the following questions, a statement of assertion (A) is followed by a statement of reason (R). Mark the correct choice as:
(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).
(b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A),
(c) Assertion (A) is true but reason (R) is false.
(d) Assertion (A) is false but reason (R) is true.

Q. 1. Assertion (A): Units which make up the nervous system are called neurons.
Reason (R): Nerve impulses are carried by dendrites towards the cell body.

Ans. Correct option: (b)
Explanation: Both the statements are true. Nervous system is the system of conducting tissues that receives the stimulus and transmits it to other parts of the body forming a network of nerves. It is involved in receiving information (sensation) and generating responses to that information (motor response). The units which make up the nervous system are called nerve cells or neurons. Nerve impulses are always transmitted across a synapse from the axon terminals of one neuron to the dendrite /cell body of the next neuron.

Q. 2. Assertion (A): Nerve impulse is a one way conduction.
Reason (R): Nerve impulse is transmitted from dendrite to axon terminals.

Ans. Correct option: (c)
Explanation: Nerve impulses are always transmitted across a synapse from the axon terminals of one neuron to the dendrite / cell body of the next neuron but never in the reverse direction. Since, the neurotransmitter is present only in the axon terminals and not in the dendrite or cell body, it cannot be released from the dendrite or cell body even if the impulse reaches there.

Q. 3. Assertion (A): Our body maintains blood sugar level.
Reason (R): Pancreas secretes insulin which helps to regulate blood sugar levels in the body.

Ans. Correct option: (a)
Explanation: Pancreas secretes insulin which helps to regulate blood sugar levels in the body. If the

@PROCBSE

sugar level in blood rises, they are detected by the cells of the pancreas which respond by producing more insulin. As the blood sugar level falls, insulin secretion is reduced.

Q. 4. Assertion (A): Failure of secretion of growth hormone from an early age causes dwarfism in the patient.
Reason (R): Growth hormone stimulates the body growth and elongation of long bones.

Ans. Correct option: (a)
Explanation: Growth hormone is secreted by the anterior lobe of pituitary gland. It stimulates body growth. The failure of secretion of growth hormone from an early age causes dwarfism while excessive secretion of this hormone from childhood leads to gigantism.

Q. 5. Assertion (A): Males have more stature than females during puberty.
Reason (R): This is because of presence of thyroxin in the blood of females.

Ans. Correct option: (c)
Explanation: Males have more stature than females because of action of male sex hormone called testosterone, which is secreted by testis in males. Testosterone controls the development of secondary sexual characters in males.
Thyroxin increases the metabolic rate of the body and maintains BMR.

C Very Short Answer Type Questions

Q. 1. Name the two components of peripheral nervous system. R [CBSE Term I, 2016]

Ans. Cranial nerves arising from the brain and the spinal nerves arising from the spinal cord.
[CBSE Marking Scheme, 2016] **1**

Q. 2. Mention the part of the brain which controls the involuntary actions like blood pressure, salivation etc. R [CBSE Term I, 2016]

Ans. Medulla in the hindbrain.
[CBSE Marking Scheme, 2016] **1**

Q. 3. Name the hormones in humans which regulates carbohydrate, protein and fat metabolism in the body. Mention the site where it is synthesized.
U [CBSE Term I, 2016]

Ans. The hormone is thyroxin.
The site where it is synthesized is thyroid gland.
[CBSE Marking Scheme, 2016] **1**

Q. 4. Define feedback mechanism of hormones. R
Ans. The mechanism that controls the flow of hormones is called feedback mechanism of hormones. **1**

AI **Q. 5. Name two components of central nervous system in humans.** R
Ans. Brain and spinal cord. **[½ + ½]**

Q. 6. Name the largest cell present in the human body. R
Ans. Neuron. **1**

AI **Q. 7. Name the part of the brain which controls posture and balance of the body.** R
Ans. Cerebellum. **1**

Q. 8. Mention the part of the body where gustatory and olfactory receptors are located. R
Ans. Tongue and Nose. **[½ + ½]**

@PROCBSE JOIN NOW

Short Answer Type Questions-I — 2 marks each

Q. 1. Different parts of brain are associated with specific functions. Name the part of human brain which performs the following functions:
(a) Sensation of feeling full
(b) Vomiting
(c) Picking up a pencil
(d) Riding a bicycle
U [CBSE Comptt. Set-I, II, III-2018]

Ans. (a) Forebrain
(b) Medulla/ Hind Brain
(c) Cerebellum/ Hind Brain
(d) Cerebellum/ Hind Brain ½ + ½ + ½ + ½
[CBSE Marking Scheme, 2018]

Q. 2. Define neuron. Name the parts of neuron where:
(i) Information is acquired.
(ii) Impulse must be converted into chemical signal for onward transmission. U [CBSE Term-I, 2015]

Ans. The unit which makes up the nervous system is called neurons.
(i) End of dendrite tip of nerve cell.
(ii) Dendrite → cell body → axon to its ends. **1 + 1**

Q. 3. Name the parts of the brain that perform the following functions:
(i) Maintaining the posture and balance of the body.
(ii) Regulating blood pressure.
(iii) Sensation of hunger or feeling full.
(iv) Seeing R [CBSE Term-I, 2015]

Ans. (i) Cerebellum
(ii) Hind brain
(iii) Fore brain
(iv) Fore brain. ½+½+½+½

Q. 4. How does our body maintain blood sugar level? U

Ans. Pancreas secretes insulin which helps to regulate blood sugar levels in the body. If sugar level in blood rises, insulin stimulates the target cells to take up the extra glucose from the blood. **2**

@PROCBSE

Short Answer Type Questions-II — 3 marks each

Q. 1. A squirrel is in a scary situation. Its body has to prepare for either fighting or running away. State the immediate changes that take place in its body so that the squirrel is able to either fight or run?

A [Delhi- Set-I, 2020]

Ans. Adrenaline hormone will be secreted in the body as the squirrel is in scary situation. This will result in:

(i) Speeding up of heartbeat

(ii) Rise in blood pressure

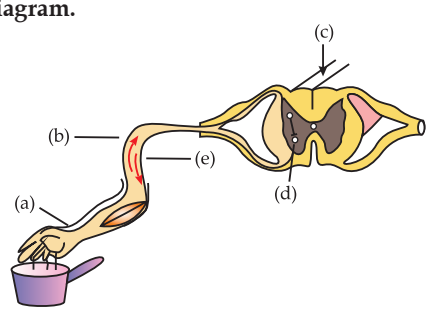
(iii) Release of more glucose in the blood. **1×3=3**

Q. 2. Why is chemical communication better than electrical impulses as a means of communication between cells in a multi-cellular organism?

U [Delhi, Set-I, 2020]

Ans. Chemical communication is better than electrical impulses because chemical communication is mediated through hormones which can diffuse to different regions of the body, thereby allowing cells to communicate even without interacting with each other. Moreover, this type of communication can be maintained at a steady rate and is easy to regulate. **3**

AI **Q. 3. Name the parts (a) to (e) in the following diagram.**



What is the term given to the sequence of events occurring in the diagram? U [Delhi, Set-III, 2020]

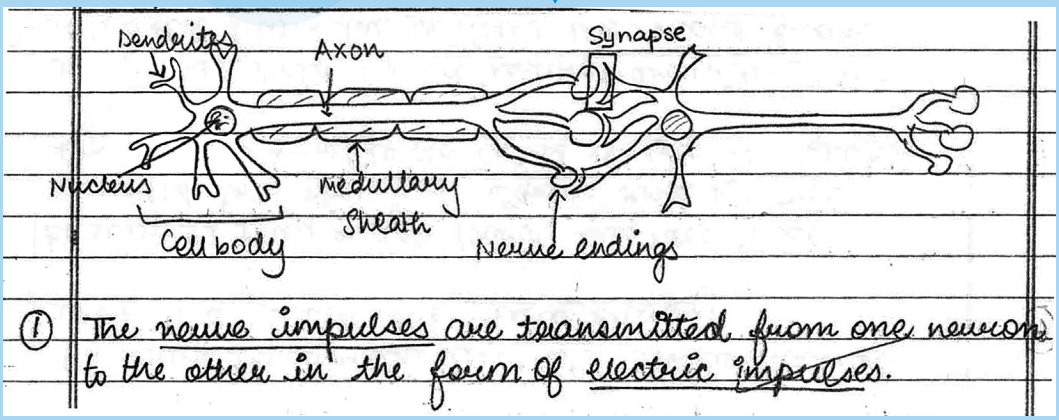
Ans. a- Receptor, b- Sensory neuron, c- Spinal cord, d- Relay neuron, e- Effector.

The term given to the sequence of events occurring in diagram is reflex arc. **2+1=3**

Q. 4. Why does the flow of signals in a synapse from axonal end of one neuron to dendritic end of another neuron take place but not in the reverse direction? Explain. U [CBSE Board 2019]

Topper Answer, 2019

Ans.

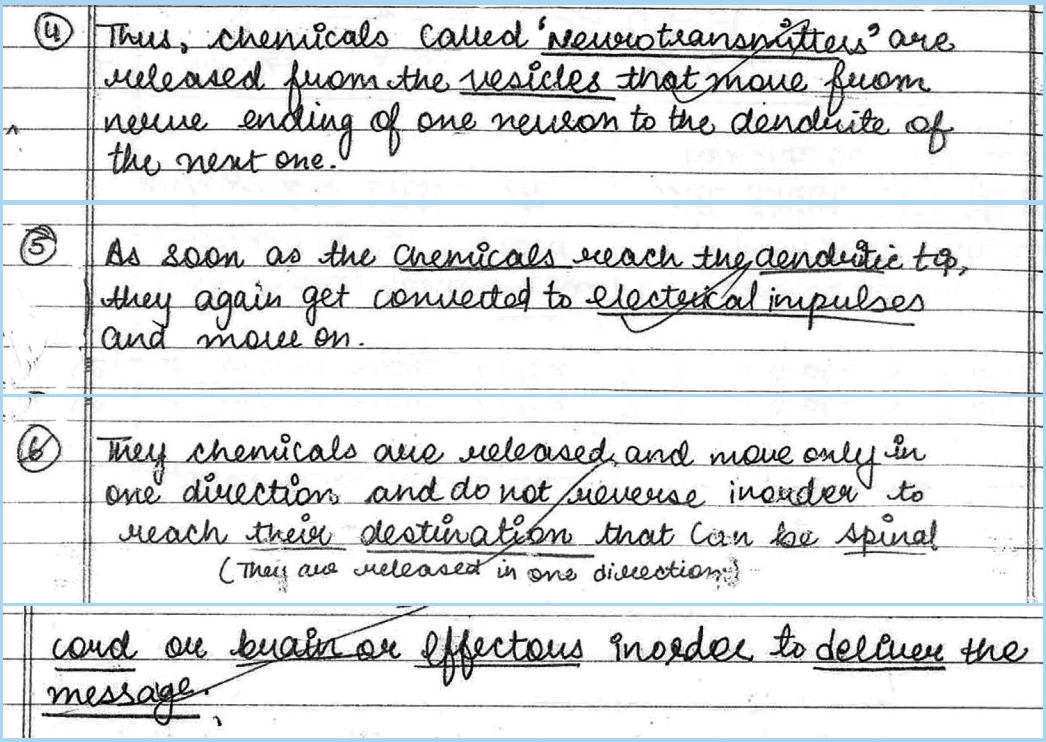


(1) The nerve impulses are transmitted from one neuron to the other in the form of electric impulses.

(2) They enter through the dendrites, move through axon and reach the nerve ending.

(3) As soon as they reach there, they need to be converted into chemical signals and electric signals are unable to cross the gap i.e. synapse.

@PROCBSE



Q. 5. Trace the sequence of events which occur when a bright light is focused on your eyes.

A [CBSE Board Delhi, Set- I, 2019]

Ans. Receptor cells of eyes/retina ⟶ Sensory neuron ⟶ Brain / CNS ⟶ Motor neuron ⟶ Eye muscles ⟶ Pupil contracts / Eye lids close/blink

(**Note:** If a child writes spinal cord in place of brain give full credit to him/her) ½ × 6

[CBSE Marking Scheme, 2019]

Detailed Answer:

When bright light is focused on our eyes, the photoreceptors generate electric impulses and pass it to the sensory neurons. They carry the stimuli to the spinal cord which transports the message to brain. The brain sends the response to the muscles of the eyelids to close by contracting the pupil.

Receptor → Sensory neuron → Spinal cord → Brain → Motor neuron → Eye → Contraction of eye muscles

Q. 6. What is feedback mechanism of hormonic regulation. Take the example of insulin to explain this phenomenon.

U [CBSE Board Delhi, Set-II, 2019]

Ans. Feedback mechanism: Mechanism by which the amount of any chemical increases or decreases resulting in secretion of the related hormone. **1**

Example: When sugar level rises, insulin secretion increases. **1**

When sugar level falls, insulin secretion reduces. **1**

[CBSE Marking Scheme, 2019]

Detailed Answer:

Feedback mechanism of hormonic regulation is the mechanism to control the timing and amount of hormone released so that they are secreted in precise quantities. If the sugar levels in blood rise, they are detected by the cells of the pancreas which respond by producing more insulin. As the blood sugar level falls, insulin secretion is reduced. **3**

Q. 7. Nervous and hormonal system together perform the function of control and coordination in human beings. Justify this statement with the help of an example. A [CBSE Board Delhi, Set- III, 2019]

Ans. For nervous and hormonal systems to control and coordinate in human beings, hypothalamus plays an important role in receiving the neural / nerve signals from brain and release hormones. **1**

E.g. In iodine deficiency, hypothalamus releases hormones to stimulate pituitary gland, it further sends stimulating hormone to thyroid gland to secrete thyroxine that regulates carbohydrate metabolism. **1 + 1**

[CBSE Marking Scheme, 2019]

Detailed Answer:

In human beings, nervous and hormonal system work together in controlling and coordinating various life processes in the body. Nervous system work by generation and transmission of electrical impulse while hormonal system works by secretion of chemical messengers called hormones. For e.g. when an emergency stimulus is detected by the nervous

@PROCBSE

system, the stimulus is received and analyzed by CNS that send message to effectors to provide proper response. At the same time, nervous system activates adrenal gland to release adrenaline that prepares body by increasing heat rate, blood pressure, respiration etc. Thus, both these systems work together to perform functions of control and coordination. **3**

Q. 8. Pertaining to endocrine system, what will you interpret if :

(i) You observe swollen neck in people living in the hills.

(ii) Over secretion of Growth Hormone takes place during childhood.

(iii) Facial hair develop in boys aged 13.

R **[CBSE SQP, 2018-19]**

Ans. (i) Less intake of Iodine (in the diet)

(ii) Will lead to gigantism

(iii) Timely secretion of testosterone.

[CBSE Marking Scheme, 2018-19] 3

Q. 9. Name the hormones by the following endocrine glands and specify one function of each:

(a) Thyroid

(b) Pituitary

(c) Pancreas

R **[CBSE Delhi/OD Set-2018]**

Ans. (a) Thyroxine regulates carbohydrate, protein and fat metabolism/ controls metabolism for balance of body growth.

(b) Growth hormone regulates growth and development of body (or any other correct answer)

(c) Insulin, regulates/decreases blood sugar level.

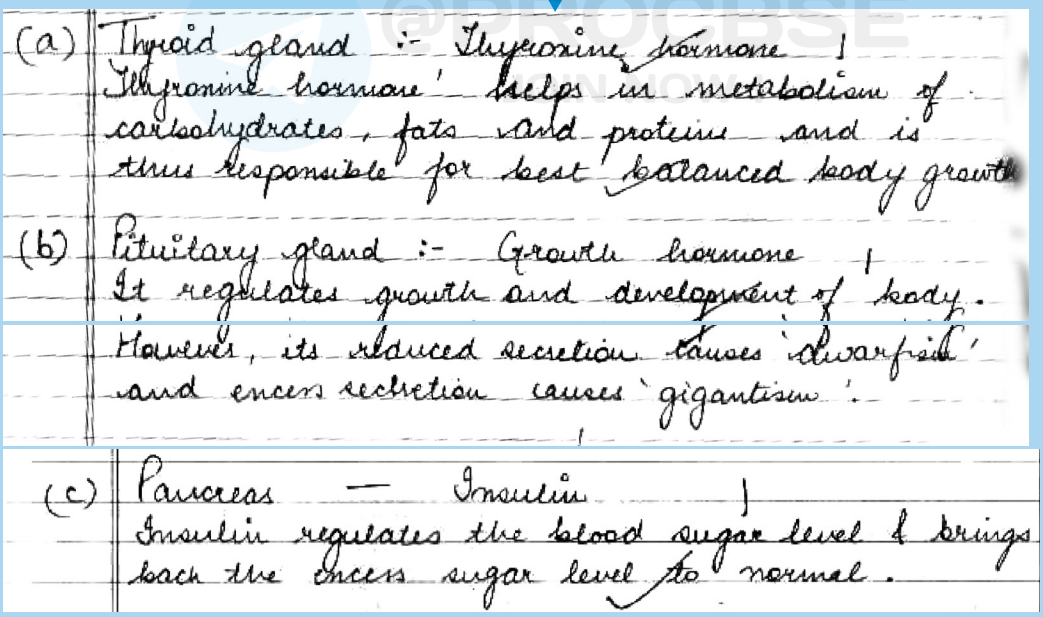
OR

Glucagon, regulates increases blood sugar.

[CBSE Marking Scheme, 2018] 1+1+1

Topper Answer, 2018

Ans.



Q. 10. (a) Name one gustatory receptor and one olfactory receptor present in human beings.

(b) Write *a* and *b* in the given flow chart of neuron through which information travels and as an electrical impulse.

Dendrite	⟶	*a*	⟶	*b*	⟶	End point of Neuron

R **[CBSE Delhi/OD Set-2018]**

Ans. (a) Gustatory receptor - Tongue

Olfactory receptor- Nose

(b) (i) Cell body/cyton

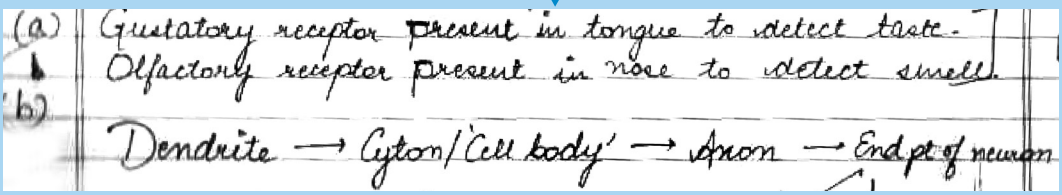
(ii) Axon

[CBSE Marking Scheme, 2018] 1 + 2

@PROCBSE

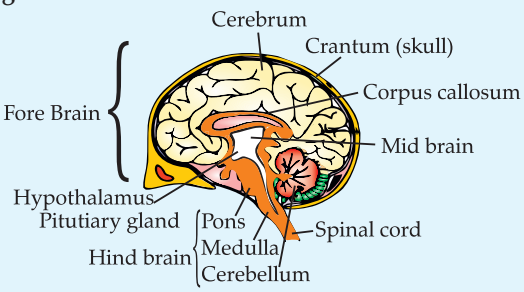
Topper Answer, 2018

Ans.



Q. 11. Draw a neat diagram of human brain and label on it the following parts:
(i) Mid brain **(ii) Pituitary gland**
(iii) Cerebellum **(iv) Cerebrum** AE [DDE, 2017]

Ans. (i) Labelled diagram of Human brain:



[2 + 1]
[CBSE Marking Scheme, 2015]

COMMONLY MADE ERROR

- Students often forget to label all the parts which are asked.

ANSWERING TIP

- Carefully draw the diagram and label the asked parts carefully. Each labelling carries a mark.

Q. 12. Explain the feedback mechanism to regulate the action of the hormones with the help of one suitable example. U [CBSE Term- I, 2016]

Ans. Hormones should be secreted in precise quantities. The timing and amount of hormone released are regulated by feedback mechanism. For e.g., if the sugar level in blood rises, they are detected by the cells of the pancreas which respond by producing more insulin. As the blood sugar level falls, insulin secretion is reduced. **3**
[CBSE Marking Scheme, 2016]

AI **Q. 13. (a) An old man is advised by his doctor to take less sugar in his diet. Name the disease from which the man is suffering. Mention the hormone due to imbalance of which he is suffering from this disease. Which endocrine gland secretes this hormone?**
(b) Name the endocrine gland which secretes growth hormone. What will be the effect of the following on a person:
(i) Deficiency of growth hormone.
(ii) Excess secretion of growth hormone.
AE [CBSE Term- I, 2016]

Ans. (a) The man is suffering from Diabetes mellitus.
Hormone is Insulin.
Endocrine gland that secretes insulin is pancreas. 1½

(b) The endocrine gland which secretes growth hormone is pituitary gland.
(i) Deficiency of growth hormone causes dwarfism.
(ii) Excess secretion of growth hormone causes gigantism. **1½**

COMMONLY MADE ERROR

- Many students write incorrect name of the hormone and the related disorder. So they are unable to score marks.

ANSWERING TIP

- Use charts and tables to learn the name of the hormones, their secretion and function.

@PROCBSE JOIN NOW!

Q. 14. Name the hormone which regulates carbohydrate, protein and fat metabolism in our body. Which gland secretes this hormone? Why is it important for us to have iodised salt in our diet?

U [CBSE Term- I, 2016]

Ans. (a) The hormone which regulates carbohydrates, protein and fat metabolism in our body is **thyroxine.**

(b) Thyroxine hormone is secreted by **thyroid gland**.

(c) Iodised salt in diet is important because it contains iodine, which is essential for the synthesis of thyroxine hormone by the thyroid gland. In case, iodine is deficient in our diet, there would be less production of thyroxine hormone and thus there is a possibility of suffering from goitre. **1 + 1 + 1**

Long Answer Type Questions — 5 marks each

Q. 1. (a) Why is the use of iodised salt advisable? Name the disease caused due to deficiency of iodine in our diet and state its one symptom.

(b) How do nerve impulses travel in the body? Explain. R [Board Outside Delhi, Set-I, 2019]

Ans. (a) Iodine is essential for functioning of thyroid / formation of thyroxine hormone. **1**
Disease is Goitre **1**
Swollen neck **1**

(b) Impulse travels from dendrite to cell body, then along the axon to its end. At the end some chemicals are released which fill the gap of synapse, and starts a similar electrical impulse to another neuron and the impulse further travel in the body. **2**

(Award marks if attempted as a flow chart also)

[CBSE Marking Scheme, 2019]

Detailed Answer:

(a) Iodine is necessary for thyroid gland to secrete thyroxine hormone which regulates carbohydrate, protein and fat metabolism in the body. Its deficiency may cause goitre. Therefore, use of iodised salt is advisable. Its key symptom is a swollen neck.

(b) The information received at the end of the dendritic tip, sets off a chemical reaction that creates an electrical impulse. This impulse travels from the dendrite to the cell body and then along axon to its end. Here, the electrical impulse sets off the release of some chemicals which cross synapse inducing similar impulse in a dendrite of the next neuron. **3+2**

Q. 2. (i) Define receptor and state their location in our body. Mention any two receptors present in our forebrain and their functions.

(ii) How do nerve impulses travel in our body?

U [CBSE Term-I, 2016]

Ans. (i) Receptor: Specialised tips of some nerve cells, which receive information from the surroundings.
Location: Sense organs
Gustatory receptor - detect taste
Olfactory receptor - detect smell

(ii) The information acquired at the end of the dendritic tip of a nerve cell, sets off a chemical reaction that creates an electrical impulse, which travels to the cell body, then along the axon to its end where it releases some chemicals across the synapses.

[CBSE Marking Scheme, 2016] **1 + 1 + 1 + 2**

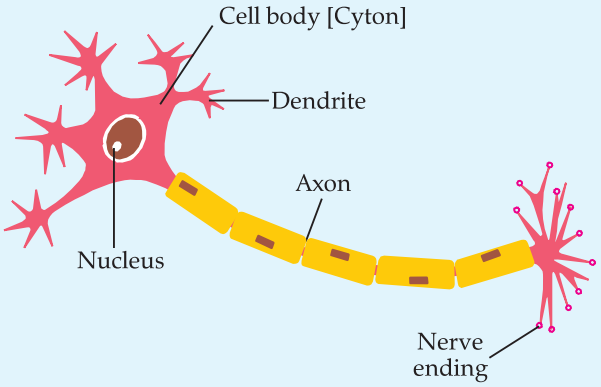
Q. 3. (a) Draw the structure of a neuron and label the following on it:
(i) Dendrite
(ii) Cell body
(iii) Nucleus
(iv) Axon

(b) Name the parts of a neuron:
(i) Where information is acquired.
(ii) Through which information travels as an electrical impulse.
(iii) Where this impulse must be converted into a chemical signal for onward transmission.

(c) Define neuromuscular junction.

U [CBSE Term-I, 2016]
[NCERT Exemplar]

Ans. (a) Refer to below figure:



(b) (i) Dendrite **(ii)** Axon **(iii)** Nerve ending.

(c) Neuromuscular junction is a chemical synapse formed by the contact between a motor neuron and a muscle fibre. **2+3**

[CBSE Marking Scheme, 2016]

Q. 4. (i) Define reflex arc. Draw a flowchart showing the sequence of events which occur during sneezing.

(ii) List four plant hormones. Write one function of each. C [DDE-2015, 17, CBSE Term-I, 2015]

Ans. (i) The pathway taken by nerve impulses in a reflex action is called the reflex arc.

@PROCBSE JOIN NOW !

Sequences of events, which occur during sneezing, are:

Nerve endings located in the nasal passage identifies the irritant entered in the nose.
↓
Receptors send the information or nerve impulses to the sneezing centre located in the brain stem.
↓
Brain stem in return sends the instructions to the lungs or diaphragm for response
↓
Diaphragm moves abruptly, chest muscles contract in response to the instructions received.
↓
Air blows out from nose and mouth instantly and rapidly
↓
Sneezing occurs in response to the irritant

(ii) Auxin: It promotes elongation and division of cell and root formation.

Gibberellins: They help in growth of stem and also induce internodal growth in genetically dwarf varieties of plants.

Cytokinins: They promote cell division and delay leaf ageing.

Abscisic acid: It inhibits growth. **3+2**

Q. 5. (i) Define reflex action. State its significance.

(ii) How do plants respond to external stimuli?

R [CBSE Term-I, 2015]

Ans. (i) Reflex action: It is defined as an unconscious, automatic and involuntary response of effectors, *i.e.* muscles and glands, to a stimulus, which is monitored through the spinal cord.

Significance: It protects us from any sudden stimulus which may harm us.

(ii) Plants respond to a number of external stimuli like light, gravity, touch, chemicals, etc. They respond to external stimuli with the help of receptors and hormones. The receptors help the plants to sense the external stimulus and act accordingly. They respond to external stimuli, usually by growing towards or away from the source of stimulus. *e.g.*, auxin is a plant hormone produced in the stem tips and roots, which controls the direction of growth.

1+2+2

Visual Case-based Questions — 4 marks each

Q. 1. Study the table in which the levels of Thyroid Stimulating Hormone (TSH) in women are given and answer the questions that follow on the basis of understanding of the following paragraph and the related studied concepts.

Age Range	Normal (mU/L)	Low (mU/L)
18 – 29 years	0.4 – 2.34 mU/L	< 0.4 mU/L
30 – 49 years	0.4 – 4.0 mU/L	< 0.4 mU/L
50 – 79 years	0.46 – 4.68 mU/L	< 0.46 mU/L

Women are at greater risk for developing abnormal TSH levels during menstruation. while giving birth and after going through menopause. Around 6% of women in the United States have some kind of thyroid problem compared to 3% of men. Despite claims that high TSH increases your risk for heart disease, a 2013 study found no link between high TSH and heart diseases. But a 2017 study showed that older women are especially at risk for developing thyroid cancer if they have high levels along with thyroid nodules.

(a) A 35 year old woman has TSH level 6.03 mU/L. What change should she bring in her diet to control this level?

(b) When do women face a greater risk of abnormal TSH level?

(c) State the consequence of low TSH level.

(d) Name the mineral that is responsible for synthesis of hormone secreted by thyroid gland.

[Outside Delhi, Set- I, 2020]

Ans. (a) She should take more iodine in her diet which would bring thyroxine levels to normal.

(b) During menstruation, while giving birth and after going through menopause.

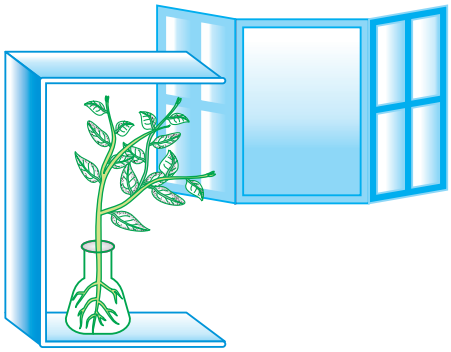
(c) Low level of TSH causes – Goitre disease

(d) Iodine. **1 + 1 + 1 + 1**

Q. 2. Read the given passage and answer any four questions from (a) to (e).

Plants perform chemical coordination for various activities with the help of hormones. Different hormones are produced by plants. These are the chemical compounds released by stimulated cells that diffuse to various locations in plants performing different function. There is a hormone that is synthesized in the tip of shoots. When light is coming from one side of the plant, this hormone diffuses towards the shady side of the shoot. Its concentration stimulates the cells to grow longer on the side of the shoot which is away from light. Thus, the plant appears to bend towards light while growing.

@PROCBSE



(a) The name of the hormone being described is:
(i) Auxin
(ii) Gibberellin
(iii) Cytokinin
(iv) Ethylene
(b) The movement of shoot towards light is known as
(i) Chemotropism
(ii) Phototropism
(iii) Thigmotropism
(iv) Geotropism
(c) A young plant receives sunlight from one direction only. What will happen to its roots and shoots?
(d) The stimulus in growth of pollen tube towards ovule during fertilisation is:
(i) Pollen
(ii) Chemical
(iii) Light
(iv) Water
(e) Which of the following is not associated with growth of plant?
(i) Auxin
(ii) Gibberellins
(iii) Cytokinins
(iv) Abscisic acid

Ans. (a) (i) Auxin is the hormone.
(b) (ii) The movement of shoot towards light is known as phototropism.
(c) The shoot of the plant bend towards light whereas roots bends away from the light.
(d) Chemicals
(e) (iv) Abscisic acid is a growth inhibitor hormone, it reverses the growth promoting effects of auxins and gibberellins. It causes dormancy of seeds, wilting of leaves, closing of stomata, etc. **1+1+1+1+1**

Q. 3. Read the passage below and answer the following questions.
Sonia went to the market along with her mother to buy fruits. She saw the fruit dealer putting small quantity of some powder wrapped in a paper in each wooden pack containing unripe mangoes. On enquiry, the fruit dealer told him that the powder is specific chemical which will help the mangoes to ripe early. Sonia was not convinced and she discussed the incidence with his class teacher the next day.

(a) The chemical that fruit dealer had kept in wrapped paper in each box is:
(i) Auxin **(ii) Gibberellin**
(iii) Cytokinin **(iv) Ethephon**
(b) Is this practice healthy?
(c) All of these hormones are growth promoters except:
(i) Gibberellin **(ii) Ethylene**
(iii) Auxin **(iv) Cytokinin**
(d) The substance that triggers the fall of mature leaves and fruits from plants is due to
(i) auxin **(ii) gibberellin**
(iii) abscisic acid **(iv) cytokinin**

Ans. (a) (iv) Ethephon is the chemical which is similar with ethylene plant hormone.
(b) No, such practices should be discouraged as the gas released from chemical may cause allergy on consumption.
(c) (ii) Ethylene
(d) (iii) Abscisic acid is a growth inhibitor hormone. It is produced in plants during adverse conditions like drought, water logging, cold conditions, etc. It causes falling of fruits and flowers and induces dormancy in seeds and buds.
Auxin promotes cell elongation, root formation, etc. Gibberellin stimulates stem elongation and germination. Cytokinin helps in breaking dormancy and regulating phloem transport. **4**

Q. 4. Study the table in which the levels of Thyroid Stimulating Hormone (TSH) in women are given and answer the questions that follow on the basis of understanding of the following paragraph and the related studied concepts.

Age Range	Normal (mU/L)	Low (mU/L)
18 – 29 years	0.4 – 2.34 mU/L	< 0.4 mU/L
30 – 49 years	0.4 – 4.00 mU/L	< 0.4 mU/L
50 – 79 years	0.46 – 4.68 mU/L	< 0.46 mU/L

Women are at greater risk for developing abnormal TSH levels during menstruation while giving birth and after going through menopause. Around 6% of women in the United States have some kind of thyroid problem compared to 3% of men. Despite claims that high TSH increases your risk for heart disease, a 2013 study found no link between high TSH and heart diseases. But a 2017 study showed that older women are especially at risk for developing thyroid cancer if they have high levels along with thyroid nodules.
(a) A 35 year old woman has TSH level 6.03 mU/L. What change should she bring in her diet to control this level?
(b) When do women face a greater risk of abnormal TSH level?
(c) State the consequence of low TSH level.
(d) Name the mineral that is responsible for synthesis of hormone secreted by thyroid gland.

A **[Outside Delhi, Set- I, 2020]**

@PROCBSE JOIN NOW

Ans. (a) She should take more iodine in her diet which would bring thyroxine levels to normal.

(b) During menstruation, while giving birth and after going through menopause.

(c) Low level of TSH causes – Goitre disease

(d) Iodine. **1×4=4**

Q. 5. Question numbers (a) – (d) are based on the two tables given below. Study these tables related to blood sugar levels and answer the questions that follow.

Table A (Blood glucose chart)

	Mean Blood Glucose Level (mg/dL)
Doctor's advice needed	380
	350
	315
	280
	250
	215
Good	180
	150
Excellent	115
	80
	50

Table B (Blood Report of Patient X and Y)

Time of check	**Blood Glucose ranges (mg/dL)**	
	Patient X	Patient Y
Before breakfast (Fasting)	< 100	70 - 130
Before lunch, supper and snack	<110	70 - 130
Two hours after meals	<140	< 180
Bedtime	<120	90 - 15

(a) Refer to Table B showing the blood report of the levels of glucose of patients X and Y.
Infer the disease which can be diagnosed from the given data. 1

(b) Identify the hormone whose level in the blood is responsible for the above disease. 1

(c) Which one of the following diets would you recommended to the affected patient? 1
(i) High sugar and low fat diet.
(ii) Low sugar and high protein diet.
(iii) High fat and low fibre diet.
(iv) Low sugar and high fibre diet.

(d) Refer to the Table A and suggest the value of the mean blood glucose level beyond which doctor's advice is necessary:
(i) 180 mg/dL
(ii) 115 mg/dL
(iii) 50 mg/dL
(iv) 80 mg/dL **[CBSE SQP, 2019]**

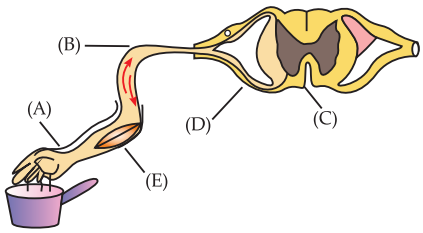
Ans. (a) Diabetes

(b) Insulin

(c) (iv) low sugar and high fiber diet

(d) (i) 180 mg/dL **1+1+1+1**

Q. 6. Study the given diagram of reflex arc and answer any four questions from (a) to (e).



(a) Give an example of reflex action.

(b) The parts labelled as A and C are
(i) Receptor and Relay neuron respectively
(ii) Receptor and Spinal cord respectively
(iii) Effector and Relay neuron respectively
(iv) Effector and Spinal cord respectively

(c) Which of these is not the function of B?
(i) It responds to stimulus.
(ii) It carries impulse from receptor to spinal cord.
(iii) It carries impulse from effector to spinal cord
(iv) None of these

(d) The correct path of reflex action is
(i) Receptors → Sensory neuron → Spinal cord → Motor neuron → Effector
(ii) Receptors → Motor neuron → Spinal cord → Sensory neuron → Effector
(iii) Effector → Sensory neuron → Brain → Motor neuron → Receptors
(iv) Effector → Motor neuron → Brain → Sensory neuron → Receptors

(e) Which of the following statements are true?
1. Sudden action in response to something in the environment is called reflex action
2. Sensory neurons carry signals from spinal cord to muscles.
3. Motor neurons carry signals from receptors to spinal cord.
4. The path through which signals are transmitted from a receptor to a muscle or a gland is called reflex arc.
(i) 1 and 2 **(ii) 1 and 3**
(iii) 1 and 4 **(iv) 1, 2 and 3**

Ans. (a) Pulling out hand from the flame if accidently touched is an example of reflex action.

(b) (i) Part labelled as A is Receptor and C is Relay neuron.

(c) Part B is Sensory neuron. It carries impulse from receptor to spinal cord.

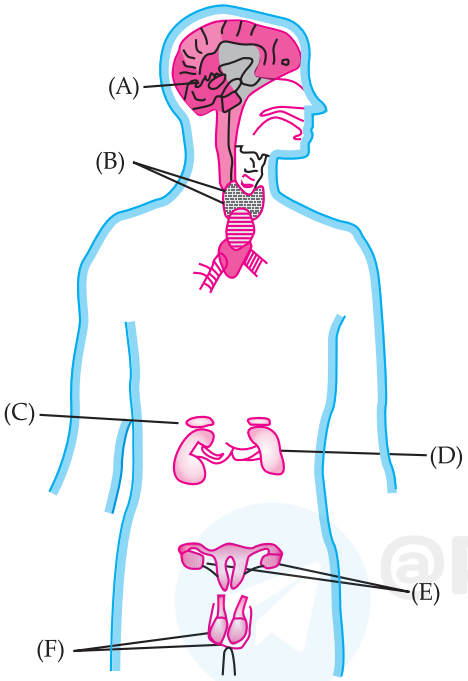
(d) (i) The pathway taken by nerve impulse in a reflex action is called the reflex arc. It follows a specific

@PROCBSE

pathway as: Receptors → Sensory neuron → Spinal cord → Motor neuron → Effector. **4**

(e) (iii) The statement 2 is false as sensory neurons carry signals from receptors to spinal cord. The statement 3 is false as motor neurons carry signals from spinal cord to effectors. **1**

Q. 7. The given diagram represents the human endocrine system. Study the diagram and answer any four questions from (a) to (e).



(a) Identify the endocrine glands A, B, C, D, E and F in the given diagram.

(b) The effect of chemical produced by gland F is:

(i) Secretes insulin which controls the amount of sugar in blood.

(ii) Secretes testosterone which controls sperm production.

(iii) Controls the activity of all other glands of our body.

(iv) All of these

(c) Which gland secretes digestive enzymes as well as hormones?

(i) B **(ii) C**

(iii) D **(iv) E**

(d) Select the mis-matched pair.

(i) A - Adrenaline **(ii) F - Testosterone**

(iii) E - Estrogen **(iv) B - Thyroxin**

(e) Which of the following endocrine glands is unpaired?

(i) Adrenal **(ii) Testes**

(iii) Pituitary **(iv) Ovary**

Ans. (a) A — Pituitary
B — Thyroid
C — Adrenal
D — Pancreas
E — Ovary
F — Testis

(b) (ii) Gland F is Testis. It secretes testosterone which controls sperm production/secondary sexual character.

(c) Gland D is pancreas. It secretes both digestive enzymes as well as hormones.

(d) (i) Adrenaline is secreted by the adrenal glands, located on top of kidneys. Growth hormone is secreted by the pituitary gland.

(e) (iii) There are two adrenal glands, one on top of each kidney that make adrenaline hormone. Testes are paired glands presents in males, secretes male sex hormone. Pituitary gland is present just below the brain and is unpaired. It is also called mastergl and as it secretes a number of hormones. Ovaries are paired glands present in females, secretes female sex hormones. **1+1+1+1+1**

Know the Terms

- **Phototropism:** Growth movements of plants towards light *e.g*, shoots bend toward light (positively phototropic) and roots move away from light (negatively phototropic)
- **Geotropism:** Growth movement of plant towards force of earth gravity.
- **Hydrotropism:** Growth movements of plant in response to external stimulus of water *e.g*, roots bend toward the source of water.
- **Thigmotropism:** Growth movement due to the stimulus of touch with foreign body *e.g*, tendril.
- **Chemotropism:** Growth movements in response to some chemical stimulus *e.g*, growth of pollen tube in style towards ovule.
- **Thermotropism:** Growth movements of plant in response to temperature, *e.g*, seedlings curve toward warm side.
- **Growth:** Permanent or irreversible increase in dry weight, size or volume of living beings.
- **Development:** Series of changes that occur in the structure & functioning of cell, organ or organism during its life history.
- **Meristem:** A tissue, the cells of which have the capacity to undergo division and give rise to a whole plant.
- **Growth regulators:** The chemical substances which modify growth. They are either **growth promoters** *e.g*, auxins, gibberellins and cytokinins or **growth inhibitors** *e.g*, abscisic acid and ethylene.

@PROCBSE

- **Phytohormone:** Chemicals that regulate plant growth.
- **Auxins:** Organic substance which promotes shoot elongation when present.
- **Indole 3-Acetic acid (IAA):** A natural auxin of plants, found in all parts of plants.
- **Synthetic auxins:** Some important synthetic compounds, which show auxin like activity *e.g,* Indole 3 - butyric acid (IBA), 2- 4, dichlorophenoxy acetic acid (2-4-D) *etc.*
- **Neuron:** Structural and functional unit of nervous system.
- **Nerve impulse:** Information in the form of electrochemical signals passing through neurons.
- **Sensory neurons:** The neurons which transmit impulses towards central nervous system.
- **Motor neurons:** The neurons which transmit impulses from central nervous system to effector organs.
- **Spinal nerves:** Nerves which arise from spinal cord. There 31 pairs of spinal nerves in human beings.
- **Cranial nerves:** Nerves which arise from brain. There are 12 pairs of cranial nerves in humans.
- **Reflex action:** A spontaneous automatic response to a stimulus without the will of an organism.
- **Conditional reflex:** Acquired reflexes during life time of an individual *e.g,* applying brakes of car.
- **Unconditional reflexes:** Unconditional Reflexes are natural and inborn reflexes and are transmitted from generation to generation *e.g,* constriction of pupil in bright light.
- **Brain stem:** Medulla oblongata, pons varolii and mid brain are collectively called the brain stem.
- **Saltatory conduction:** Conduction of impulse along a myelinated nerve fibre.
- **Corpus callosum:** Band of nerve fibres that joins the cerebral hemispheres.
- **Endocrine system:** The endocrine glands and their secretions (hormones) constitute endocrine system.
- **Endocrine glands:** Ductless glands whose secretions are poured directly into the blood stream *e.g,* thyroid glands and adrenal glands etc.
- **Hormones:** Chemical messengers of the body that transfer information from one set of cells to another.
- **Tropic hormone:** A hormone which stimulates another endocrine gland to secrete its hormone. *e.g,* Thyrotropic hormone stimulates the thyroid gland to secrete thyroxine.
- **Pituitary gland:** It is the master gland which controls all other endocrine glands.

@PROCBSE
JOIN NOW !



❑❑❑

@PROCBSE

Reproduction

Asexual reproduction

Reproduction through vegetative parts of Plants
- Through Leaves- *Bryophyllum*
- Through Eyes-Potato
- Through stem-Rose
- Through Roots -Dahlia

Budding
- Bulb like projection comes out of the cells
- Reproduction through buds
- eg. *Yeast, Hydra*

Fragmentation
- Breaking into two or more fragments
- Eg. *Spirogyra*

Spore formation
- Spores covered by hard protective coat to withstand harsh condition
- E.g.Fungus
- Under favourable conditions, spore germinates

Sexual reproduction in human beings

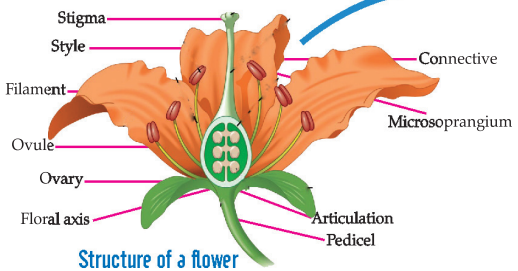
Male Reproductive System
- Sperm duct
- Testis (releases sperm)
- Penis

Parts of a sperm
- Head
- Middle piece
- Tail

Female Reproductive system
- Ovaries
- Oviduct
- Ova (egg)
- Uterus

- Fertilization : Ova (from ovaries) fuses with sperm (from testis) to form zygote
- Implantation of embryo in uterus
- Develops into baby

Sexual reproduction in plants



Structure of a flower

Through Flowers

Fertilization
Fusion of male and female gametes- develops into embryo

Pollination

Cross Pollination
Transfer of Pollen grains on stigma of another flower

Self Pollination
Transfer of Pollen grains on stigma of same flower

Seeds

Seed dispersal
- By wind
- By water
- By animals

- Contains embryo
- After fertilization, ovules form seeds and ovary forms fruit

Trace the Mind Map

First Level Second Level Third Level

@PROCBSE

CHAPTER

8

REPRODUCTION

Syllabus

Reproduction in animals and plants (asexual and sexual), reproductive health-need and methods of family planning; Safe sex, HIV/AIDS; Child bearing and women's health.

Trend Analysis

List of Concepts	2018 (OD/D)	2019 (OD/D)	2020 (OD/D)
Basics of reproduction, Asexual reproduction – their methods and vegetative reproduction	1 Q (3 M)	1 Q (5 M)	
Sexual reproduction in plants		1 Q (5 M)	1 Q (5 M)
Reproduction in human beings	1 Q (5 M)		OR 1 Q (5 M)

@PROCBSE JOIN NOW!

TOPIC - 1
Asexual Reproduction and Vegetative Propagation

Revision Notes

Introduction

- Reproduction is the process by which living organisms produce new individuals similar to themselves. It ensures continuity of life on earth.
- Nucleus of the cell contains DNA (Deoxyribose Nucleic Acid) which is the hereditary material.
- DNA replicates and forms new cells causing variation. So, these new cells will be similar but may not be identical to original cell.
- Variations are useful for the survival of the individual and species over time. It is the base of evolution.

Types of Reproduction

(a) Asexual Reproduction

- A single individual give rise to new individual.
- Gametes are not formed.
- New individual is identical to parent.
- Adopted by lower organisms.

TOPIC - 1
Asexual Reproduction and Vegetative Propagation
Page No. 172

TOPIC - 2
Sexual Reproduction in Plants
Page No. 183

TOPIC - 3
Reproduction in Human Beings
Page No. 188

@PROCBSE

(b) Sexual Reproduction

- Two individuals i.e., one male and one female are needed to give rise to new individual.
- Gametes are formed.
- New individual is genetically similar but not identical to parents.
- It is useful to generate more variations in species.
- Adopted by higher organisms.

Scan to know more about this topic

Mode of reproduction

➢ **Asexual reproduction** takes place through fission, fragmentation, regeneration, budding, vegetative propagation, and spore formation. These modes of reproduction depend on the body design of the organisms.

(a) Fission: It is of two types - binary fission and multiple fission.

(i) Binary fission: It is the division of one cell into two similar or identical cells. The nucleus first divides amitotically into two, followed by the division of the cytoplasm. The cell finally splits into two daughter cells. *e.g.*, *Amoeba*

(ii) Multiple fission: In multiple fission, many individuals are formed from a single individual. *e.g.*, *Plasmodium*.The nucleus divides repeatedly, producing many nuclei and many daughter cells are formed.

Scan to know more about this topic

Asexual Reproduction- Budding in Yeast

(b) Fragmentation: It takes place in multicellular organisms with simple body organisation such as in *Spirogyra*. In this, the body breaks up into two or more small pieces of fragments upon maturation. These fragments grow into new individuals.

(c) Regeneration: It is the ability of a fully differentiated organism to give rise to new individual organisms from its body parts. Small cut or broken parts of the organism's body grow or regenerate into separate individuals. **For example:** *Planaria* and *Hydra*.

(d) Budding: In budding, a small part of the body of the parent grows out as a bud which then detaches and becomes a new organism. *Hydra* reproduces by budding using the regenerative cells.

(e) Vegetative Propagation: In many plants, new plants develops from vegetative parts of plant body such as stem, roots, leaves, etc.

Methods of vegetative propagation:

(i) Natural methods are:

(a) By roots: *e.g.*, Dahlia, sweet potato.
(b) By stems: *e.g.*, Potato, ginger.
(c) By leaves: *e.g.*, *Bryophyllum* (leaf margins bear buds which develop into plants).

(ii) Artificial methods:

(a) Grafting: *e.g.*, Mango
(b) Cutting: *e.g.*, Rose
(c) Layering: *e.g.*, Jasmine
(d) Tissue culture: *e.g.*, Ornamental plants, orchid.

(f) Spore Formation: Spores are small bulb like structures which are covered by thick walls. Under favourable conditions, they germinate and produce new organisms.

@PROCBSE JOIN NOW !

Mnemonics

Concept: Vegetative Reproduction

Mnemonics: **P**ositive **E**xample **B**ased **L**earning

Interpretation:

P - Potato
E - Eyes
B - Bryophyllum
L - Leaf buds

@PROCBSE

How is it done on the GREENBOARD?

Q. What is vegetative propagation? List with brief explanation three advantages of practising this process for growing same types of plants. Select two plants from the following which are grown by this process :
Banana, Wheat, Mustard, Jasmine, Gram 5

Solution:

Step I: Vegetative propagation is the development of a new plant from the vegetative parts / roots, stem and leaves of a plant.

Advantages of Vegetative reproduction :

Step II: Such plants can bear flowers and fruits earlier than those produced from seeds.

Step III: Allows propagation of plants (banana, orange etc) that have lost capacity to produce seeds.

Step IV: Two plants grown by this process are:
Jasmine, banana.

Objective Type Questions — 1 mark each

A Multiple Choice Questions

Q. 1. Reproduction is essential for living organisms in order to
(a) keep the individual organism alive.
(b) fulfill their energy requirement.
(c) maintain growth.
(d) continue the species generation after generation. [NCERT Exemp.]

Ans. Correct option : (d)
Explanation : Reproduction serves to continue the species which would otherwise extinct due to struggle for survival and natural/accidental death of individuals. **1**

Q. 2. A feature of reproduction that is common to *Amoeba*, *Spirogyra* and Yeast are that
(a) they reproduce asexually.
(b) they are all unicellular.
(c) they reproduce only sexually.
(d) they are all multicellular. [NCERT Exemp.]

Ans. Correct option : (a)
Explanation : All of them reproduce asexually. **1**

Q. 3. In *Spirogyra*, asexual reproduction takes place by
(a) breaking up of filaments into smaller bits.
(b) division of a cell into two cells.
(c) division of a cell into many cells.
(d) formation of young cells from older cells. [NCERT Exemp.]

Ans. Correct option : (a)
Explanation : Fragmentation is a type of asexual reproduction in animals in which parental body is broken down into pieces and each of these pieces develop into an individual animal. **1**

Q. 4. The ability of a cell to divide into several cells during reproduction in *Plasmodium* is called
(a) budding **(b) reduction division**
(c) binary fission **(d) multiple fission** [NCERT Exemp.]

Ans. Correct option : (d)
Explanation : Multiple fission is a repeated division of organism to produce many daughter cells all together. **1**

Q. 5. Factors responsible for the rapid spread of bread mould on slices of bread are
(i) large number of spores.
(ii) availability of moisture and nutrients in bread.
(iii) presence of tubular branched hyphae.
(iv) formation of round shaped sporangia.
(a) (i) and (iii) **(b) (ii) and iv)**
(c) (i) and (ii) **(d) (iii) and (iv)** [NCERT Exemp.]

Ans. Correct option : (c)
Explanation : Bread mould prefers damp and warm substratum with ample supply of nutrients on which its air-borne spores land and germinate to produce mycelium. **1**

@PROCBSE JOIN NOW!

B Assertions and Reasons Type Questions

Directions: In the following questions, a statement of assertion (A) is followed by a statement of reason (R). Mark the correct choice as:

(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

(b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).

(c) Assertion (A) is true but reason (R) is false.

(d) Assertion (A) is false but reason (R) is true.

Q. 1. Assertion (A): *Amoeba* reproduces by binary fission.
Reason (R): All unicellular organisms reproduce asexually.

Ans. Correct option : (a)
Explanation : *Amoeba* is a unicellular organism. It reproduces asexually through binary fission. It is the division of one cell into two similar or identical cells.

Q. 2. Assertion (A): Plants are vegetatively propagated even though they bear seeds.
Reason (R): Potatoes reproduces through tubers, apples by cutting etc.

Ans. Correct option : (b)
Explanation : Vegetative reproduction happens through the use of vegetative parts of the plants, such as leaves, stems, and roots to produce new plants or through growth from specialized vegetative plant parts. **1**

Q. 3. Assertion (A): Characteristics of parental plants can be preserved through asexual reproduction.
Reason (R): Vegetative reproduction involves only mitosis.

Ans. Correct option : (a)
Explanation : Asexual reproduction involves a single individual, which give rise to new individual that are genetically identical to parents. It is because, when organisms reproduce asexually, only mitotic divisions are involved and the chromosome number remains the same. **1**

Q. 4. Assertion (A): *Plasmodium* reproduces by multiple fission.
Reason (R): Multiple fission is a type of asexual reproduction.

Ans. Correct option : (b)
Explanation : *Plasmodium* reproduces asexually by multiple fission. **1**

Q. 5. Assertion (A): DNA copying is necessary during reproduction.
Reason (R): DNA copying leads to the transmission of characters from parents to offspring.

Ans. Correct option : (a)
Explanation : DNA copying is necessary during reproduction because it leads to the transmission of characters from parents to offsprings and brings about variation. **1**

C Very Short Answer Type Questions

Q. 1. How does *Plasmodium* reproduce? Is this method sexual or asexual type of reproduction? U **[Delhi Set III, 2017]**

Ans. *Plasmodium* reproduces by a process known as **multiple fission**. Multiple fission is a type of asexual reproduction. **1**

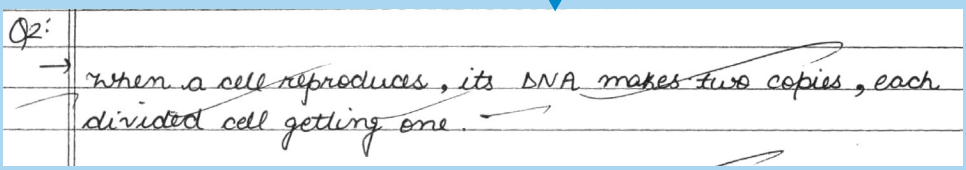
AI **Q. 2. Name the method by which *Spirogyra* reproduces under favourable conditions. Is this method sexual or asexual type of reproduction?** R **[Delhi Set I, 2017]**

Ans. Fragmentation, Asexual ½ + ½

Q. 3. When a cell reproduces, what happens to its DNA? **[CBSE, O.D. Set 1, 2017]**

Topper Answer, 2017

Ans.



Q. 4. Newly formed DNA copies may not be identical at times. Give one reason. A **[OD 31/2, 2017]**

Ans. If there is an error in DNA copying or mutation, then newly formed DNA copies may not be identical at time. **1**

Q. 5. What are those organisms called which bear both the sex organs in the same individual? Give one example of such organism. R **[Board Term-II, O.D. II, 2016]**

Ans. Bisexual; For *e.g.*, *Hydra*/Earthworm/Mustard/*Hibiscus*. **(Any one)** ½ + ½
[CBSE Marking Scheme, 2016]

Q. 6. What is a gene?

Ans. Gene is a part of DNA that encodes the instructions that allow a cell to produce a specific protein or enzyme. **1**

Q. 7. What is DNA? R **[Board Term II, Foreign Set III, 2015]**

@PROCBSE

Ans. DNA is the carrier of hereditary information from parents to the next generation. Hereditary material is present in all living cells.
[CBSE Marking Scheme, 2015] **1**

Q. 8. Name the type of reproduction mostly seen in unicellular organisms.
R [Board Term-II, Delhi 2015]

Ans. Asexual reproduction.
[CBSE Marking Scheme, 2015] **1**

Q. 9. Name two simple organisms having the ability of regeneration. R [Board Term II, O.D. Set III, 2015]

Ans. *Planaria* and *Hydra*. ½ + ½
[CBSE Marking Scheme, 2015]

Short Answer Type Questions-I — 2 marks each

Q. 1. List four modes of asexual reproduction.
R [O.D. Comptt 31/1 2017]

Ans. Four modes of asexual reproduction are:
(i) Binary fission
(ii) Budding
(iii) Multiple fission
(iv) Fragmentation. ½ × 4 = **2**

AI **Q. 2. (i) What is meant by vegetative propagation?**
(ii) How will a plant be benefitted if it reproduces by vegetative propagation? U

Ans. (i) Propagation by vegetative parts such as the roots, stems and leaves. **1**
(ii) Plants raised by vegetative propagation can bear flowers and fruits earlier than those produced from seeds. Such method also makes possible the propagation of plants that have lost the capacity to produce seeds. **1**

Q. 3. How is the process of binary fission different in *Amoeba* and *Leishmania*? U

Ans. *Amoeba* reproduces through simple binary fission. *Leishmania* reproduces asexually through binary fission that occurs along a definite orientation related to the whip like structure at one end of the cell. **1+1**

Q. 4. Fallen leaves of '*Bryophyllum*' on the ground produce new plants whereas the leaves of rose do not? Explain this difference between the two plants. A

Ans. In *Bryophyllum*, vegetative propagation occur through leaves where buds occur on their margins. **1**
Rose leaves do not form buds. **1**

Short Answer Type Questions-II — 3 marks each

AI **Q. 1. (a) List in tabular form two differences between binary fission and multiple fission.**
(b) What happens when a mature *Spirogyra* filament attains considerable length?
U [Delhi, Set-II, 2020]

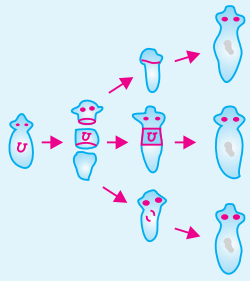
Ans. (a) Difference between binary fission and multiple fission:

1.	It is the division of one ogranism into two similar identical organisms.	It is the division of one ogranism into multiple organisms.
2.	The nuclear first divides amitotically into two, followed by division of the cytoplasm.	The nucleus first divides repeatedly producing many nuclei and many daughter cells are produced.
	e.g. Amoeba	*e.g. Plasmodium*

(b) *Spirogyra* reproduces asexually by fragmentation. In this, the body breaks up into two or more small pieces of fragments upon maturation. These fragments grow into new *Spirogyra*. **2+1**

Q. 2. (a) Budding, fragmentation and regeneration, all are considered as asexual mode of reproduction. Why?
(b) With the help of neat diagram, explain the process of regeneration in *Planaria*.
R + U [Board Outside Delhi, Set- III, 2019]

Ans. (a) Because these methods involve only one parent / organisms are formed as a result of mitotic division / progeny (organisms) are similar in their genetic make up and no variations. **(any one) 1**



Regeneration of Planaria **1**

(i) *Planaria* can be cut into any number of pieces and each piece grows through specialized cells into a complete organism.
[CBSE Marking Scheme, 2019] **1**

AI **Q. 3. Write one main difference between asexual and sexual mode of reproduction. Which species is likely to have comparatively better chances of**

@PROCBSE

survival-the one reproducing asexually or the one reproducing sexually? Justify your answer.

AE **[CBSE, Delhi & OD, 2018]**

Ans. Any one of the following difference:

(i) In sexual reproduction, two opposite sexes are involved whereas in asexual reproduction, only one individual is involved.

(ii) In sexual reproduction, male and female gamete formation takes place whereas in asexual no gamete formation occurs.

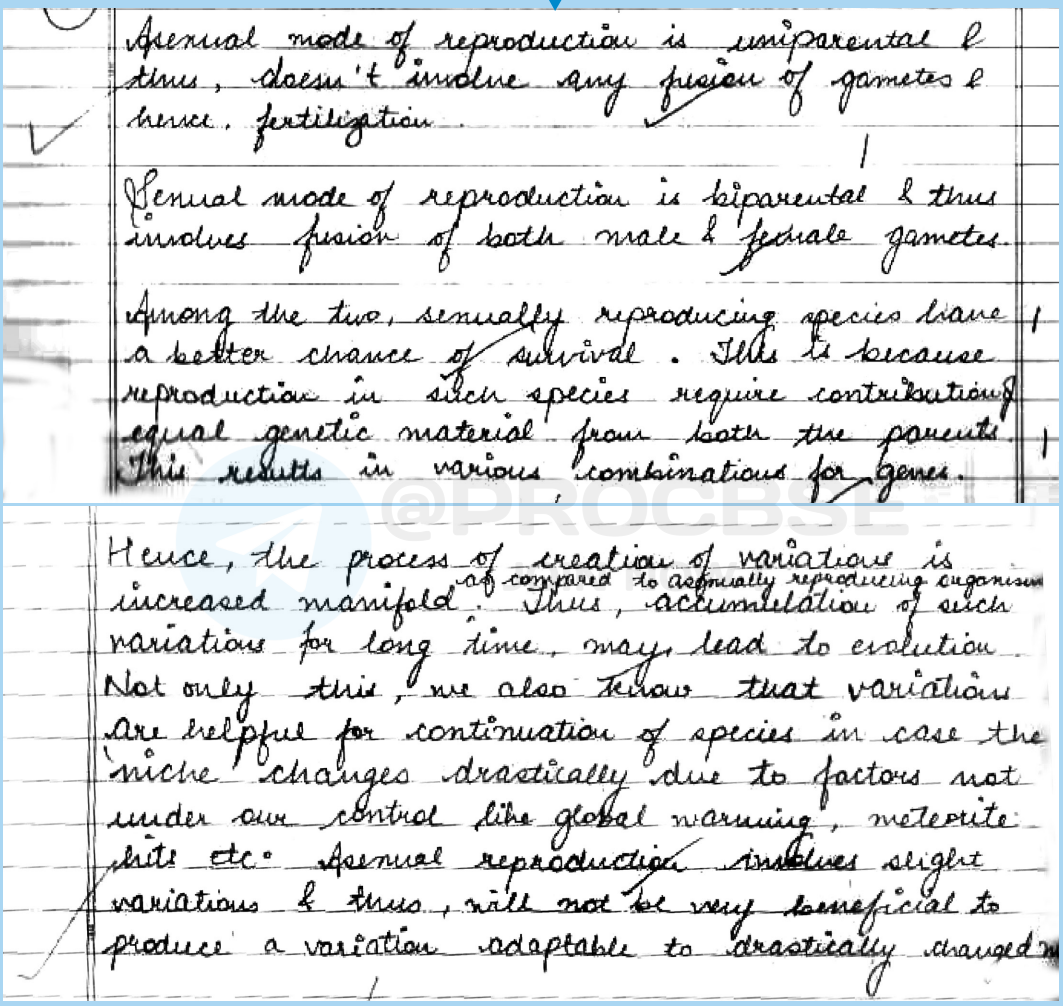
Sexually reproducing organisms have better chances of survival.

Because more variations are generated. **1 + 2**

[CBSE Delhi, O.D. Marking Scheme, 2018]

Topper Answer, 2018

Ans.



Asexual mode of reproduction is uniparental & thus, doesn't involve any fusion of gametes & hence, fertilization.

Sexual mode of reproduction is biparental & thus involves fusion of both male & female gametes.

Among the two, sexually reproducing species have a better chance of survival. This is because reproduction in such species require contribution of equal genetic material from both the parents. This results in various combinations for genes.

Hence, the process of creation of variations is increased manifold (as compared to asexually reproducing organism). Thus, accumulation of such variations for long time, may lead to evolution. Not only this, we also know that variations are helpful for continuation of species in case the 'niche' changes drastically due to factors not under our control like global warming, meteorite hits etc. Asexual reproduction involves slight variations & thus, will not be very beneficial to produce a variation adaptable to drastically changed

AI **Q. 4. What is reproduction? Explain two advantages of sexual reproduction over asexual reproduction.**

U **[Delhi Comptt. 31/1/3, 2017]**

Ans. Reproduction: It is a (biological) process by which new individuals of the same species are produced by the existing organisms. **1**

Advantages of sexual reproduction:

(i) Leads to stability of population of species. **1**

(ii) Results in variations useful for the survival of species over time.

[CBSE Marking Scheme, 2017] 1

Q. 5. What is vegetative propagation? State two advantages and two disadvantages of this method.

U **[CBSE OD. Set 1-2017]**

Ans. Vegetative propagation is a mode of asexual reproduction in which new plants are formed from roots, stems, leaves and buds of the individual vegetative parts of the plants. *e.g.* eyes of potato. 1

@PROCBSE

Advantages:

(i) Offsprings are genetically identical and therefore useful traits can be preserved. ½

(ii) It is a rapid and economical method. ½

Disadvantages:

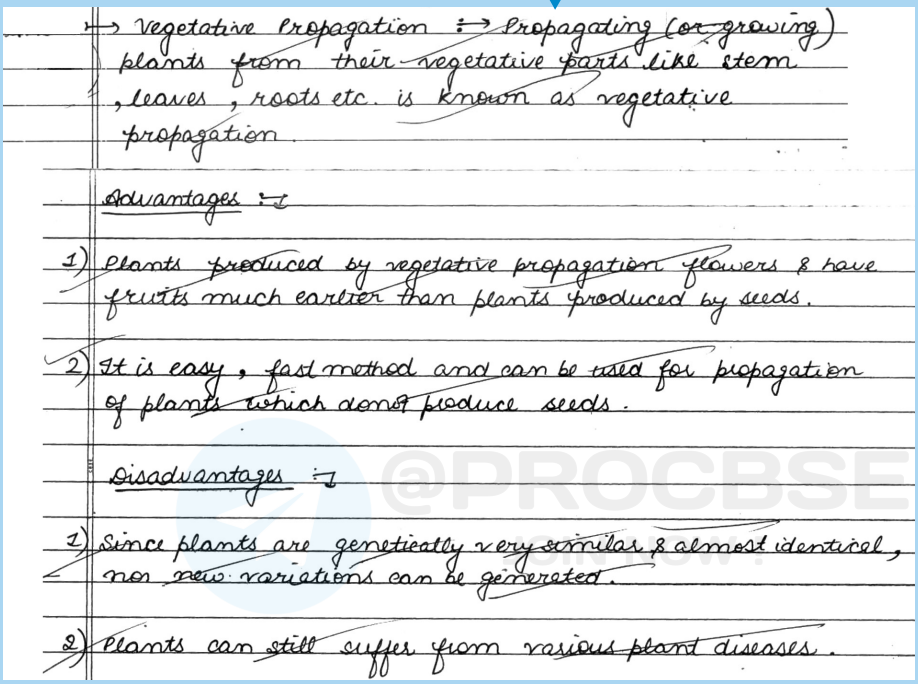
(i) New characters cannot be introduced. ½

(ii) The disease of the parent plant gets transferred to the offsprings. ½

OR

Topper Answer, 2017

Ans.



→ Vegetative propagation :→ Propagating (or growing) plants from their vegetative parts like stem, leaves, roots etc. is known as vegetative propagation.

Advantages :→

1) Plants produced by vegetative propagation flowers & have fruits much earlier than plants produced by seeds.

2) It is easy, fast method and can be used for propagation of plants which don't produce seeds.

Disadvantages :→

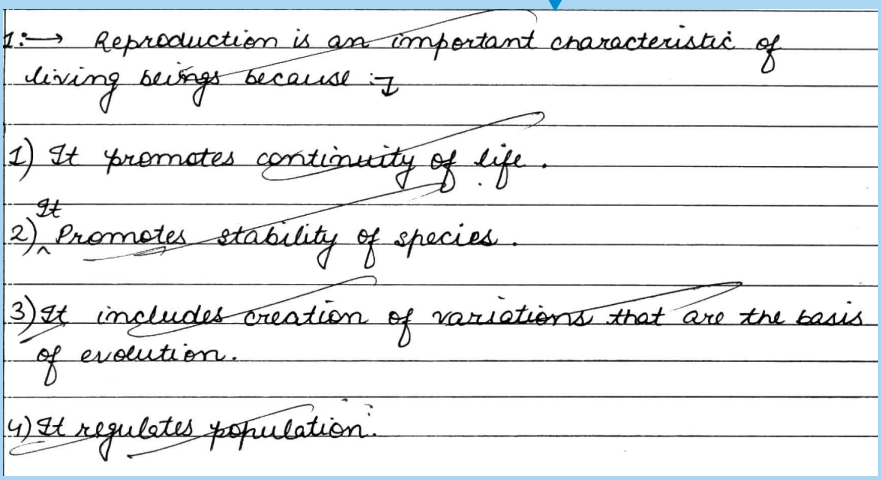
1) Since plants are genetically very similar & almost identical, no new variations can be generated.

2) Plants can still suffer from various plant diseases.

Q. 6. Reproduction is one of the most important characteristics of living beings. Give three reasons in support of the statement. AE [CBSE OD. Set 1-2017]

Topper Answer, 2017

Ans.



1:→ Reproduction is an important characteristic of living beings because :→

1) It promotes continuity of life.

2) It promotes stability of species.

3) It includes creation of variations that are the basis of evolution.

4) It regulates population.

@PROCBSE

Q. 7. What is regeneration? Give one example of an organism that shows this process and one organism that does not. Why does regeneration not occur in the latter? AE **[Foreign 31/2/1, 2017]**

Ans. (i) Regeneration: Ability of organisms to give rise to new individual organisms from their body parts. **1**

(ii) *Planaria/Hydra* ½

(iii) *Amoeba/Rhizopus*/Banana/Sugarcane/any other ½

(iv) Regeneration is carried out by specialized cells which are not present in non regenerating organisms. U **[CBSE Marking Scheme, 2017]** **1**

AI **Q. 8. What happens when:**

(a) Accidently, *Planaria* gets cut into many pieces?

(b) *Bryophyllum* leaf falls on the wet soil?

(c) On maturation sporangia of *Rhizopus* bursts?

R **[Delhi Set 1, 2017, Board Term II, Foreign Set I 2016]**

Ans. (a) Each piece regenerates into new *Planaria*. **1**

(b) Buds called **leaf buds** at its notches develop into new plants. **1**

(c) It releases spores which germinate into new mycelium in moist conditions. **1**

[CBSE Marking Scheme, 2017]

Detailed Answer:

(a) When *Planaria* gets cut into many pieces, each piece regenerates into a new Planarian organism.

(b) When *Bryophyllum* leaf falls on the wet soil, the buds that are present along the margin of the leaf will develop into new plants by the process known as **vegetative propagation**.

(c) When the sporangia of *Rhizopus* burst upon maturation, it releases spores which germinate into new mycelium in moist conditions.

AI **Q. 9. How do organisms, whether reproduced asexually or sexually maintain a constant chromosome number through several generations? Explain with the help of suitable example.**

AE **[Board Term-II, Delhi Set-I, 2016]**

Ans. (i) When organisms reproduce asexually, only mitotic divisions are involved and the chromosome number remains the same.

(ii) During asexual reproduction, the DNA (in the chromosomes) or the cells involved are copied and then equally divided among the two daughter cells. Thus, chromosome number remains unchanged. ½

(iii) In sexual reproduction, organisms produce gametes through a special type of division called **meiosis reductional division**, in which the original number of chromosomes is reduced to half.

These two male & female gametes fuse to form the zygote and the original number of chromosomes is restored.

(iv) In sexual reproduction, specialized cells / germ cells with only half the number of chromosomes are formed. When these germ cells from two individuals combine to form a new individual, the original chromosome number is restored. ½ + ½

(v) Example: In humans, the parents (father and mother) each have 46 or 23 pairs of chromosomes. In the gametes. The sperm has half the number of chromosomes *i.e.*, 23 and the egg also has 23 chromosomes. When the sperm and the egg fuse, the zygote has 46 or 23 pairs of chromosomes. Thus, the chromosome number remains constant. **1½**

[CBSE Marking Scheme, 2016]

Q. 10. What is multiple fission? How does it occur in an organism? Explain briefly. Name one organism which exhibits this type of reproduction.

AE **[Board Term-II, Delhi Set-II, 2016]**

Ans. Multiple fission: The process of reproduction in which many individuals are formed or produced from the parent cell. **1**

In this process, the nucleus divides repeatedly to produce large number of nuclei. Each nucleus gathers a bit of cytoplasm around itself, develops a membrane around each structure.

Many daughter cells develop which on liberation grow into adult organism. **1½**

Plasmodium exhibits this type of fission. ½

[CBSE Marking Scheme, 2016]

Q. 11. Explain the term "Regeneration" as used in relation to reproduction of organisms. Describe briefly how regeneration is carried out in multicellular organisms like *Hydra*. U **[O.D. Set I, 2016]**

Ans. Regeneration: It is the ability of an organism to give rise to a new organism/individual from their body parts. **1**

Regeneration in *Hydra*:

(i) The body of *Hydra* by any means is cut into number of pieces. ½

(ii) Each piece contains specialized cells. ½

(iii) These cells, proliferate and make large number of cells. ½

(iv) From this mass of cells, different cells undergo changes to become various cell types and tissues, which finally develops into a new organism. **[CBSE Marking Scheme, 2016]** ½

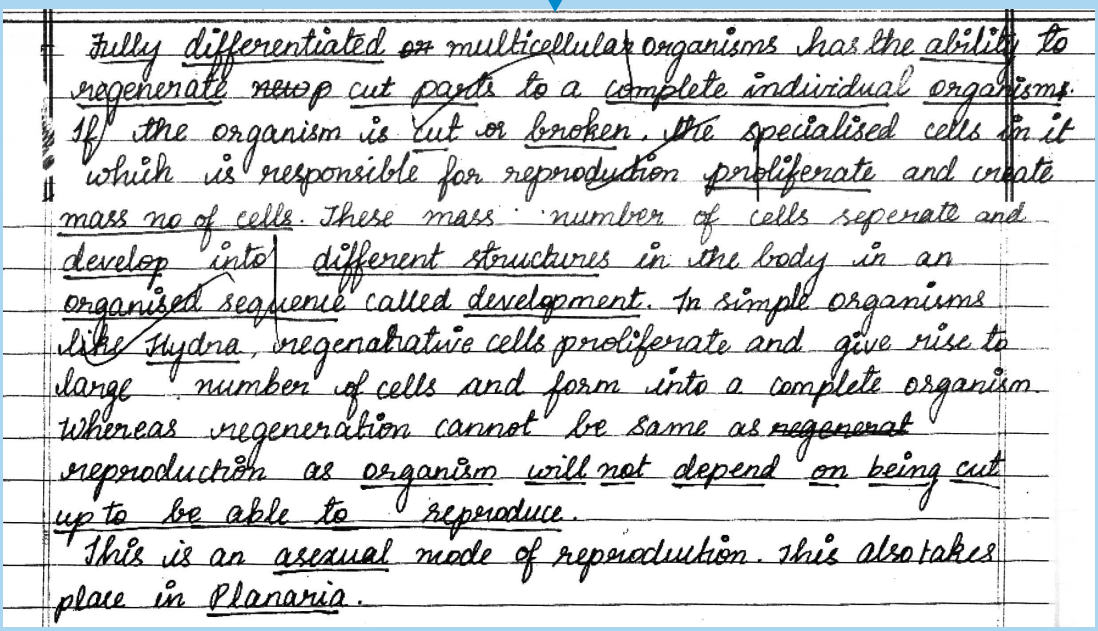
@PROCBSE JOIN NOW

@PROCBSE

OR

Topper Answer, 2016

Ans.



Fully differentiated or multicellular organisms has the ability to regenerate new cut parts to a complete individual organisms. If the organism is cut or broken, the specialised cells in it which is responsible for reproduction proliferate and create mass no of cells. These mass number of cells seperate and develop into different structures in the body in an organised sequence called development. In simple organisms like Hydra, regenerative cells proliferate and give rise to large number of cells and form into a complete organism. Whereas regeneration cannot be same as regenerat reproduction as organism will not depend on being cut up to be able to reproduce.
This is an asexual mode of reproduction. this also takes place in Planaria.

Q. 12. In the context of reproduction of species state the main difference between fission and fragmentation. Also give one example of each.

U [Board Term-II O.D. Set II, 2016]

Ans. Fission: It is the method of asexual reproduction in unicellular forms of life.

In this process, the parent organism splits to form two or more daughter cells.

Example: *Amoeba / Plasmodium / Paramecium*.

(Or any other relevant example) 1½

Fragmentation: It is the process found in multicellular organisms. The filament breaks up into two or more pieces upon maturation. These pieces then grow into new individuals.

Example: *Spirogyra*. 1½

[CBSE Marking Scheme, 2016]

Detailed Answer:

Fission: It is defined as the splitting of a unicellular organism into two or more than two separate daughter cells. It is the most common and simplest method of asexual reproduction in unicellular organisms, such as bacteria and Protozoa. Generally it is of two types *i.e.* binary and multiple fission. In binary fission, parent organism divides into two identical daughter organism with definite orientation. In multiple fission, parent organism divides into many identical daughter organisms. The nucleus of the cell splits repeatedly to form many smaller nuclei called **daughter nuclei** surrounded by a little bit of cytoplasm and thin membrane around them. 1½

Fragmentation: It is a form of asexual reproduction in which multicellular organisms like filamentous algae (*Spirogyra*) breaks up into two or more small fragments or pieces. On maturity, each of which subsequently grows to form a complete new organism. 1½

Q. 13. Define reproduction. How does it help in providing stability to the population of species? U

[Board Term II O.D. Set-I, 2016]

Ans. Reproduction: It is a (biological) process by which new individuals of the same species are produced by the existing organisms. **1**

(i) Populations of organisms live in well-defined places called **niches** in the ecosystem using their ability to reproduce. ½

(ii) Reproduction involves DNA copying which is the source of information for making proteins thereby controlling body design. ½

(iii) These body designs allow the organism to use a particular niche for the stability of the population of a species. ½

(iv) (Minor) variations may also lead to the stability of the species. [CBSE Marking Scheme, 2016] ½

@PROCBSE JOIN NOW

OR

Topper Answer, 2016

Ans.

The creation of new individuals from the existing individuals or individual for the species to survive is called reproduction. The consistency of the DNA is maintained inorder to reproduce similar kind of organisms with same body design for the organism to fit to a particular niche. Thus, reproduction is linked to the stability of the population of species.
It increases population size, that makes us to notice the particular organisms from a species and thus maintaines the gene pool of a species.

Long Answer Type Questions — 5 marks each

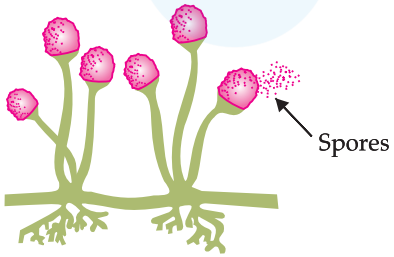
Q. 1. (a) Draw a diagram to show spore formation in *Rhizopus*.

(b) With the help of an example differentiate between the process of Budding and Fragmentation.

(c) Why is vegetative propagation practiced for growing some type of plants?

U [Outside Delhi, Set- III, 2020]

Ans. (a) Spore formation in *Rhizopus*:



2

(b) Differences between Budding and Fermentation:

Budding	Fragmentation
In budding, a small part of the body of the parent grows out as a bud which then detaches and become a new organism.	In this, the body breaks up into one or more small pieces of fragments and grow into new individual.
Hydra reproduces by budding using the regenarative cells.	It takes place in multicellular organisms with simple body organisation such as *Spirogyra*.

½ + ½=1

(c) Vegetative propagation is practiced for growing some type of plants because:

(i) Only one parent is required for reproduction; this eliminates the need of special mechanisms (pollination) and fusion of gametes *i.e.*, fertilization.

(ii) Many plants are able to tide over unfavourable conditions because of the presence of vegetative reproductive parts like tubers, corns and bulbs.

(iii) Plants that do not produce seeds can be propagated by this method, *e.g.*, sugarcane and potato.

(iv) Vegetative propagation is a cheaper, easier and rapid method of reproduction in plants than growing plants from seeds. For example. lilies grow very slowly and take up to seven years to develop flowers when their seeds are grown, but when grown vegetatively, flowers are produced only after a year or two.

(v) The trait (character) of the parent plant is preserved and the offsprings are genetically identical. **(Any two) 1+1=2**

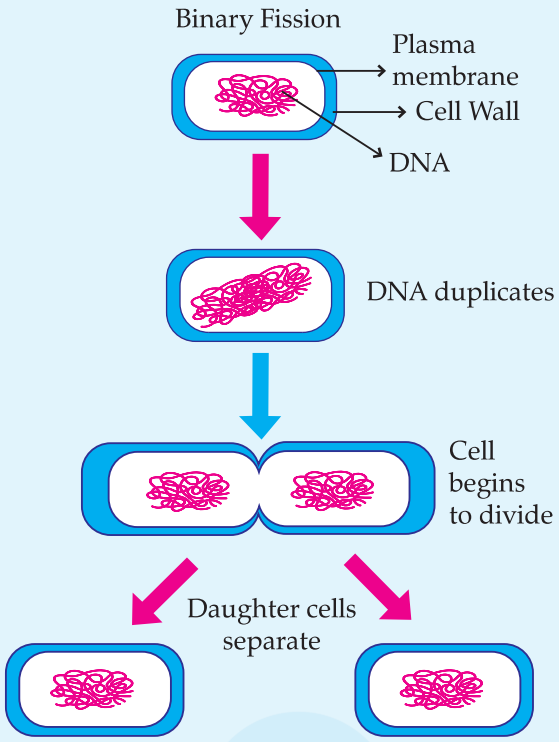
AI **Q. 2. (i) Describe the various steps involved in the process of binary fission with the help of a diagram.**

(ii) Why do multicellular organisms use complex way of reproduction? R [Board SQP, 2020]

@PROCBSE JOIN NOW

@PROCBSE

Ans. (i)



(ii) Multicellular organisms cannot reproduce by cell because they are not simple random collection of cells. In them, specialized cells are organized as tissues which are organized into organs. Cell-by-cell division would be impractical. Multicellular organisms, therefore, require to use more complex ways of reproduction. **3 + 2**

[CBSE Marking Scheme, 2020]

AI **Q. 3. What is vegetative propagation? List with brief explanation three advantages of practising this process for growing same types of plants. Select two plants from the following which are grown by this process:**

Banana, Wheat, Mustard, Jasmine, Gram.

U **[Board Term-II, Foreign I, 2016]**

Ans. (a) Vegetative propagation is the development of a new plant from the vegetative parts / roots, stem and leaves of a plant. **1**

(b) Advantages: (i) Such plants can bear flowers and fruits earlier than those produced from seeds.

(ii) Allows propagation of plants (banana, orange etc) that have lost capacity to produce seeds.

(iii) All plants produced are genetically similar to the parent plant and hence have all its characters.

3 × 1 = 3

Jasmine, banana. ½ + ½

[CBSE Marking Scheme, 2016]

Q. 4. Different organisms reproduce by different methods suitable to their body designs.

(i) Justify the above statement using examples of three different organisms which reproduce by different methods of asexual reproduction.

(ii) Differentiate between sexual and asexual modes of reproduction. A **[Board Term II, 2015]**

Ans. (i) *Amoeba*: Binary fission

Plasmodium: Multiple fission

Hydra: Budding

Planaria: Regeneration **(Any three + Explain)**

(ii) Sexual two parents; Asexual single parent.

[CBSE Marking Scheme, 2015] 5

Detailed Answer:

(i) (a) Binary Fission in *Amoeba:* In this method, the nucleus first divides mitotically into two, followed by the division of the cytoplasm. The cell finally splits into two daughter cells. So, from one *Amoeba* parent, two daughter amoebae are formed.

(b) Budding in *Hydra:* In Budding, a small part of the body of the parents grows out as a 'bud' which then detaches and becomes a new organism. *Hydra* reproduces by budding using the regenerative cells. A bud develops as an outgrowth in *Hydra* due to repeated cell division at one specific site. When fully mature, the bud detaches itself from the parent body and develops into new independent individuals.

(c) Regeneration in *Planaria:* In this method, small cut or broken parts of the organisms body grow or regenerate into separate individuals. *Planaria* can be cut into any number of pieces and each piece grows into a complete organism.

(ii) Differences between Sexual and Asexual Reproduction:

S No.	Sexual Reproduction	Asexual Reproduction
(i)	Two parents are required.	Only one parent is required.
(ii)	Offsprings are genetically dissimilar from parents.	Offsprings are identical to parents.

3 + 2

@PROCBSE JOIN NOW

@PROCBSE

TOPIC - 2
Sexual Reproduction in Plants

Revision Notes

Scan to know more about this topic

Structure of flower

Parts of Flower

- Flowers are main reproductive part of a plant. The main parts of a flower are: sepals, petals, stamens and carpels.
- Stamens and carpels are the reproductive parts of a flower which contain the germ cells. The male organ of a flower called '**stamen**' makes the male gamete which are present in the pollen grain. The female organ of a flower called '**carpel**' makes the female gamete, which are present in ovules of the plant.
- Flowers may be unisexual (*e.g.* papaya and watermelon) or bisexual (*e.g.* *Hibiscus* and mustard).
- **Pollination:** It is the transfer of pollen grain from the anther of a stamen to the stigma of a carpel. Pollination is of two types: self pollination and cross pollination.
- The transfer of pollens takes place by agent like wind, water or animals.
- After pollination, a pollen tube grows out of pollen grains, through which male germ cell reaches the ovary and fuses with the female germ cell.
- Fertilisation is the process of fusion of male and female gamete to produce zygote. It occurs inside the ovary.
- After fertilisation, ovary develops into fruit whereas ovules into the seed.
- **Double fertilisation:** It is a characteristic feature of flowering plants. In this process, out of the two sperm nuclei, one sperm nucleus fuses with the egg nucleus to form an embryo (process is called **syngamy**) and another fuses with the secondary nucleus to form an endosperm (process is called **triple fusion**).
- Because two kinds of fusion syngamy and triple fusion take place, the process is known as **double fertilisation**.

Scan to know more about this topic

Pollination and fertilization

@PROCBSE JOIN NOW !

Mnemonics

Concept: Reproductive parts of Flower

Mnemonics: Stamina of MEN, Pistil vali MAA

Interpretation:
Stamen : Male part of a Flower
Pistil/Stigma : Female part of flower

How is it done on the GREENBOARD?

Q. Distinguish between pollination and fertilisation. Mention the site and the product of fertilisation in a flower. 3

Solution:

Difference between pollination and fertilisation is :

Step I: Pollination is the transfer of pollen grains from stamen/ anther to stigma.

Step II: Fertilization is the fusion of male and female gamete (or germ cells)

Step III: Ovary/ Ovule

The product of fertilisation is:

Step IV: Zygote.

@PROCBSE

Objective Type Questions — 1 mark each

A Multiple Choice Questions

Q. 1. In a flower, the parts that produce male and female gametes (germ cells) are

(a) stamen and anther
(b) filament and stigma
(c) anther and ovary
(d) stamen and style [NCERT Exemp.]

Ans. Correct option : (c)

Explanation : In a flower, pollen grains are formed inside the anther, which produces the male gametes while the ovary bears the female gamete.

Q. 2. Which of the following is the correct sequence of events of sexual reproduction in a flower?

(a) Pollination, fertilisation, seedling, embryo
(b) Seedling, embryo, fertilisation, pollination
(c) Pollination, fertilisation, embryo, seedling
(d) Embryo, seedling, pollination, fertilisation
[NCERT Exemp.]

Ans. Correct option : (c)

Explanation : The correct sequence of events of sexual reproduction in a flower is pollination, fertilization, embryo, seedling. Pollination is the process of transfer of pollens from stamen to stigma after which fertilization takes place, during which germ cells fuse together to form zygote which in turn leads to embryo formation within the ovule. Fertilized ovule becomes seed and seeds germinate to produce seedling.

Q. 3. The correct sequence of reproductive stages seen in flowering plants is

(a) gametes, zygote, embryo, seedling
(b) zygote, gametes, embryo, seedling
(c) seedling, embryo, zygote, gametes
(d) gametes, embryo, zygote, seedling
[NCERT Exemp.]

Ans. Correct option : (a)

Explanation : Gamete formation is followed by pollination and fertilization to produce zygote which in turn leads to embryo formation. Fertilized ovule become seed and seeds germinate to produce seedling.

Q. 4. Which of the following statements are true for flowers?

(i) Flowers are always bisexual.
(ii) They are the sexual reproductive organs.
(iii) They are produced in all groups of plants.
(iv) After fertilisation they give rise to fruits.
(a) (i) and (iv) **(b) (ii) and (iii)**
(c) (i) and (iii) **(d) (ii) and (iv)**
[NCERT Exemp.]

Ans. Correct option : (d)

Explanation : Flowers are the sexual reproductive organs of a plant and a fertilized flower gives rise to fruit.

Q. 5. A student while observing an embryo of a gram seed listed various parts of the embryo as listed below: Testa, Micropyle, Cotyledon, Tegmen, Plumule, Radicle.

On examining the list the teacher commented that only three parts are correct. Select these three correct parts:

(a) Cotyledon, Testa, Plumule
(b) Cotyledon, Plumule, Radicle
(c) Cotyledon, Tegmen, Radicle
(d) Cotyledon, Micropyle, Plumule
[CBSE Board, Delhi Region, 2016]

Ans. Correct option : (b)

Explanation : When a plant produces a seed, it has 3 basic parts: plumule (the future shoot), radicle (the future root) and the cotyledons which may be 2 or 1 based on the type of plant being it dicot or monocot, respectively.

B Assertions and Reasons Type Questions

Directions: In the following questions, a statement of assertion (A) is followed by a statement of reason (R). Mark the correct choice as:

(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).
(b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).
(c) Assertion (A) is true but reason (R) is false.
(d) Assertion (A) is false but reason (R) is true.

Q. 1. Assertion (A): An embryo is formed from fertilized egg.

Reason (R): A monocot embryo comprises embryonal axis with two cotyledons.

Ans. Correct option : (c)

Explanation: Zygote, a fertilized egg give rise to an embryo, which has the ability to develop into a complete plant. A typical dicot embryo comprises an embryonal axis with two cotyledons.

Q. 2. Assertion (A): Unisexual flowers have separate male and female flowers whereas a typical monocot embryo comprises an embryonal axis with single cotyledon.

Reason (R): Cucumber, pumpkin and water melon are example of unisexual flowers.

Ans. Correct option : (b)

Explanation : Unisexual flowers have separate male and female flowers. The example includes cucumber, pumpkin and watermelon.

Q. 3. Assertion (A): Double fertilisation is unique to angiosperms.

@PROCBSE

Reason (R): Triple fusion occurs in asexual reproduction.

Ans. Correct option : (c)

Explanation : Double fertilization is a characteristic feature of flowering plants. In this process, out of the two sperm nuclei, one sperm nucleus fuses with the egg nucleus to form an embryo (process is called **syngamy**) and another fuses with the secondary nucleus to form an endosperm (process is called **triple fusion**). Because two kinds of fusion—syngamy and triple fusion—take place, the process is known as **double fertilisation**.

C Very Short Answer Type Questions

Q. 1. List two unisexual flowers.

R [Board Term-II, Foreign Set II, 2016]

Ans. Watermelon, papaya. ½ + ½

[CBSE Marking Scheme, 2016]

AI **Q. 2. Why is fertilization not possible without pollination?** A [Board Term-II, Foreign III, 2016]

Ans. Pollination allows pollen grains that produce male germ cell to reach the carpel which contain the female germ cell, egg.

Thus, fertilization which involves fusion of male and female germ cells can only occur after pollination. [CBSE Marking Scheme, 2016] **1**

Q. 3. Name the parts of a bisexual flower that are not directly involved in reproduction.

A [Board Term-II, Foreign Set III, 2015]

Ans. Sepals/calyx
Petals/corolla
Thalamus **(Any two)** ½ + ½

[CBSE Marking Scheme, 2015]

Short Answer Type Questions-I — 2 marks each

AI **Q. 1. In a flowering plant, summarize the events that take place after fertilization.** R [CBSE, SQP, 2019]

Ans. Fertilization results in formation of zygote.

Zygote divides several times to form an embryo. The ovule develops a thick coat and changes into seed. The ovary grows rapidly and ripens to form the fruit. [CBSE Marking Scheme, 2019] **2**

AI **Q. 2. Give one example of each, the unisexual and bisexual flowers.** U

Ans. Unisexual flowers contain either stamens or carpels but never both.

Example: Papaya, watermelon.

Bisexual flowers contain both stamens and carpels.

Example: *Hibiscus*, Mustard. **1+1**

AI **Q. 3. (i) What is the fate of the ovules and the ovary in a flower after fertilization?**

(ii) How is the process of pollination different from fertilization? U

Ans. (i) After fertilization, ovules become seeds and ovary forms the fruit. ½+½

(ii) Pollination is the transfer of pollen grains from anther to the stigma of a flower. ½

Fertilization is the fusion of male and female gametes. ½

Short Answer Type Questions-II — 3 marks each

AI **Q. 1. Define the term pollination. Differentiate between self pollination and cross pollination. What is the significance of pollination?**

U [Delhi, Set- I, 2020]

Ans. The transfer of pollen grains from the anther to the stigma of a flower is known as pollination.

The two types of pollination are:

(a) Self pollination: When the pollen grains from the stamens of a flower fall on the stigma of the same flower, then it is called self pollination.

(b) Cross pollination: When pollen grains from the stamens of a flower fall on the stigma of another flower, it is called cross pollination.

Significance of pollination:

(i) It is a significant event because it precedes fertilization.

(ii) It brings the male and female gametes closer for the process of fertilization.

(iii) Cross-pollination introduces variations in plants because of the mixing of different genes. These variations further increase the adaptability of plants towards the environment or surroundings. **(Any one) 1+1+1=3**

Q. 2. Distinguish between pollination and fertilisation. Mention the site and the product of fertilisation in a flower. U [Board Outside Delhi, Set- II, 2019]

Ans. Pollination: Transfer of pollen grains from stamen/anther to stigma. **1**
Fertilization: Fusion of male & female gamete (or germ cells) **1**
Site of fertilisation: Ovary/ Ovule ½
Product: Zygote. ½
[CBSE Marking Scheme, 2019]

@PROCBSE

AI **Q. 3. What is carpel? Write the function of its various parts.** R **[Board Outside Delhi, Set-I, 2019]**

Ans. Female reproductive part of the plant. **1**
(i) Stigma: Receive pollen grains
(ii) Style: Passage for the growth of pollen tube
(iii) Ovary: Site for fertilization **1 + 1**
If any two parts with function attempted award marks only **1½**
[CBSE Marking Scheme, 2019]

Detailed Answer:

Carpel is the female reproductive part that produces egg cells.

Main parts of carpel are:

(i) Stigma being sticky in nature receives pollen grains during pollination.

(ii) Style connects the stigma and ovary thus, helping with the transfer of pollen through style to the ovary.

(iii) Ovary is the reproductive organ of carpel which produces the female gamete ovule.

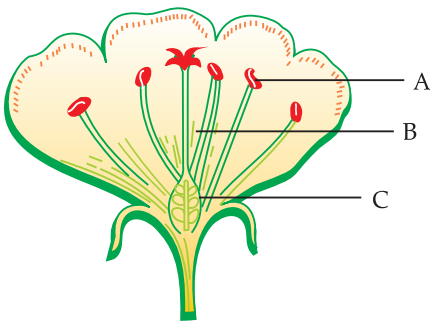
1+1+1

Q. 4. What is sexual reproduction? List its four significance. R **[Board Term II, Foreign Set I, 2016]**

Ans. Two major processes namely formation of gametes and fusion of gametes constitute sexual reproduction. **1**
Significance–(i) Incorporates the process of combining DNA from two different individuals during reproduction.
(ii) Increases genetic variation.
(iii) Promotes diversity in the offsprings.
(iv) Plays a role in the origin of new species. **4 × ½ = 2**
[CBSE Marking Scheme, 2016]

AI **Q. 5. Name the parts A, B and C shown in the following diagram and state one function of each.**

U **[Board Term- II, Delhi Set I, 2016]**



Ans. A. Anther: It produces pollen grains. ½ + ½
B. Style: It provides the path through which the pollen tube grows and reaches the ovary. ½ + ½
C. Ovary: It contains ovules and each ovule has an egg cell/female gamete. It develops into fruit after fertilization.
[CBSE Marking Scheme, 2016] ½ + ½

Q. 6. In a germinating seed, which parts are known as future shoot and future root? Mention the function of cotyledon. R **[Board Term II, SQP, 2016]**

Ans. Future shoot–Plumule
Future root–Radicle
Function of cotyledon–It stores food for the future plant or embryo. **1+1+1=3**
[CBSE Marking Scheme, 2016]

Q. 7. Name the reproductive parts of an angiosperm. Where are these parts located? Explain in brief the structure of its female reproductive parts.

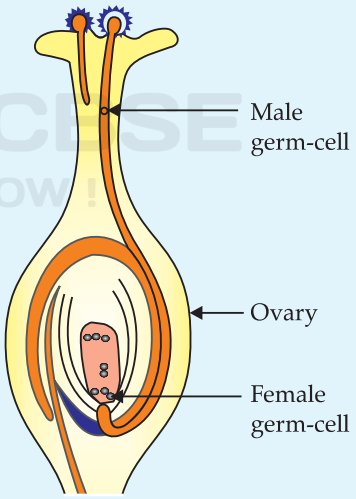
R **[Board Term-I, Foreign Set II, 2016]**

Ans.(i) Stamen and Carpel. **1**
(ii) Located in the flower. ½
(iii) The female reproductive part is Carpel. It is made up of three parts–the bottom swollen part is ovary, middle elongated part is the style, terminal sticky part is stigma. **½ × 3 = 1½**
[CBSE Marking Scheme, 2016]

AI **Q. 8. Draw a diagram of the longitudinal section of a flower exhibiting germination of pollen on stigma and label.**
(i) Ovary, (ii) Male germ-cell, (iii) Female-germ cell and (iv) ovule on it.

AE **[Board Term-II, Foreign Set-III, 2015]**

Ans.



(Drawing) 1

Four correct labelling, viz., ovary, male germ cell, female germ cell and ovule. **½ × 4**
[CBSE Marking Scheme, 2015]

COMMONLY MADE ERROR

- There is not one, but two germ cells in the pollen tube. They are male gametes formed by the division of generative cell.

ANSWERING TIP

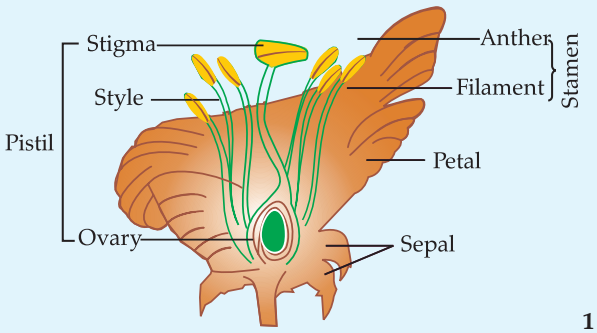
- Practice self-explanatory diagrams with proper labelling, arrows and headings.

@PROCBSE JOIN NOW!

Q. 9. Draw longitudinal section of a bisexual flower and label the following parts on it:
(i) Anther, (ii) Ovary, (iii) Stigma, (iv) Style.

U [Board Term-II, Foreign Set II, 2015]

Ans.



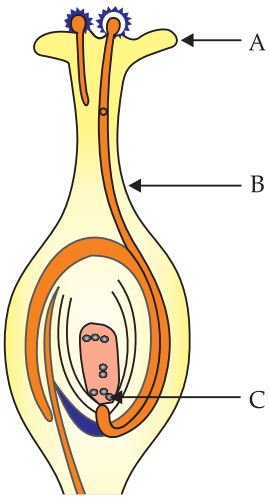
1

4 correct labellings **(i)** Anther **(ii)** Ovary **(iii)** Stigma **(iv)** Style ½ × 4

[CBSE Marking Scheme, 2015]

Q. 10. Name the parts A, B and C shown in the diagram and write their functions.

A [Board Term-II, Delhi III, 2015]



Ans. Part A is Stigma.
Function: It is the terminal part of carpel, which may be sticky and helps in receiving the pollen grains from the anther of stamen during pollination.
Part B is Pollen tube.
Function: The pollen tube grows out of the pollen grain through the style to reach the ovary. It carries male gametes into the embryo sac in ovule.
Part C is Female Germ Cell.
Function: It is a female gamete which fuses with male gamete to form a diploid cell known as **zygote**.
½+½+½+½+½+½

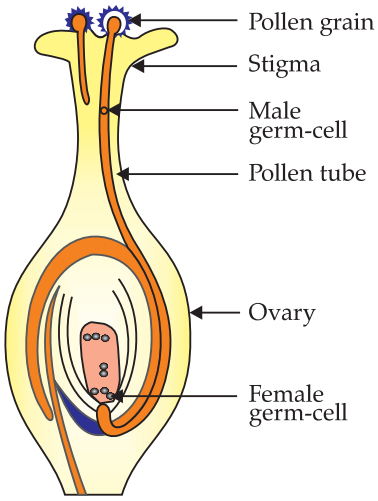
@PROCBSE LEARN NOW !

Long Answer Type Questions — 5 marks each

Q. 1. (a) Draw a diagram showing germination of pollen on stigma of a flower and mark on it the following organs/parts:
(i) Pollen grain (ii) Pollen tube (iii) Stigma (iv) Female germ cell
(b) State the significance of pollen tube.
(c) Name the parts of flower that develop after fertilization into: (i) Seed (ii) Fruit.

U [Outside Delhi, Set- I, 2020]

Ans. (a)



(b) Pollen tube carries male gametes to ovule present inside the ovary leading to fertilization.

(c) After fertilization, ovary develops into fruit whereas ovules into the seed. **3+1+1=5**

AI **Q. 2. Define pollination. Explain the different types of pollination. List two agents of pollination. How does suitable pollination lead to fertilization?**

R [CBSE Board Delhi, Set- I, 2019]

Ans. Pollination: Transfer of pollen from anther / stamen to stigma of the flower
Types of Pollination:
(a) Self pollination: Transfer of pollen from anther/ stamen to stigma occurs in the same flower
(b) Cross pollination: Pollen is transferred from anther stamen of one flower to stigma of another flower
Agents of pollination: Wind, Water, Insects and Animals (Any two)
A tube grows out of the pollen grain and travels through the style, to reach the female germ cell in the ovary to cause fertilization. **1+1+1+1+1**

[CBSE Marking Scheme, 2019]

Q. 3. Give one example each of unisexual and bisexual flowers. Differentiate between the two types of pollination that occur in flowers. What happens

@PROCBSE

when a pollen lands on a suitable stigma? Write about the events that occur till the seed formation in the ovary. U **[Foreign 31/2/1, 2017]**

Ans. Unisexual Flower: Papaya/Water-melon/ any other **(any one)** ½

Bisexual Flower: *Hibiscus*/Rose/ any other **(any one)** ½

Self pollination: The pollen grains are transferred from the anther to the stigma of the same flower or to the flower of the same plant. **1**

Cross pollination: The pollen grains are transferred from the anther to the stigma of a flower of a different plant. **1**

- After pollen lands on a suitable stigma, a pollen tube grows out of pollen grain and travels through the style to reach the ovary. ½
- The male germ cell fuses with the female germ cell to form a zygote. ½
- Zygote divides several times to form an embryo within the ovule. ½
- The ovule develops tough coat and gradually gets converted into a seed. ½

[CBSE Marking Scheme, 2017]

AI **Q. 4. (a) What is pollination? Give its two types.**

(b) Draw a longitudinal section of female reproductive part of a flower showing germination of pollen grain. Label on it the following:

(i) Stigma;

(ii) Pollen tube with a male germ cell;

(iii) Female germ cell.

R **[Delhi Comptt. 31/1/1, 2017]**

Ans. (a) Pollination: Process of transfer of pollen grains from the anther to the stigma of the flower. **1**

Two types: Self-pollination and Cross pollination ½ + ½

(b)

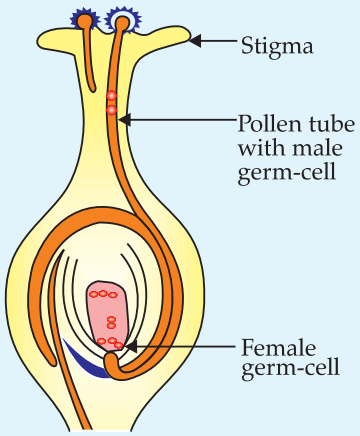


Diagram **1½**

Three labellings ½ × 3

[CBSE Marking Scheme, 2017]

@PROCBSE JOIN NOW !

TOPIC - 3
Reproduction in Human Being

Revision Notes

- Humans have sexual mode of reproduction.
- It needs sexual maturation, which is the period of life when production of germ cells *i.e.,* ova (female) and sperm (male) start in the body. This period of sexual maturity is called **puberty**.
- **Changes at Puberty are:**
  - **(a) Common in male and female**
    - Thick hair growth in armpits and genital area.
    - Skin becomes oily, may result in pimples.
  - **(b) In girls:**
    - Breast size begins to increase.
    - Girls begin to menstruate.
  - **(c) In boys:**
    - Thick hair grows on face.
    - Voice begins to crack.
    - These changes signals that sexual maturity is taking place.

Scan to know more about this topic

Sexual reproduction in humans

- **Male Reproductive System**
  - **(a) Testes:** A pair of testes are located inside scrotum which is present outside the abdominal cavity. Scrotum has a relatively lower temperature needed for the production of sperms.

    Functions of testes:
    - Produce male germ cells *i.e.,* sperms are formed here.
    - Testes release male sex hormone (testosterone). Its function is to:
      - **(i)** Regulate production of sperms.
      - **(ii)** Bring changes at puberty.

@PROCBSE

(b) **Vas deferens:** It passes sperms from testes towards the urethra.

(c) **Urethra:** It is a common passage for both sperms and urine. Its outer covering is called **penis**. It is like a fibromuscular long tube which travels through penis.

(d) **Associated glands:** Seminal vesicles and prostate gland add their secretion to the sperms. This fluid provide nourishment to sperms and make their transport easy. Sperm along with secretion of glands form semen.

- **Female Reproductive System**

(a) **Ovary:** A pair of ovary is located in both sides of abdomen.
- Female germ cells *i.e.,* eggs are produced here.
- At the time of birth of a girl, thousands of immature eggs are present in the ovary.
- At the onset of puberty, some of these eggs start maturing.

(b) **Oviduct or Fallopian tube**
- Receives the egg produced by the ovary and transfer it to the uterus.
- Fertilisation *i.e.,* fusion of gametes takes place here.

(c) **Uterus:** It is a bag-like structure where development of the foetus takes place.
- Uterus opens into vagina through cervix.
- The embryo moves down to reach the uterus. The embedding of the embryo in the thick inner lining of the uterus is called **implantation**.

Scan to know more about this topic

Contraception

- The time period from the development of foetus inside the uterus till birth is called **gestation period**. The act of giving birth to the fully developed foetus at the end of gestation period is termed as **parturition**.
- The breakdown and removal of the inner, thick and soft lining of the uterus along with its blood vessels in the form of vaginal bleeding is called **menstrual flow** or **menstruation**.
- Reproductive health is all those aspects of general health which help a person to lead a normal, safe and satisfying reproductive life.
- **Sexually Transmitted Diseases (STDs)** are the diseases which spread by sexual contact from an infected person to a healthy person. Some common STDs are Gonorrhoea, syphilis, trichomoniasis, AIDS.
- There are different methods which are developed to prevent and control pregnancy such as mechanical methods, chemical methods, oral pills and surgical methods.
- **Contraception:** It is the avoidance of pregnancy, which can be achieved by preventing the fertilisation of ova.
- **Methods of contraception**

(a) **Physical barrier**
- To prevent union of egg and sperm.
- Use of condoms, cervical caps and diaphragm.

(b) **Chemical methods**
- Use of oral pills.
- These change hormonal balance of body so that eggs are not released.
- May have side effects.

(c) **Intrauterine contraceptive device (IUCD)**
- Copper-T or loop is placed in uterus to prevent pregnancy.

(d) **Surgical methods**
- In males the vas deferens is blocked to prevent sperm transfer called **vasectomy**.
- In females, the fallopian tube is blocked to prevent egg transfer called **tubectomy**.

Mnemonics

Concept: Parts of Male Reproductive System	Concept: Accessory glands in Males
Mnemonics: **SEVEn UP**	Mnemonics: **Saint Peters**
Interpretation: **S- S**eminiferous tubules **E- E**pididymis **V- V**as deferens **E- E**jaculatory duct **U - U**rethra **P - P**enis	**Interpretation:** **S**eminal vesicle, **P**rostate gland

@PROCBSE JOIN NOW !

@PROCBSE

Concept: Accessory Ducts in Females	**Concept: Birth Control Methods**
Mnemonics: **Our United Villages**	Mnemonics: **S**wiss **N**ational **B**ank's **I**ndian **O**ffice
Interpretation: **O**viduct, **U**terus, **V**agina	**Interpretation:** **S**urgical, **N**atural, **B**arrier, **I**UD, **O**ral contraceptive
Concept: Barrier Methods	
Mnemonics: **CDC V**olunteered **S**tudent's **J**unior **F**ellowship	
Interpretation: Condoms, Diaphragm, Cervical caps, vaults, Spermicidal creams, jellies, foams	

How is it done on the GREENBOARD?

Q. (a) "Use of a condom is beneficial for both the sexes involved in a sexual act," Justify this statement giving two reasons.

(b) How do oral contraceptive help in avoiding pregnancies ?

(c) What is sex selective abortion? How does it affect a healthy society ? (State any one consequence) 3

Solution:

The two reasons are :

Step I: (a) Prevents meeting of sperm and ova

Step II: Protects against sexually transmitted diseases

Step III: (b) Oral pills contain hormones which prevent the ovaries from releasing ovum into the oviduct.

Step IV: (c) Sex selective abortion is the term referred to abortion (termination) of pregnancy, especially female foeticide.

Effect of sex selective abortion is:

Step V: Society will have imbalance in the male female ratio.

Objective Type Questions — 1 mark each

A Multiple Choice Questions

Q. 1. During adolescence, several changes occur in the human body. Mark one change associated with sexual maturation in boys.

(a) Loss of milk teeth **(b) Increase in height**
(c) Cracking of voice **(d) Weight gain**

[NCERT Exemp.]

Ans. Correct option : (c)

Explanation: Cracking of voice is one of the secondary sexual characters of human males observed during adolescence.

Q. 2. In human females, an event that reflects onset of reproductive phase is

(a) growth of body
(b) changes in hair pattern
(c) change in voice
(d) menstruation **[NCERT Exemp.]**

Ans. Correct option : (d)

Explanation: Development of female secondary sexual characters marks onset of puberty and initiation of menstrual cycle reflects onset of reproductive phase.

Q. 3. In human males, the testes lie in the scrotum, because it helps in the

(a) process of mating.
(b) formation of sperm.

@PROCBSE

(c) easy transfer of gametes.
(d) all of the above. [NCERT Exemp.]

Ans. Correct option : (b)

Explanation: Scrotum provides lower temperature needed for sperm formation.

Q. 4. Which among the following is not the function of testes at puberty?
(i) Formation of germ cells
(ii) Secretion of testosterone
(iii) Development of placenta
(iv) Secretion of estrogen
(a) (i) and (ii) (b) (ii) and (iii)
(c) (iii) and (iv) (d) (i) and (iv)
[NCERT Exemp.]

Ans. Correct option : (c)

Explanation: Development of placenta and secretion of estrogen are female reproductive functions.

B Assertions and Reasons Type Questions

Directions: In the following questions, a statement of assertion (A) is followed by a statement of reason (R), Mark the correct choice as:

(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).
(b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).
(c) Assertion (A) is true but reason (R) is false.
(d) Assertion (A) is false but reason (R) is true.

Q. 1. Assertion (A): Sexual reproduction increases genetic diversities and plays a role in origin of new species.
Reason (R): Sexual reproduction involves formation of gametes and fusion of gametes.

Ans. Correct option : (a)

Explanation: Sexual reproduction involves two parents that results in the offsprings that are not identical to the parents. It causes variations; which are essential for evolution as well as survival of species under unfavourable conditions.

Q. 2. Assertion (A): In human male, testes are extra-abdominal organs which are present inside scrotum.
Reason (R): Scrotum has a relatively lower temperature needed for the production and storage of sperms.

Ans. Correct option : (a)

Explanation: Formation of sperms needs lower temperature than the normal body temperature. Hence, testes lie outside the body cavity in the scrotum.

Q. 3. Assertion (A): At puberty, in boys, voice begins to crack and thick hair grows on face.
Reason (R): At puberty, there is decreased secretion of testosterone in boys.

Ans. Correct option : (c)

Explanation: Puberty in boys is regulated by male sex hormone called **testosterone**, which are secreted by testes. In puberty, secondary sexual characters like growth of hair on face, chest, broadening of shoulders and deepening of voice occurs.

Q. 4. Assertion (A): Surgical methods are most effective methods of contraception.
Reason (R): Surgical method blocks gametes transport and hence prevent fertilisation.

Ans. Correct option: (a)

Explanation: Surgical method like vasectomy in male and tubectomy in female prevent pregnancy. These methods block gamete transport and hence prevent fertilisation. They are very effective but reversibility is very poor.

C Very Short Answer Type Questions

Q. 1. What is fertilisation? Where does it occur in a human female? R [Foreign 31/2/3, 2017]

Ans. Fusion of male and female gamete is known as **fertilization**. It occurs in fallopian tube. ½ + ½

AI **Q. 2. Name the organs producing sperms and ova respectively in humans.**
R [Foreign 31/2/3, 2017]

Ans. Testis: Sperms, **Ovary:** Ova. ½ + ½

Q. 3. List two functions of ovary of human female reproductive system.
R [Board Term-II, O.D. Set III, 2016]

Ans. Two functions of Ovary:
(i) To produce female gamete / ovum.
(ii) To secrete female hormones / estrogen and progesterone.
[CBSE Marking Scheme, 2016] ½ + ½

Q. 4. Give reason for the statement— Since the ovary releases one egg every month, the uterus also prepares itself every month by making its lining thick and spongy. A [Board Term-II, SQP, 2016]

Ans. It is required for nourishing the embryo if fertilization takes place and reaches the uterus.
[CBSE Marking Scheme, 2016] **1**

Q. 5. In the human female reproductive system where does fertilization occur? R [Board Term II, 2015]

Ans. Oviduct or Fallopian tube. **1**
[CBSE Marking Scheme, 2015]

Q. 6. Write the role of testes in male reproductive system. R [Board Term II, 2015]

Ans. Formation of sperms and to secrete hormone called testosterone.
[CBSE Marking Scheme, 2015] ½ + ½

@PROCBSE JOIN NOW

Short Answer Type Questions-I — 2 marks each

Q. 1. What is the main difference between sperms and eggs of humans? Write the importance of this difference. U

Ans. Sperms contain one of the two types of sex chromosomes i.e., X—chromosomes and Y—chromosomes.

Egg contains one type of sex chromosomes only i.e., X—chromosome.

This chromosomal difference helps in determination of sex. If sperm carrying Y-chromosome fuses with egg, the resultant zygote will develop in male. If sperm with X chromosome fuses with egg, the zygote will develop into a female child. **2**

Q. 2. Write two functions of each (i) Testis, (ii) Ovaries. A

Ans. (i) Testis: It produces sperms and secretes male sex hormones called testosterone. **1**

(ii) Ovary: It produces ovum and secretes female sex hormones called estrogen and progesterone. **1**

Q. 3. Mention the functions of (a) placenta, (b) fallopian tube in the human female reproductive system. U

Ans. (a) **Placenta:** (i) Helps in the transportation of glucose and oxygen from the mother to the embryo. ½

(ii) Waste generated by the embryo is removed by transferring it to the mother's blood. ½

(b) Fallopian tube: (i) Egg is carried from the ovary to the uterus. ½

(ii) Fertilization occurs here. ½

Q. 4. List any two contraceptive methods practised only by women. Mention how these methods work? R

Ans. (i) Oral pills: Change hormonal balance so eggs are not released. **1**

(ii) Loop / Copper-T: Placed in the uterus. Prevent pregnancy by checking the entry of sperms through the vagina. **1**

Short Answer Type Questions-II — 3 marks each

Q. 1. State the basic requirement for sexual reproduction? Write the importance of such reproductions in nature. A **[Delhi 31/1/1, 2017]**

Ans. Formation of male and female gametes, fusion of gametes/syngamy ½ + ½

Importance: Combination of DNA from two different individuals lead to increase in genetic variation in the organism. **1**

This leads to diversity in the population which helps in natural selection.

[CBSE Marking Scheme, 2017] 1

Detailed Answer:

Basic requirements in sexual reproduction are:

(i) Formation of gametes through meiosis.

(ii) Transfer of male gametes into the female body.

(iii) Fusion of male and female gametes. Process is fertilization.

(iv) Formation of offspring from a single celled zygote- Post fertilization changes.

The basic requirements for sexual reproduction to take place are involvement of two parents and fusion of haploid gametes.

Importance of sexual reproduction:

Fusion of gametes results in genetic variations in the offspring. This promotes diversity of characters in offspring. These genetic variations, thus, lead to evolution of species as well as allow the organisms to become better adapted in the changing environment. **3**

Q. 2. Mention the total number of chromosomes along with the sex chromosomes that are present in a human female and a human male. Explain how in sexually producing organisms the number of chromosomes in the progeny remains the same as that of the parents. U **[Delhi 31/1/2, 2017]**

Ans. Total number of chromosomes is 46. In human male, two sex chromosomes *i.e.*, X or Y are present, while in human female, both sex chromosomes are X.

During sexual reproduction, a female gamete or egg cell fuses with a male gamete or sperm cell which are haploid to form zygote. Zygote is diploid (2n) which contains 46 chromosomes, 23 chromosomes from mother and 23 from father. In this way, an equal genetic contribution of male and female parents is ensured in the progeny. **2 + 1**

Q. 3. State the changes that take place in the uterus when:

(i) Implantation of embryo has occurred.

(ii) Female gamete/egg is not fertilised.

U **[Delhi 31/1/1, 2017]**

Ans. (a) When implantation of embryo has occurred, the uterine wall thickens and is richly supplied with blood to nourish the growing embryo. **1½**

(b) The thick and spongy lining of the uterus slowly breaks and comes out through the vagina as blood and mucus. **[CBSE Marking Scheme, 2017] 1½**

@PROCBSE JOIN NOW

Detailed Answer:

(i) When implantation has occurred in uterus of mother, the inner lining of the uterus thickens and is richly supplied with the blood vessels to provide nourishment to the growing embryo.

(ii) If the egg is not fertilised, it lives for one day. Since, the thickened uterus lining is no more required; it slowly breaks down and comes out of the vagina as blood and mucous, known as **menstruation**, which lasts for about two to eight days.

AI **Q. 4. Write the functions of the following parts of human female reproductive system:**

(i) Ovary, (ii) Fallopian tube (iii) Uterus.

C **[Delhi Comptt. 31/1/2, 2017]**

Ans. (i) Ovary: Produces egg or female gamete, female sex hormone/ estrogen. ½ + ½

(ii) Fallopian tube: Transfer of ovum to the uterus, site for fertilization ½ + ½

(iii) Uterus: Site of implantation of zygote, development of embryo. ½ + ½

[CBSE Marking Scheme, 2017]

Detailed Answer:

(i) Ovary: It produces eggs (ova) and female sex hormone estrogen and progesterone.

(ii) Fallopian Tube: The fallopian tube provides passage for the eggs (ova) to pass into the uterus by ciliary action. It is the site for fertilisation.

(iii) Uterus: Uterus is the site of implantation of zygote and site of development of embryo.

AI **Q. 5. State briefly the changes that take place in a fertilized egg till birth of the child in the human female reproductive system. What happens to the egg when it is not fertilized?**

U **[Delhi Comptt. 31/1/3, 2017]**

Ans. Changes in fertilized egg:

(a) Zygote/fertilized egg starts dividing.

(b) Implantation of zygote in the inner uterine wall.

(c) Embryo starts growing with the help of the placenta which results in the development of the child.

(d) Birth of a child as a result of rhythmic contraction of the muscles in the uterus. ½ × 4

When egg is not fertilized, the inner lining of the uterus slowly breaks and comes out through the vagina as blood and mucous (Menstruation) **1**

[CBSE Marking Scheme, 2017]

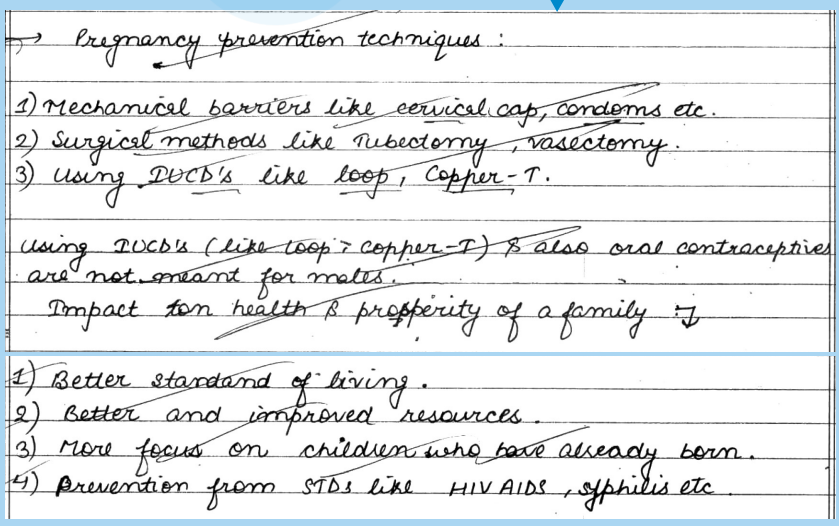
AI **Q. 6. List three techniques that have been developed to prevent pregnancy. Which one of these techniques is not meant for males? How does the use of these techniques have a direct impact on the health and prosperity of a family?**

A **[CBSE OD,Set-1-2017]**

@PROCBSE JOIN NOW !

Topper Answer, 2017

Ans.



Pregnancy prevention techniques :

1) Mechanical barriers like cervical cap, condoms etc.
2) Surgical methods like Tubectomy, vasectomy.
3) Using IUCD's like loop, Copper-T.

Using IUCD's (like loop & copper-T) & also oral contraceptives are not meant for males.

Impact on health & prosperity of a family :-

1) Better standard of living.
2) Better and improved resources.
3) More focus on children who are already born.
4) Prevention from STDs like HIV AIDS, syphilis etc.

Detailed Answer:

Three techniques that have been developed to prevent pregnancy are:

(i) Barrier method: Physical methods such as condom, diaphragm and cervical caps are used to prevent entry of sperms in females.

(ii) Chemical methods: Drugs such as oral pills and vaginal pills are used by females.

(iii) Surgical methods such as vasectomy in males and tubectomy in females.

Chemical methods are not meant for males.

The use of these techniques helps in controlling population explosion thus providing better living conditions.

It helps in keeping proper gap between siblings thus gives better health to mother as well as children. **1+1+1**

@PROCBSE

Q. 7. What is contraception? Name any two methods. How does the use of these methods have a direct effect on the health and prosperity of a family? State any three points. U [Foreign 31/2/1, 2017]

Ans. (i) Contraception: Any method which prevents conception/ pregnancy is called **contraception**. ½

(ii) Barrier Method, Chemical Method, Surgical Method. **(Any two)** ½ + ½

(iii) Health of women (mother) is maintained, Parents can give more attention to their children/ family, More resources may be made available for improvement of standard of living. **(or any other relevant point)** **(Any three)** ½ × 3

[CBSE Marking Scheme, 2017]

Q. 8. Name the two types of mammalian gametes. How are these different from each other? Name the type of reproduction they are involved in. Write the advantage of this type of reproduction. U [Foreign 31/2/3, 2017]

Ans. Male gamete: sperm ½

Female gamete: ovum/egg ½

Sperms are motile and produced by male individual, ova/eggs are non-motile and produced by female individual. **1**

Type of reproduction is Sexual reproduction ½

Advantage: Generates more variations ½

[CBSE Marking Scheme, 2017]

Q. 9. What are the functions of testis in the human male reproductive system? Why are these located outside the abdominal cavity? Who is responsible for bringing about changes in appearance seen in boys at the time of puberty? U [Board Term-II, Delhi Set II, 2016]

Ans. Functions of testis:

(i) Produce sperms. ½

(ii) Produces male hormone/ testosterone. ½

These are located outside the human body, as sperms need lower temperature than the normal body temperature to mature. **1**

Testosterone. [CBSE Marking Scheme, 2016] **1**

Q. 10. What is placenta? Write any two major functions of placenta. R [Board Term-II, SQP, 2016]

Ans. Placenta: A disc shaped organ or special tissue in the uterus of pregnant mammal, nourishing and maintaining the foetus through the umbilical cord.

Functions of Placenta:

(i) Provides large surface area for glucose and oxygen to pass from mother to the embryo.

(ii) Removal of waste generated in the developing embryo into the mother's blood. **1 + 1 + 1**

[CBSE Marking Scheme, 2016]

Q. 11. (a) Mention the role of the following organs of human male reproductive system:

(i) Testis; (ii) Scrotum; (iii) Vas deferens; (iv) Prostate glands.

(b) What are the two roles of testosterone?

U [Board Term-II, Foreign Set III, 2016]

Ans. (a) (i) Testis: To produce male gametes / sperm or male hormone / testosterone.

(ii) Scrotum: To provide optimal temperature to testis for the formation of sperms.

(iii) Vas deferens: To deliver the sperms to the urinary bladder.

(iv) Prostrate glands: To secrete the fluid which provides nutrition and medium for transport of sperms. **4 × ½**

(b) (i) Regulates formation of sperms, **(ii)** Brings about the changes in boys during adolescence ½ + ½

[CBSE Marking Scheme, 2016]

Long Answer Type Questions — 5 marks each

Q. 1. (a) "Use of a condom is beneficial for both the sexes involved in a sexual act," Justify this statement giving two reasons.

(b) How do oral contraceptive help in avoiding pregnancies?

(c) What is sex selective abortion? How does it affect a healthy society? (State any one consequence)

AE [Outside Delhi, Set- I, 2020]

Ans. (a) (i) Prevents meeting of sperm and ova

(ii) Protects against sexually transmitted diseases

(b) Oral pills contain hormones which prevent the ovaries from releasing ovum into the oviduct. (c) Selective abortion means abortion (termination) of pregnancy, especially female foeticide. Effect: Society will have imbalance in the male female ratio. **2+1+2=5**

Q. 2. (a) Suggest any two categories of contraceptive methods to control the size of human population which is essential for the prosperity of a country. Also explain about each method briefly.

(b) Name two bacterial and two viral infections each that can get sexually transmitted.

(c) List two advantages of using condom during sexual act. U [Outside Delhi, Set-III, 2020]

Ans. (a) Methods of contraception:

(i) Barrier method or mechanical method/ Condom/ Diaphragm, to prevent the meeting of sperms and ova.

(ii) Chemical method/ Oral pills: Changes the hormonal balance of the female partner so that the eggs are not released.

@PROCBSE

(iii) Surgical method: to block the vas deferens in males/ vasectomy or the fallopian tube (oviduct) in females/ tubectomy, to prevent the transfer of sperms or egg and hence no fertilization takes place. (Any two)

(b) Bacterial infections: Syphilis and Gonorrhea
Viral infections: Human papilloma virus (HPV), HIV

(c) (i) Prevents meeting of sperm and ova
(ii) Protects against sexually transmitted diseases

2+2+1

Q. 3. (i) Describe the role of prostate gland, seminal vesicle and testes in the human male reproductive system.

(ii) How is the surgical removal of unwanted pregnancies misused?

(iii) Explain the role of oral contraceptive pills in preventing conception. R **[CBSE SQP, 2020]**

Ans. (i) Prostate glands and seminal vesicle add their secretions so that the sperms are in a fluid and it makes their transport easier and also provides nutrition. Testes secrete testosterone which brings about changes in the appearances in the boys at the time of puberty.

(ii) Female foeticides/illegal sex selected abortion of female foeticide.

(iii) Interfere in release of egg and eggs are not released.

[CBSE Marking Scheme, 2020] 3+ 2

Q. 4. (a) Draw a diagram of human female reproductive system and label the parts:

(i) Which produce an egg.

(ii) Where fertilization takes place.

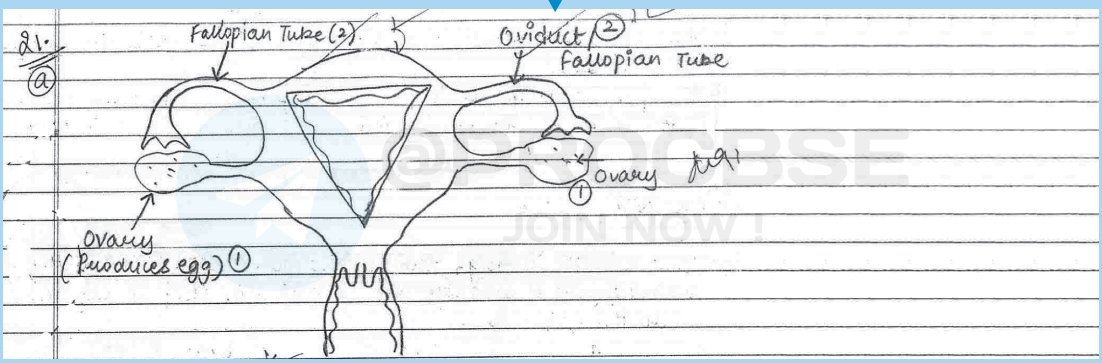
(b) List two bacterial diseases which are transmitted sexually.

(c) What are contraceptive devices? Give two reasons for adopting contraceptive devices in humans.

R **[CBSE Board, 2019]**

Topper Answer, 2017

Ans.



(b) Gonorrhoea and Syphilis are bacterial diseases transmitted sexually.

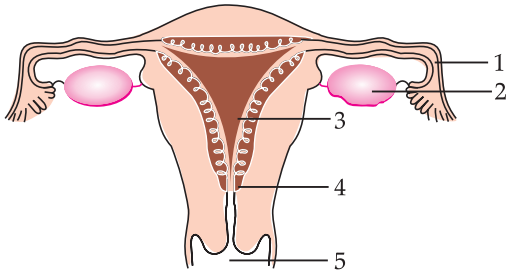
(c) The devices used to prevent fertilisation in human females are known as contraceptive devices.

(1) They are adopted to prevent unwanted pregnancies.

(2) They help to maintain the reproductive health of women & induced to control birth & death rate.

Q. 5. (a) Identify the given diagram. Name the parts 1 to 5.

(b) What is contraception? List three advantages of adopting contraceptive measures.



R **[CBSE Board Delhi, Set- I, 2019]**

@PROCBSE

Ans. (a) Female reproductive system

Name of parts –

1: Fallopian tube/Oviduct

2: Ovary

3: Uterus

4: Cervix

5: Vagina ½+ ½ × 5

(b) Contraception: Method to avoid pregnancy ½

Advantages:

(i) Proper gap between two pregnancies

(ii) Avoiding unwanted pregnancy

(iii) Keeping population under control ½ × 3

[CBSE Marking Scheme, 2019]

Q. 6. What is sexual reproduction? Explain how this mode of reproduction give rise to more viable variations than asexual reproduction? How does this affect the evolution?

R [Board Outside Delhi, Set- III, 2019]

Ans. When male and female organisms are involved in producing young ones, is known as **sexual reproduction** / Gametes from two organisms of opposite sex must fuse to produce young ones. **1**

- Gametes (germs cells) produced are the products of meiosis / due to combining of DNA from two individuals, this results in mixing of characters and causes variations. **1 + 1**
- In asexual reproduction, single parent produces young ones. There is no mixing of characters. **1**
- More variations help in the process of evolution. Helpful variations accumulate over time and produce new species and result in evolution. [CBSE Marking Scheme, 2019] **1**

Detailed Answer:

Sexual reproduction is a natural mode of reproduction which involves two individuals and gamete formation.

During sexual reproduction, at the time of gamete formation, meiotic cell division takes place. During meiosis, crossing over between fragments of homologous chromosomes occurs which brings about new gene combinations to be transferred to new generation. Crossing over is the fundamental cause of origin of variations in sexually reproducing organisms.

Whereas in asexual reproduction, chance variations can only occur when there is inaccurate copying of DNA as only one individual is involved. The variations caused by crossing over in sexually reproducing organisms are subjected to the selection process. Natural selection selects those variations which have more adaptive value and guide them towards evolution of new species. In this way, sexual reproduction gives rise to more viable variations for evolution.

Q. 7. (a) Draw the diagram of female reproductive system and match and mark the part(s):

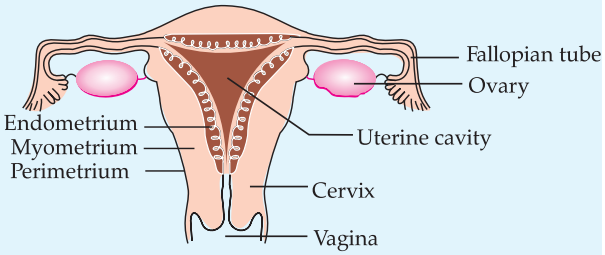
(i) Where block is created surgically to prevent fertilization.

(ii) Where CuT is inserted?

(iii) Inside which condom can be placed.

(b) Why do more and more people prefer to use condoms? What is the principle behind use of condoms? U [CBSE, SQP-2018-19]

Ans. (a)



Correct diagram with correct labelling, correctly matched with the following parts:

(i) Fallopian Tube/Oviduct

(ii) Uterus

(iii) Vagina

(b) People prefer use of condoms as it prevents STDs/ gives privacy to the user. Condoms help create a mechanical barrier preventing meeting of sperms and ovum. [CBSE Marking Scheme, 2018] 5

Q. 8. (a) Write the functions of following parts in human female reproduction system:

(i) Ovary, (ii) Oviduct, (iii) Uterus

(b) Describe in brief the structure and function of placenta. AE [Board Delhi. OD. Set 2018]

[Board term II Delhi Set-1-2015 & 2016]

Ans. (a)(i) Ovary: Releases egg/female gamete/ovum, Releases oestrogen/female hormones. **(any one)**

(ii) Oviduct: Transportation of ovum/egg/ from ovary to the uterus/Site of fertilization.

(iii) Uterus: Development of embryo/foetus.

(b) Placenta: It is disc like tissue embedded in uterine wall which contains villi on the embryo side of the tissue and blood space on mother side.

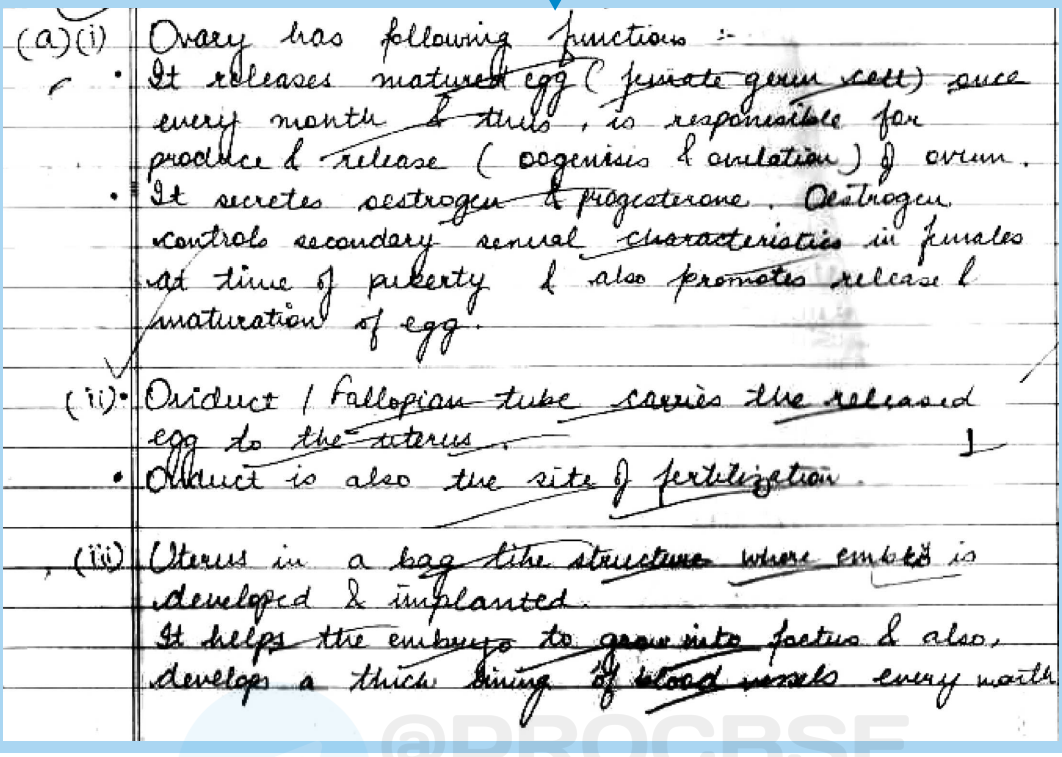
Function of placenta: Provides nourishment to embryo from mother's blood / Removal of waste from embryo to mother's blood. **3 + 2**

[CBSE Marking Scheme, 2018]

@PROCBSE

Topper Answer, 2018

Ans.


(a)(i) Ovary has following functions :-
• It releases matured egg (female germ cell) once every month & thus, is responsible for production & release (oogenesis & ovulation) of ovum.
• It secretes oestrogen & progesterone. Oestrogen controls secondary sexual characteristics in females at time of puberty & also promotes release & maturation of egg.

(ii) • Oviduct / Fallopian tube carries the released egg to the uterus.
• Oviduct is also the site of fertilization.

(iii) Uterus is a bag like structure where embryo is developed & implanted.
It helps the embryo to grow into foetus & also, develops a thick lining of blood vessels every month

Q. 9. **(a) Name the organ that produces sperms as well as secretes a hormone in human males. Name the hormone it secretes and write its functions.**

(b) Name the parts of the human female reproductive system where fertilisation occurs.

(c) Explain how the embryo gets nourishment inside the mother's body. R **[Delhi 31/1/1, 2017]**

Ans. (a) Testes ½
Testosterone ½
Functions of Testosterone:
(i) Formation of sperms
(ii) Development of secondary sexual characters ½ × 2

(b) Fallopian Tubes/Oviduct ½

(c) Placenta, a special disc-like tissue embedded in the mother's uterine wall and is connected to the foetus/embryo. ½ + 1
Placenta provides a large surface area for glucose and oxygen/nutrients to pass from the mother's blood to the developing embryo/foetus. **1**
[CBSE Marking Scheme, 2017]

Q. 10. **(a) Name the human male reproductive organ that produces sperms and also secretes a hormone. Write the functions of the secreted hormone.**

(b) Name the parts of the human female reproductive system where:
(i) Fertilization takes place
(ii) Implantation of the fertilised egg occurs.

(c) Explain how the embryo gets nourishment inside the mother's body.

R **[Board Term-II, O.D. Set I, 2015]**

Ans. Refer Q.9 of Long Answer Types Questions

Visual Case-based Questions — 4 marks each

Q. 1. **Read the following passage and answer any four questions from (a) to (e).**
The growing size of the human population is a cause of concern for all people. The rate of birth and death in a given population will determine its size. Reproduction is the process by which organisms increase their population. The process of sexual maturation for reproduction is gradual

@PROCBSE JOIN NOW !

@PROCBSE

and takes place while general body growth is still going on. Some degree of sexual maturation does not necessarily mean that the mind or body is ready for sexual acts or for having and bringing up children. Various contraceptive devices are being used by human beings to control the size of population.

(a) List two common signs of sexual maturation in boys and girls.

(b) What is the result of reckless female foeticide?

(c) Which contraceptive method changes the hormonal balance of the body?

(d) Write two factors that determine the size of a population.

(e) What should be maintained for a healthy society?

(i) rate of birth & death rate

(ii) male & female sex ratio

(iii) child sex ratio

(iv) None of these

A **[Delhi- Set-I, 2020]**

Ans. Common signs for sexual maturation in boys and girls are:

(a) (i) Broadening of shoulder and chest in boys and development of mammary gland or breast in girls. (ii) Appearance of hairs on body parts like pubic area, armpits and face.

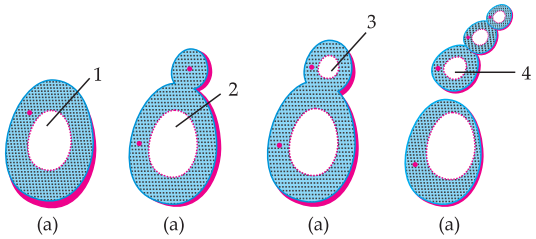
(b) The number of females will become low in comparison to males. Hence, there will be huge imbalance between male and female ratio in the population.

(c) Chemical method of contraception e.g. Oral pills.

(d) Factors are: Birth rate and death rate. **1×4=4**

(e) (ii) Male & Female Sex ratio

Q. 2. Study the diagram given below and answer any four questions from (a) to (e).



(a) The above process.

(i) Binary fission **(ii) Budding**

(iii) Fragmentation **(iv) Regeneration**

(b) Which organism uses the above method for reproduction?

(i) Yeast **(ii) *Amoeba***

(iii) *Spirogyra* **(iv) *Leishmania***

(c) An organism capable of reproducing by two asexual reproduction methods one similar to the reproduction in yeast and the other similar to the reproduction in *Planaria* is:

(i) *Spirogyra* **(ii) *Hydra***

(iii) *Bryophyllum* **(iv) *Paramecium***

(d) A *Planaria* worm is cut horizontally in the middle into two halves P and Q such that the part P contains the whole head of the worm. Another Planaria worm is cut vertically into two halves R and S in such a way that both the cut pieces R and S contain half head each. Which of the cut pieces of the two *Planaria* worms could regenerate to form the complete respective worms?

(i) Only P **(ii) Only R and S**

(iii) P, Rand S **(iv) P, Q, R and S**

(e) Among the following select the statements that are true regarding the sexual reproduction in flowering plants?

(1) Fertilisation is a compulsory event

(2) It always results in the formation of zygote

(3) Offsprings formed are clones

(4) It requires two types of gametes

(i) (1) and (4) **(ii) (1), (2) and (3)**

(iii) (1), (2) and (4) **(iv) (2), (3) and (4)**

Ans. (a) (ii) Budding is a type of asexual reproduction wherein a daughter organism is formed from a small projection known as bud.

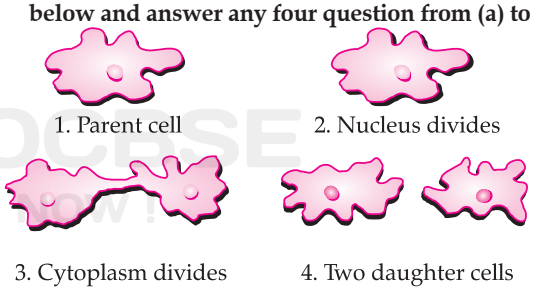
(b) (i) Yeast

(c) (ii) Hydra

(d) (iv) P, Q, R and S

(e) (iii) (1), (2) and (4) **1+1+1+1**

Q. 3. Study the process depicted in the picture given below and answer any four question from (a) to (e):



(a) Which of these organisms divides by the above process?

(i) *Amoeba* **(ii) *Spirogyra***

(iii) *Leishmania* **(iv) *Yeast***

(b) How the above process is different from multiple fission.

(c) Which of the following statement is correct about the above type of reproduction?

(i) It involves two individuals.

(ii) It involves a mature parent cell.

(iii) It involves union of two types of gametes.

(iv) All of these

(d) Differentiate between fission in above organism and *Leishmania*.

(e) Which of these are the characteristics of vegetative reproduction?

I. Involves two individuals

II. Daughter cells are genetically identical to the parent.

III. The cell division is only mitotic.

(i) I and II only **(ii) I, and III only**

(iii) II and III only **(iv) All of these**

Ans. (a) (i) Binary fission: *Amoeba*

(b) Binary fission: Two daughter cells are produced.

Multiple fission: Many daughter cells are formed simultaneously.

@PROCBSE JOIN NOW !

@PROCBSE

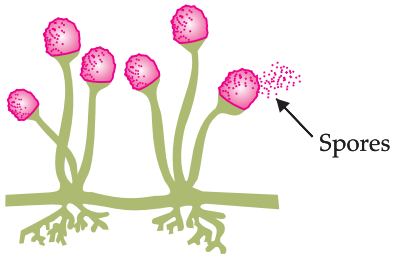
(c) (ii) The above type of reproduction is asexual. It involves a mature parent cell.

(d) In *Amoeba*, splitting into two cells during division can take place in any plane.

In *Leishmania*, binary fission occurs in a definite orientation in relation to the whip like structure.

(e) (iii) The characteristic features of vegetative reproduction are: cell division take place by mitosis and daughter cells formed are genetically identical to the parent. **1+1+1+1**

Q. 4. Study the given diagram and answer any four questions from (a) to (e) as given below



(a) The above diagram depicts:
(i) Spore formation in *Rhizopus*
(ii) Fragmentation in *Spirogyra*
(iii) Binary fission in *Amoeba*
(iv) Spore formation in Yeast

(b) Name the following:
(i) Thread like non-reproductive structures present.
(ii) 'Blobs' that develop at the tips of the non-reproductive threads.

(c) How the labelled structure 'spores' protect themselves. Explain how these structures protect themselves

(d) What is the function of spores in these organisms?

(e) Which of these plants reproduces in the same way as the given process?
(i) Balsam **(ii) Fern**
(iii) Mango **(iv) *Hibiscus***

Ans. (a) (i) Spore formation in *Rhizopus*

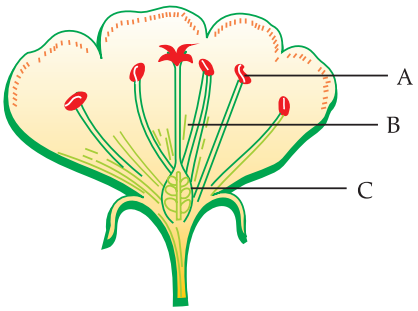
(b) (i) Hyphae, **(ii)** Sporangia

(c) Spores have an outer thick wall that protects them in adverse conditions until they come in contact with another moist surface and begin to grow.

(d) Functions: They germinate into new individuals under favourable conditions.

(e) (ii) Fern reproduces by spores. **1+1+1+1**

Q. 5. The given diagram represent the structure of a flower. Study the structure and answer any four questions from (a) to (e).



(a) The labels A, B and C are
(i) Anther, Style and Ovary respectively.
(ii) Stamen, Stigma and Ovule respectively.
(iii) Anther, Style and Stigma respectively.
(iv) Stamen, Fragment and Ovary respectively.

(b) Which of these is the function of part labelled as C?
(i) Contains ovules which develop into seeds.
(ii) Attracts pollinators.
(iii) Protect rising buds.
(iv) Receive pollens

(c) When an insect sits on the flower of a plant then some particles from the little stalks in the flowers sticks to its body and when this insect sits on the flower of another plant, the particles get deposited in that flower. What are these particles?
(i) Dust **(ii) Pollens**
(iii) Grains **(iv) Seeds**

(d) A student decides to study the impact of removing certain flower parts on fruit formation in plant species X. He chooses three separate plants that are growing in the same plot under uniform conditions. The data is given in the table below.

Plants	Part Removed	Impact on formation
1.	Anther	30% less fruit formed than average plants in the plot
2.	Stigma	No fruit formed
3.	Petal	No significant impact

Which of the following can be inferred from the above data?
(i) Anthers and stigmas are crucial in sexual reproduction in species X.
(ii) Pollen grains are probably unable to germinate if they land on other parts of the carpel besides the stigma.
(iii) Species X is likely to be wind-pollinated.
(iv) Species X relies completely on cross-pollination.

(e) In a flowering plant, summarize the events that take place after fertilization.

Ans. (a) (i) Anther, Style and Ovary respectively.

(b) (i) The part labelled as C is Ovary. Ovary contains ovule which develops into seeds while ovary forms the fruit.

(c) (ii) These particles are pollen grains.

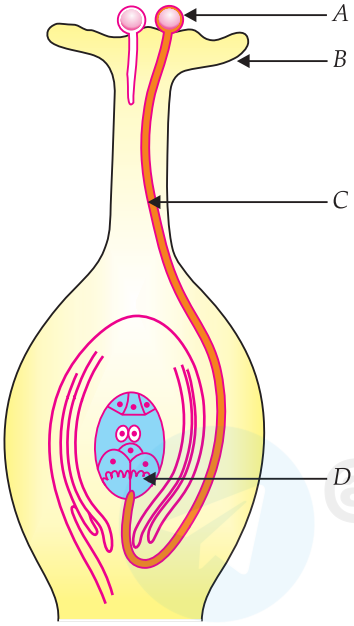
(d) (iii) The removal of anthers affects fruit formation in plant 1, this implies that species X relies partially on self-pollination. The removal of either anthers or stigmas affects rate of fruit formation significantly. No fruits are observed when the stigmas in plant 2 are removed. This shows that pollen grains are probably unable to germinate if they land on any other part of the

@PROCBSE JOIN NOW

carpel besides the stigma. The petals do not seem to play a significant role in facilitating fruit formation. Species-X is therefore likely to be wind-pollinated with reduced petals.

(e) Fertilization results in formation of zygote. Zygote divides several times, to form an embryo. The ovule develops a thick coat and is developed into seed. The ovary grows rapidly and ripens to form the fruit. **1+1+1+1**

Q. 6. Study the diagram given below and answer any four questions from (a) to (e).



(a) The part labelled as A in the diagram is:
(i) Dust **(ii) Germs**
(iii) Pollen **(iv) Pollinators**

(b) How does 'A' reaches part 'B'?

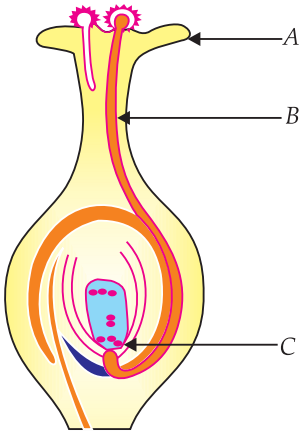
(c) State the importance of the part 'C'.

(d) What happens to the part marked 'D' after fertilization is over?

(e) Choose the incorrect statements about the reproductive system of a plant?
(i) The male organs are the stamens.
(ii) The anthers produce female gametes.
(iii) The male gametes are present in the pollen grains.
(iv) A male gamete from a pollen grain fertilize a female gamete in an ovule.

Ans. (a) (iii) Pollen/pollen grain.
(b) By pollination/agents of pollination.
(c) It (pollen tube) carries male gamete to reach egg in embryo sac in ovule
(d) Converted into embryo.
(e) (ii) In a flower, the male reproductive parts are anthers which produce the male gametes. **1+1+1+1**

Q. 7. Study the diagram given below and answer any four questions from (a) to (e).



(a) The part labelled as A is:
(i) Dust **(ii) Germs**
(iii) Pollen **(iv) Pollinators**

(b) The role of part labelled as B is:
(i) Transport of male gametes to the ovary.
(ii) Transport of female gametes to the ovary
(iii) Contains ovules which develop into seeds.
(iv) All of these

(c) How many male gametes are produced by each pollen grain?
(i) One **(ii) Two**
(iii) Three **(iv) Four**

(d) What happens to the label A which falls on a suitable stigma.

(e) List two reasons for the appearance of variations among the progeny formed by sexual reproduction. **4**

Ans. (a) (iii) The part labelled as A is male germ cells (pollen grain).
(b) (ii) Style facilitate the transport of the male gametes to the ovary.
(c) (ii) Each pollen grain produces two male gametes.
(d) The part labelled A is pollen. The pollen grain starts germinating and forms a pollen tube. The pollen tube grows into the style till it reaches the ovule through micropyle. The pollen tube then reaches the embryo sac into which it releases the two male gametes contained in it. The male gamete then fuses with the female gamete in the embryo sac.
(e) (i) Involvement of two different individuals.
(ii) Creation of new combination of variants.
1+1+1+1

@PROCBSE

Know the Terms

- **Vegetative method:** It is a method in which new plants are obtained from the vegetative parts of old plants such as stem, roots and leaves, without help of any reproductive organs.
- **Tissue culture:** It is the production or propagation of new plants from isolated plant cells or small pieces of plant tissue in a nutrient medium. This technique is also known as **micro propagation**, and in vitro culture because it takes place outside the body of the parent plant in a test tube in an artificial environment.
- **Sexual reproduction:** It is the process in which two sexes male and female are involved. The male sexual unit is known as **male gamete** or **sperm** while female sexual unit is termed as **female gamete** or **ovum**.
- **Zygote:** The cell which is formed by the fusion of a male gamete and female gamete is called **zygote**, *i.e.* it is a '**fertilized ovum**' or '**fertilized egg**.'
- **Embryo:** It is the stage of development between the zygote or fertilized egg and the newly formed offspring.

OSWAAL LEARNING TOOL
To learn from Oswaal Concept Video
Visit: http:qrgo.page.link OR Scan this code

❑❑❑

@PROCBSE
JOIN NOW !

@PROCBSE

Heredity and Evolution
Variations
Brings about evolution
Evidences of Evolution
Vestigial
Organs present but no function
Palaeontological
• Micro-evolution
• Study of Fossils
Morphological and anatomical
Analogous Organs & homologous organs
Speciation (Formation of new species)
Factors Affecting:
• Genetic drift
• Reproductive isolation
• Geographical isolation
• Natural Selection
Sex determination in humans
Female: 22 + XX
22 autosomes
XX sex chromosome
Male: 22 + XY
22 autosomes
XY sex chromosome
• Child who inherits an X chromosome from his father : Girl (XX)
• Child who inherits a Y chromosome from the father : Boy (XY).
Trace the Mind Map
First Level
Second Level
Third Level
Gregor John Mendel (Heredity)
Monohybrid Cross
Law of Segregation
F1 generation
• Phenotype : All red
• Genotype : Rr
F2 generation
• Phenotype : 3 Red : 1 White
• Genotype : 1 RR : 2 Rr : 1 rr
Monohybrid Cross
Law of Dominance
• It states that recessive alleles will always be masked by dominant alleles.
• In F1 generation, phenotype of all plants are red.
Dihybrid Cross
Law of Independent Assortment
F2 generation
• Phenotype
1. Round Yellow
2. Wrinkled Yellow
3. Round Green
4. Wrinkled Green
• Genotype
9:3:3:1
F1 generation
• Phenotype : All round yellow
• Genotype : Hybrid (RrYy)

@PROCBSE

CHAPTER

9

HEREDITY AND EVOLUTION

Syllabus

Heredity, Mendel's contribution, Laws for inheritance of traits, sex determination – brief introduction, basic concepts of evolution.

Trend Analysis

List of Concepts	2018	2019	2020
Heredity, Mendel's contribution, Acquired and Inherited traits	1 Q (1 M)		1 Q (3 M)
Basic concept of Evolution		1 Q (5 M)	1 Q (3 M)

@PROCBSE JOIN NOW !

TOPIC - 1
Heredity and Mendel's Contribution

Revision Notes

Introduction

- Variations arise usually during the process of sexual reproduction. They may be few in asexual reproduction, but many in case of sexual reproduction.
- The minor variations arising during sexual reproduction are caused by slight inaccuracies in DNA copying. In sexual reproduction, variations are also caused by crossing over process during meiosis.
- Beneficial variations help the species to survive better in the environment.
- Nature selects the beneficial variations thereby leading to evolution.
- Sexual reproduction produces offspring with similar body design of the parents. However, the offsprings are not identical and show a great deal of variation from the parents.
- **Importance of Variation:**
  (i) Depending upon the nature of variations, different individuals would have different kinds of advantages.
  e.g., Bacteria that can withstand heat will survive better in a heat wave.
  (ii) Main advantage of variation to species is that it increases the chances of its survival in a changing environment.

Mendel and His Work on Inheritance

- **Gregor Johann Mendel (1833 & 1884):** Started his experiments on plant breeding and hybridization. He proposed the laws of inheritance in living organisms.

TOPIC - 1
Heredity and Mendel's Contribution
Page No. 203
TOPIC - 2
Basic Concepts of Evolution
Page No. 214

@PROCBSE

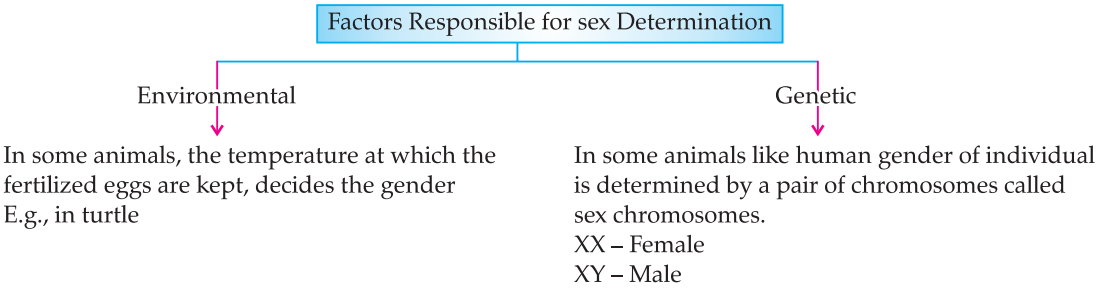
- Mendel was known as the **Father of Genetics.**
- Plant selected by Mendel was *Pisum sativum* (garden pea). Mendel used a number of varieties of garden pea to study the inheritance of seven pairs of contrasting characters.
- **Seven pairs of** contrasting characters in garden pea, selected by Mendel were:

Character	Dominant Trait	Recessive Trait
Flower colour	Violet	White
Flower position	Axillary	Terminal
Seed colour	Yellow	Green
Seed shape	Round	Wrinkled
Pod shape	Inflated	Constricted
Pod colour	Green	Yellow
Height of plant	Tall	Dwarf/Short

Scan to know more about this topic

Mendel's Experiment

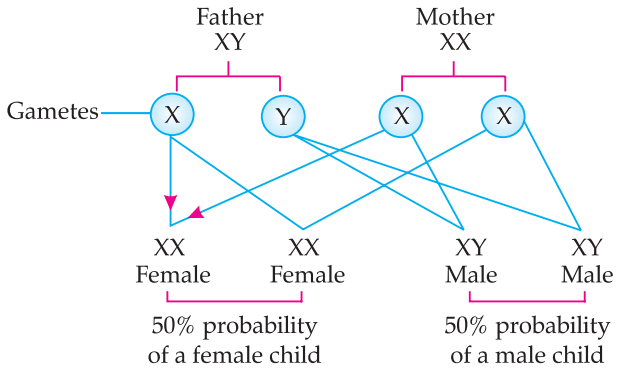
- Mendel conducted a series of experiments in which he crossed the pollinated plants to study one character (at a time).
- In case of monohybrid cross with pure line breeding varieties of plants, the phenotypic ratio obtained in F_2 generation was 3: 1.
- In case of dihybrid cross *i.e.*, involving two pairs of contrasting characters, the phenotypic ratio obtained in F_2 generation was 9: 3: 3: 1.
- Mendel concluded that out of any pair of contrasting characters, one is dominant *i.e.*, it makes its appearance in the hybrid while the other is recessive i.e., the manifestation of the other is masked.
- The homozygous dominant trait is denoted by two capital letters whereas the homozygous recessive trait is denoted by two small letters.
- The factors or genes controlling a particular trait separate from each other during gamete formation. Hence, gamete is always pure as far as contrasting characters are considered. Each gamete will possess only one gene set.
- In crossing, if two or more traits are involved, their genes assort independently, irrespective of the combinations present in the parents.
- Genes carry information for producing proteins, which in turn control the various body characteristics.
- For a particular trait, the offspring receives one allele from the father and one allele from the mother.
- The combination of the male and female germ cells gives a diploid zygote. Thus, the normal diploid number of chromosomes in the offspring is restored.
- Different mechanisms are used for sex determination in different species.



- **Sex Chromosomes:** In human beings, there are 23 pairs of chromosomes. Out of these, 22 chromosomes pairs are called **autosomes** and the last pair of chromosome which helps in deciding sex of the individual is called **sex chromosome**.

@PROCBSE

➢ **Sex determination in human beings:**



Scan to know more about this topic

Sex determination

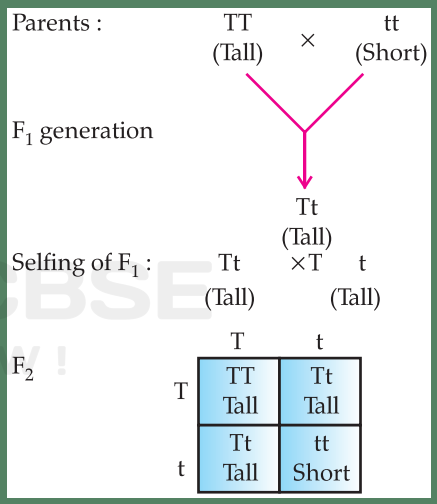
How is it done on the GREENBOARD?

Q. Name the plant Mendel used for his experiment. What type of progeny was obtained by Mendel in F_1 and F_2 generations when he crossed the tall and short plants? Write the ratio he obtained in F_2 generation plants. 3

Ans.:

Step I: Mendel used *Pisum sativum* (Pea plant) for his experiment.

Step II:



Step III: F_1 – All tall

Step IV: F_2- Tall and short

Step V: Phenotypic ratio - 3 Tall: 1 Short

Step VI: Genotypic ratio - 1 Tall (TT): 2 Hybrid (Tt) : 1 Short (tt)

Objective Type Questions — 1 mark each

A Multiple Choice Questions

Q. 1. Which of the following statement is incorrect?
(a) For every hormone there is a gene.
(b) For every protein there is a gene.
(c) For production of every enzyme there is a gene.
(d) For every molecule of fat there is a gene.
[NCERT Exemp.]

Ans. Correct option : (d)
Explanation: Hormone and enzymes are proteins and formation of any particular protein is controlled by a particular gene. Hence, all other options are correct.

Q. 2. If a round, green seeded pea plant (RRyy) is crossed with wrinkled, yellow seeded pea plant, (rrYY) the seeds produced in F_1 generation are
(a) round and yellow.
(b) round and green.
(c) wrinkled and green.
(d) wrinkled and yellow. [NCERT Exemp.]

Ans. Correct option : (a)

@PROCBSE JOIN NOW !

Explanation: As roundness and yellow colour are shown by capital letters in the genotype, so they are dominant traits. In F_1 generation, only dominant traits are expressed.

Q. 3. The maleness of a child is determined by

(a) the X chromosome in the zygote.

(b) the Y chromosome in zygote.

(c) the cytoplasm of germ cell which determines the sex.

(d) sex is determined by chance.

[NCERT Exemp.]

Ans. Correct option : (b)

Explanation: Y-chromosome in zygote means that the zygote would develop into a male child.

Q. 4. A zygote which has an X-chromosome inherited from the father will develop into a

(a) boy.

(b) girl.

(c) X- chromosome does not determine the sex of a child.

(d) either boy or girl. **[NCERT Exemp.]**

Ans. Correct option : (b)

Explanation: A zygote with XX chromosomes in the 23rd pair would develop into a girl child.

Q. 5. From the list given below, select the character which can be acquired but not inherited.

(a) colour of eye. **(b) colour of skin.**

(c) size of body. **(d) nature of hair.**

[NCERT Exemp.]

Ans. Correct option : (c)

Explanation: Traits in other options are always inheritable traits.

B Assertions and Reasons Type Questions

Directions: In the following questions, a statement of assertion (A) is followed by a statement of reason (R). Mark the correct choice as:

(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

(b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).

(c) Assertion (A) is true but reason (R) is false.

(d) Assertion (A) is false but reason (R) is true.

Q. 1. Assertion: A geneticist crossed a pea plant having violet flowers with a pea plant having white flowers, he got all violet flowers in first generation.
Reason: White colour gene is not passed on to next generation. A **[CBSE SQP, 2021]**

Ans. Correct option : (c)

Explanation: The gene for violet flowers is dominant over the gene for white flowers so that only the violet gene is expressed as violet flowers in the first generation. **1**

Q. 2. Assertion (A): Mendel chose a number of varieties of garden pea as plant material for his experiments.
Reason (R): Garden pea has well defined characters and is bisexual.

Ans. Correct option : (a)

Explanation: Mendel chose garden pea as plant material for his experiment because garden pea plants were easily available / they grow in one season / fertilization was easy. **1**

Q. 3. Assertion (A): In humans, males play an important role in determining the sex of the child.
Reason (R): Males have two X chromosomes.

Ans. Correct option : (c)

Explanation: Sex of a child is dependent on the type of the male gamete that fuses with the female gamete. Human beings possess 23 pairs of chromosomes. Out of these, 22 pairs are known as **autosomes**, while the remaining one pair comprises sex chromosomes (XX in females and XY in males). At the time of fertilisation, the egg cell fuses with the sperm cell, resulting in the formation of the zygote. If the egg cell carrying an X chromosome fuses with the sperm carrying an X chromosome, the resulting child would be a girl. If the egg cell carrying an X chromosome fuses with the sperm carrying a Y chromosome, the resulting child would be a boy. **1**

Q. 4. Assertion (A): Learning a skill such as dance and music is an acquired trait.
Reason (R): Acquired traits develop in the life time of an individual and do not pass to the progeny.

Ans. Correct option : (a)

Explanation: Trails which develop in the life time of an individual and do not pass to the progeny are called **acquired traits**. Learning a skill such as dance/music/loss of body parts/weight etc are example of acquired traits.

Q. 5. Assertion (A): Traits like eye colour or height are inherited traits.
Reason (R): Inherited traits are not transferred from parents to young ones.

Ans. Correct option : (c)

Explanation: Eye colour and height are genetically inherited traits, as these are expressed by genes. Inherited traits are the traits which are transferred from parents to young ones. Acquired traits are the characters that are acquired by the individual during its lifetime. These traits cannot be inherited. For example, if a wrestler develops large muscles due to his training program that does not mean it will be passed on to his offspring. **1**

@PROCBSE JOIN NOW

C Very Short Answer Type Questions

Q. 1. Mendel took tall pea plants and short pea plants and produced F_1 progeny through cross-fertilisation. What did Mendel observe in the F_1 progeny? AE **[CBSE, Comptt. Set. I, II & III, 2018]**

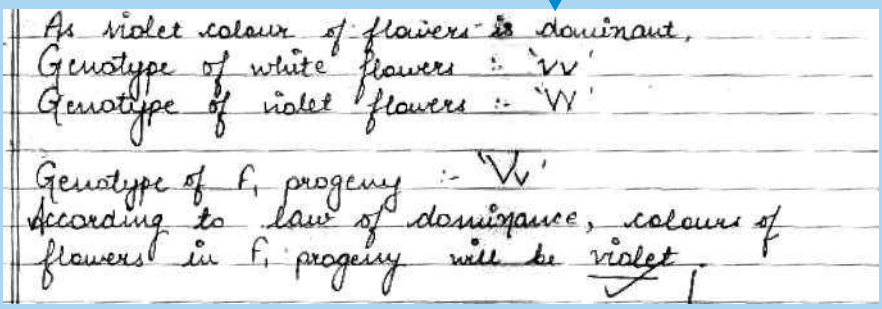
Ans. All pea plant were tall in F_1 generation. **1**
[CBSE Marking Scheme, 2018]

AI **Q. 2. A Mendelian experiment consisted of breeding pea plants bearing violet flowers with pea plants bearing white flowers. What will be the result in F_1 progeny?** AE **[CBSE, Delhi & O.D. Set, 2018]**

Ans. Violet flowers. **1**
[CBSE Marking Scheme, 2018]

Topper Answer, 2018

Ans.


As violet colour of flowers is dominant,
Genotype of white flowers : 'vv'
Genotype of violet flowers : 'VV'
Genotype of F_1 progeny :- 'Vv'
According to law of dominance, colours of flowers in F_1 progeny will be violet.

Q. 3. What is DNA? R **[Board Term II, Foreign Set II, 2016]**

Ans. DNA is the carrier of hereditary information from parents to the next generation. **1**
[CBSE Marking Scheme, 2016]

Q. 4. How many pairs of chromosomes are present in human beings? R **[Board Term II, 2015]**

Ans. 23 pairs. **1**

Q. 5. Where is DNA found in a cell? R **[O.D. Set II, 2015]**

Ans. DNA is found in the cell nucleus. **1**

Q. 6. What is a gene? R **[Outside Delhi Set I, 2014]**

Ans. Gene is a part of DNA that encodes the instructions that allow a cell to produce a specific protein or enzyme. **1**

AI **Q. 7. What is heredity?** R **[Outside Delhi Set II, 2014]**

Ans. The transmission of characteristics from one generation to another is known as **heredity**. **1**

Q. 8. Name the information source for making proteins in the cells. R **[Delhi Set-II, 2014]**

Ans. Cellular DNA is the information source for making proteins in cells. **1**

Short Answer Type Questions-I — 2 marks each

Q. 1. "The chromosome number of the sexually reproducing parents and their offspring is the same." Justify this statement. A

Ans. Male individual have 46 chromosomes but because the gametes are always haploid i.e., they have half the number of chromosomes; sperms will be haploid (23 chromosomes). Female individual also contains only 23 chromosomes in egg. It is the fusion of the sperm and egg which leads to an offsprings with 46 chromosomes. **2**

Q. 2. Give the respective scientific terms used for studying:
(i) the mechanism by which variations are created and inherited and
(ii) the development of new type of organisms form from the existing ones. R

Ans. (i) Genetics is the study of mechanism by which variations are created and inherited.
(ii) Evolution is used for studying the development of new type of organisms from the existing ones. **1+1**

AI **Q. 3. Differentiate between dominant and recessive traits.** U

Ans. (a) The character which gets expressed in the presence of its contrasting form is termed as dominant trait.
(b) The trait which remains unexpressed in the presence of its contrasting form is called recessive trait. **1+1**

Q. 4. 'Gene control traits'? Explain this statement with an example. A

Ans. Gene controls the trait by synthesizing the specific enzyme. Consider tallness as a trait. Plant height depends upon particular plant hormone which in turn will depend on the efficiency of the process for making it. If the enzyme responsible for the

@PROCBSE

production of this hormone is efficient, plant will be tall. If the gene for that enzyme has an alteration that makes enzyme less efficient, the amount of hormone will be less and plant will be short. **2**

Short Answer Type Questions-II — 3 marks each

Q. 1. After self-pollination in pea plants with round, yellow seeds, following types of seeds were obtained by Mendel:

Seeds	Number
Round, yellow	630
Round, green	216
Wrinkled, yellow	202
Wrinkled, green	64

Analyse the result and describe the mechanism of inheritance which explains these results.

A [CBSE SQP, 2021]

Ans. The ratio obtained is 9:3:3:1 in which parental as well as new combinations are observed. This indicates that progeny plants have not inherited the whole set of genes from each parent.
Every germ cell takes on chromosome from the pair of maternal and paternal chromosomes. When two germ cells combine, segregation of one pair of characters is independent of other pair of characters. **3**

[CBSE Marking Scheme, 2021]

AI **Q. 2. In humans, there is a 50% probability of the birth of a boy and 50 % probability that a girl will be born. Justify the statement on the basis of the mechanism of sex-determination in human beings.**

A [CBSE SQP, 2021]

Ans. In human beings, the genes inherited from our parents decide whether it will be a boy or girl. Women have a perfect pair of sex chromosomes (XX). But, men have a mismatched pair (XY).
All children will inherit an X chromosome from their mother regardless of whether they are boys or girls. Thus, the sex of the children will be determined by what they inherit from their father. A child who inherits an X chromosome from her father will be a girl, and one who inherits a Y chromosome from him will be a boy. **3**

[CBSE Marking Scheme, 2021]

Q. 3. A green stemmed rose plant denoted by GG and a brown stemmed rose plant denoted by gg are allowed to undergo a cross with each other.

(a) List your observations regarding:

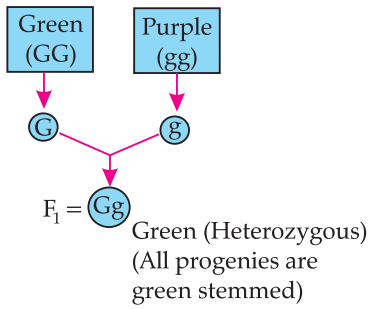
(i) Colour of stem in their F_1 progeny

(ii) Percentage of brown stemmed plants in F_2 progeny if F_1 plants are self pollinated.

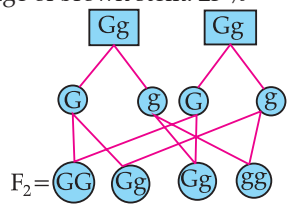
(iii) Ratio of GG and Gg in the F_2 progeny.

(b) Based on the finding of this cross, what conclusion can be drawn? [CBSE OD SET I, 2020]

Ans. (a) (i) Colour of the stem in F_1 progeny: All green



(ii) Percentage of brown stem: 25 %



(iii) GG: Gg is 1: 2

(b) Based on the above cross, it can be concluded that green colour is dominant and get expressed in F_1 generation. The brown stem, which does not get express itself in the F_1 generation, is the recessive character. This is the law of dominance. **2+1=3**

Q. 4. In a pea plant, the trait of flowers bearing purple colour (PP) is dominant over white colour (pp). Explain the inheritance pattern of F_1 and F_2 generations with the help of a cross following the rules of inheritance of traits. State the visible characters of F_1 and F_2 progenies.

A [Board SQP, 2020]

Ans. Let purple trait be represented by: PP and White trait be: pp

Parental — PP × pp — ½

F_1 generation — Pp × Pp (Selfing) — 1

Selfing of F_1

Gametes of F_2

	P	p
P	PP	Pp
p	Pp	pp

½ + ½

Visible characters of F_1 progeny all flowers are purple coloured and in F_2 progenies 3 are purple coloured and 1 is white coloured flower **3**

[CBSE Marking Scheme, 2020]

COMMONLY MADE ERROR

- Students often get confused between phenotype and genotype and between F_1 and F_2 generation.

@PROCBSE

ANSWERING TIP

➲ Practice concept of phenotype along with F_1 and F_2 generation and genotype with the help of examples.

Q. 5. Name the plant Mendel used for his experiment. What type of progeny was obtained by Mendel in F_1 and F_2 generations when he crossed the tall and short plants? Write the ratio he obtained in F_2 generation plants. R [Board Delhi, Set- I, 2019]

Ans. Pea Plant / Garden pea / *Pisum sativum*

F_1 – All tall; F_2- Tall and short

Ratio – Tall: Short

3: 1 / 1: 2: 1 **1+ 1 +1**

[CBSE Marking Scheme, 2019]

Detailed Answer:

Mendel used *Pisum sativum* (Pea plant) for his experiment.

Mendel took a tall pea (*TT*) plant and a short pea (*tt*) plant. When he crossed both, the first filial generation (F_1) obtained were tall. When F_1 progeny was self-pollinated, all plants obtained in F_2 generation were not tall. Instead, three tall pea (dominant) plants and one short pea (recessive) plant was obtained.

Parents : TT (Tall) × tt (Short)

F_1 generation → Tt (Tall)

Selfing of F_1 : Tt (Tall) × T t (Tall)

F_2

	T	t
T	TT Tall	Tt Tall
t	Tt Tall	tt Short

Phenotypic ratio and genotypic ratio should be in same horizontal line.

Phenotypic ratio	Genotypic ratio
3 Tall: 1 short	1 Pure Tall (TT): 2 Hybrid (Tt): 1 Pure short (tt) **3**

COMMONLY MADE ERROR

➲ Mostly students explain this answer incorrectly.

ANSWERING TIP

➲ Practice a number of examples for Monohybrid and Dihybrid cross.

Q. 6.List two differences between acquired traits and inherited traits by giving an example of each.

U [Board Delhi, Set- I, 2019]

Ans.

Acquired Trait	Inherited Trait
1. These traits are not transferred from one generation to the next generation.	These traits are transferred from one generation to the next.
2. They do not bring about change in DNA. **Example:** Acquiring any skill.	They bring about changes in DNA. **Example:** Eye colour.

(or any other relevant point and example) 1+1+1

[CBSE Marking Scheme, 2019]

COMMONLY MADE ERROR

➲ Students often write the differences in paragraph form rather than in tabular form.

ANSWERING TIP

➲ Differences between acquired and inherited traits must be written in tabular form and the points should be compatible. Don't forget to write the examples as asked.

AI **Q. 7. What are acquired traits? Why are these traits generally not inherited over generations? Explain.**

C [CBSE, Comptt. Set I, II & III, 2018]

OR

With the help of suitable examples, explain why certain traits cannot be passed on to the next generation. What are such traits called?

A [Board Term II 2014; Outside Delhi Set I, 2015]

Ans. Characters that a person acquires during one's life time are known as **acquired characters/traits.** **1**

Such changes do not occur in the reproductive tissues. **1**

Changes in the non-reproductive tissues are not passed on to the DNA of the germ cells and therefore not inherited by the next generation. **1**

[CBSE Marking Scheme, 2018]

AI **Q. 8. If we cross-bred tall (dominant) pea plant with pure-bred dwarf (recessive) pea plant, we will get plants of F_1 generation. If we now self-cross the pea plant of F_1 generation, we obtain pea plants of F_2 generation.**

(i) What do the plants of F_1 generation look like?

(ii) State the ratio of tall plant to dwarf plants in F_2 generation.

@PROCBSE JOIN NOW

(iii) State the type of plants not found in F_1 generation but appeared in F_2 generation. Write the reason for the same. AE [OD Comptt. 31/1 2017]

Ans. (i) Tall **1**

(ii) 3: 1 ½

(iii) Dwarf ½

Reason: Being a recessive trait, dwarfness can only be expressed in the recessive homozygous condition or in the absence of dominant trait. **1**

AI **Q. 9. How do Mendel's experiment show that traits are inherited independently?**

C [O.D. Set I, 2016 , Delhi 31/1/3 2017]

Ans. (i) When a cross was made between a tall pea plant with round seeds and a short pea plant with wrinkled seeds, the F_1 progeny plants are all tall with round seeds. This indicates that tallness and round seeds are the dominant traits. **1**

(ii) When the F_1 plants are self-pollinated, the F_2 progeny consist of some tall plants with round seeds and some short plants with wrinkled seeds which are the parental traits. **1**

(iii) There were also some new combinations like tall plants with wrinkled seeds and short plants with round seeds. ½

(iv) Thus, it may be concluded that tall and short traits and round and wrinkled seed traits have been inherited independently. ½

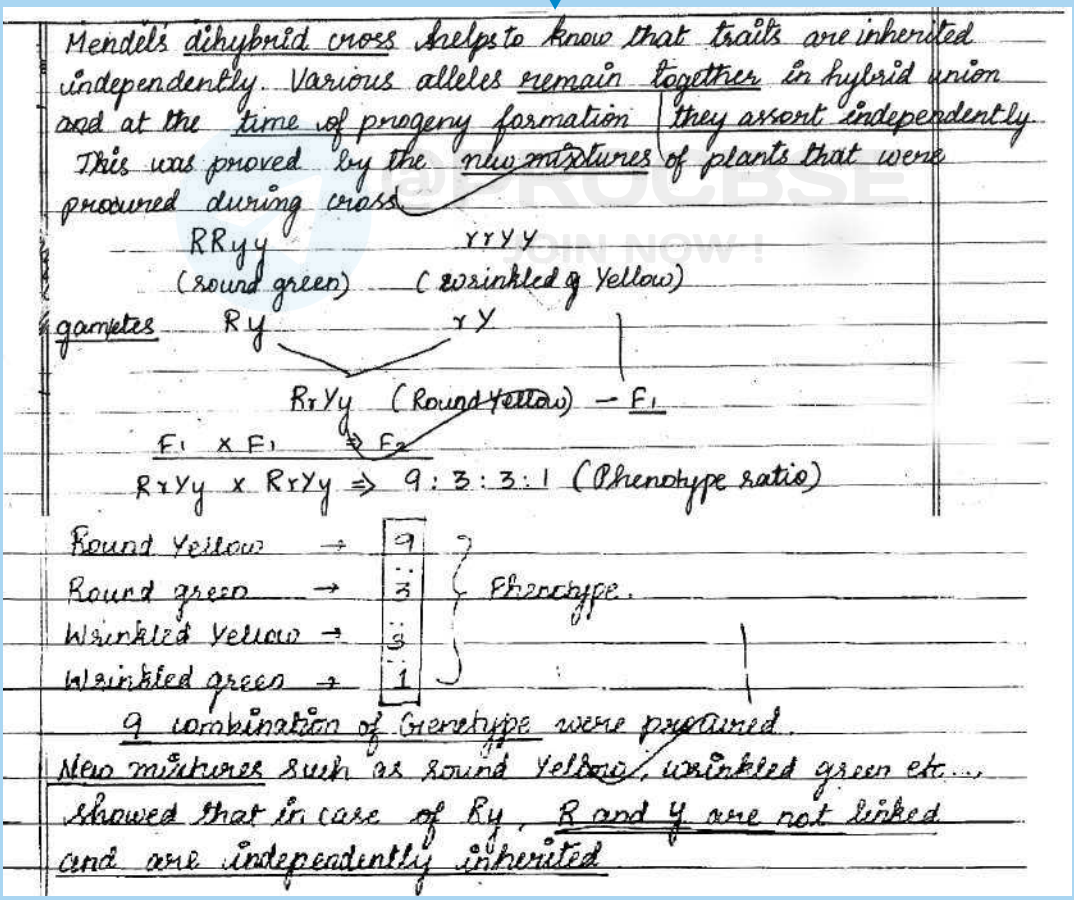
OR

A flow chart depicting the same.

Note: Any other contrasting characters can also be taken [CBSE Marking Scheme, 2016]

Topper Answer, 2016

Ans.



Q. 10. In one of his experiments with pea plants Mendel observed that when a pure tall pea plant is crossed with a pure dwarf pea plants, in the first generation, F_1 only tall plants appear.

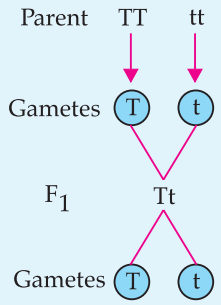
(i) What happens to the traits of the dwarf plants in this case?

(ii) When the F_1 generation plants were self-fertilised, he observed that in the plants of second generation, F_2, both tall plants and dwarf plants were present. Why it happened? Explain briefly.

AE [Board Term II, Delhi Set I, 2016]

@PROCBSE

Ans. (i)



1

The dwarf traits of the plants is not expressed due to the presence of the dominant tall trait.

F_2	TT	Tt	Tt	tt
	Tall	Tall	Tall	Dwarf

Tall: Dwarf = 3: 1 ratio **1**

(ii) In the F_2 generation, both the tall and dwarf traits are present in the ratio of 3: 1. This showed that the traits for tallness and dwarfness are present in the F_1 generation, but the dwarfness, being the recessive trait, does not express itself in the presence of tallness, the dominant trait. **1**

[CBSE Marking Scheme, 2016]

COMMONLY MADE ERROR

- Mostly students make error while drawing the cross. Some of them forget to label the stages.

ANSWERING TIP

- Practice cross with the help of different characteristic features in three stages:
  (a) Parents
  (b) F_1 generation
  (c) F_2 generation

Q. 11. How did Mendel interpret his result to show that traits may be dominant or recessive? Describe briefly. U [Board Term II, Delhi Set II, 2016]

Ans. Mendel conducted breeding experiments on Pea plants.

(i) He selected pure breed tall and dwarf plants. ½

(ii) He cross-pollinated these plants. ½

(iii) In the F_1 generation, he obtained only tall plants. Tallness is the dominant trait. ½

(iv) Then, he produced F_2 generation by self cross of hybrids / F_1. ½

(v) He found that $3/4^{th}$ of the plants were tall and $1/4^{th}$ were dwarf. ½

(vi) The trait which remains hidden in F_1 generation plants is the recessive traits. ½

[CBSE Marking Scheme, 2016]

Q. 12. In a monohybrid cross between tall pea plants (TT) and short pea plants (tt) a scientist obtained only tall pea plants (Tt) in the F_1 generation. However, on self cross of the F_1 generation pea plants, he obtained both tall and short plants in F_2 generation. On the basis of above observations with other angiosperms also, can the scientist arrive at a law? If yes, explain the law. If not, give justification for your answer.

U [Board Term II, Delhi Set III, 2016]

Ans. Yes, the scientist may arrive at the law of dominance according to which the trait that is expressed in the F_1 generation is the dominant trait, although both the dominant and recessive traits are present in the F_1 generation. In the F_2 generation the recessive traits is also expressed along with the dominant traits. **1 + 1 + 1**

[CBSE Marking Scheme, 2016]

Q. 13. 'Different species use different strategies to determine sex of a newborn individual. It can be environmental cues or genetically determined.' Explain the statement by giving example for each strategy. A [Board Term II, SQP, 2016]

Ans. Environmental Cue: (i) In some animals, the temperature at which fertilised eggs are kept determines whether the developing animal in egg is male or female.

(ii) In some animals like snail, individual can change sex.

Genetical Cue: A child who inherits an X-chromosome from her father will be a girl and one who inherits a Y- chromosome from the father will be boy. **1 + 1 + 1**

[CBSE Marking Scheme, 2016]

Q. 14. What is DNA copying? State its importance.

R [Board Term II, Delhi Set II, 2015]

Ans. DNA replication or DNA copying is the process of producing two identical replicas from one original DNA molecule during cell division.

Importance of DNA Copying:

(i) DNA replication needs to occur so that during cell division, new cells will also have a copy of organism's DNA.

(ii) DNA is necessary to make all the RNA and proteins needed for cells to carry out necessary reactions and cellular processes in order to survive. **1+ 1 + 1**

@PROCBSE

Long Answer Type Questions — 5 marks each

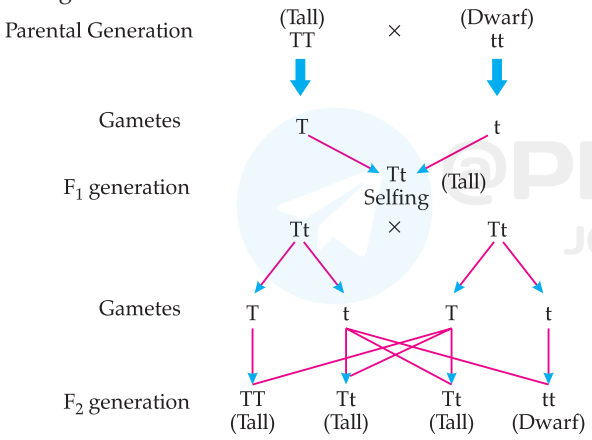
Q. 1. (a) What is the law of dominance of traits? Explain with an example.

(b) Why are the traits acquired during the life time of an individual not inherited? Explain.

C [Delhi Set I, 2020]

Ans. (a) Law of dominance of traits: It states that "When parents having pure contrasting characters are crossed then only one character expresses itself in F_1 generation. This character is the dominant character and the character which cannot express itself is called recessive character".

Let us take an example of tall and dwarf in pea plant. When pure line tall (TT) plants were crossed with pure line dwarf (tt) plants, offspring were all heterozygous tall (Tt). The appearance of all Tall plants in the F_1 generation shows that tallness is the dominant character while dwarfness is the recessive character. The ratio of Tall to Dwarf in F_2 generation is 3: 1.



(b) Characters that a person acquires during one's life time are known as acquired characters/traits. Such changes do not occur in the reproductive tissues. Changes in the non-reproductive tissues are not passed on to the DNA of the germ cells and therefore not inherited by the next generation. **3+2**

Q. 2. (a) What are dominant and recessive traits?

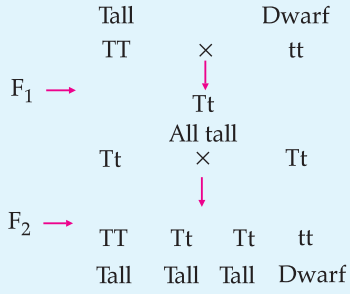
(b) "Is it possible that a trait is inherited but may not be expressed in the next generation?" Give a suitable example to justify this statement.

R [Board Outside Delhi, Set- II, 2019]

Ans. (a) Dominant Trait: The trait which expresses itself in F_1 (first) generation after crossing contrasting (opposite) trait is known as **dominant character** (trait). **1**

Recessive Trait: The trait which is not expressed itself in F_1 (first) generation after crossing contrasting (opposite) trait. **1**

(b) Yes **1**



2

(Or can be explained in words also)

[CBSE Marking Scheme, 2019]

AI **Q. 3. (a) Why did Mendel choose garden pea for his experiments? Write two reasons.**

(b) List two contrasting visible characters of garden pea Mendel used for his experiment.

(c) Explain in brief how Mendel interpreted his results to show that the traits may be dominant or recessive. R [Board Term II, Foreign I, 2016]

Ans. (a) Reasons:

(i) Pea plant is small and easy to grow.

(ii) A large number of true breeding varieties of pea plant are available.

(iii) Short life cycle.

(iv) Both self and cross-pollination can be made possible. **(Any two reasons) 2 × ½ = 1**

(b) Contrasting characters:

Round / Wrinkled seeds
Tall / Short plants
White / Purple flowers
Green / Yellow seeds **(Or any other)**

(Any two) 2 × ½

(c) When Mendel crossed two pea plants with a pair of contrasting characters, only one character appeared in all the members of F_1 progeny and the others remain hidden.

On selfing F_1, the hidden characters reappeared in just 25% of the offsprings and the other 75% shared the characters expressed in F_1.

Mendel concluded that the character which expresses itself in F_1 and in 75% of the individuals of F_2 is dominating while the other is recessive. (Or same thing can be explained by using an example) **1 + 1 + 1**

[CBSE Marking Scheme, 2016]

Q. 4. How do Mendel's experiments show that

(a) Traits may be dominant or recessive?

(b) Inheritance of two traits is independent of each other? U [Delhi 31/1/1 2017]

@PROCBSE

Ans. (a) Mendel conducted a Monohybrid cross/ (crossed pure tall pea plants with pure dwarf pea plants) he observed only tall pea plants in the F_1 generation, but on self crossing of the F_1 progeny, both tall and dwarf pea plants were observed in F_2 generation in the ratio 3: 1. Appearance of tall character in F_1 and F_2 generations shows tallness to be a dominant character. But absence of dwarf character in F_1 and its reappearance in F_2 confirms that dwarfness is recessive character. **2½**

(b) Mendel conducted a dihybrid cross and observed that though he started with two types of parents, he obtained four types of individuals in F_2. The appearance of new recombination in F_2 generations along with parental type characters showed that traits are inherited independently of each other. **2½**

[CBSE Marking Scheme, 2017]

A **Q. 5. With the help of one example for each, distinguish between the acquired traits and the inherited traits., Why are the traits/experiences acquired during the entire lifetime of an individual not inherited in the next generation? Explain the reason of this fact with an example.** AE **[OD 31/1 2017]**

Ans. Acquired traits: Traits which develop in the life time of an individual and do not pass to the progeny. **1**
Example: Learning a skill such as dance/music/loss of body parts/weight/any other example. **½**
Inherited traits: Traits present in the gamete/germ cells which can be seen in the progeny. **1**
Example: Skin colour/eyebrows/any other example. **½**
Reason: Traits/characteristics acquired during one's life time do not bring any change in the DNA of the reproducing cells/germ cells. **1**
Example: Decrease in body weight of beetles due to starvation do not pass on to the next generation because there is no change in the germ cells of beetles. **1**

[CBSE Marking Scheme, 2017]

OR

Topper Answer, 2017

Ans.

ACQUIRED TRAITS	INHERITED TRAITS
1) These traits are acquired by a person during his lifetime.	1) These traits are inherited by the individual from his/her parents.
2) They donot pass to next generations.	2) They pass to next generations.
3) They donot direct evolution.	3) They direct evolution.
4) eg ↦ Body weight, Knowledge.	4) eg ↦ eye colour, skin colour, height etc.

The traits which are acquired by individual during his lifetime can't be passed to future generations as they donot bring any change in the DNA of germ cells. Any change in non-reproductive tissue cannot lead to change in DNA of germ cells. for eg ↦ There were red beetles living in green bushes and the bushes were hit by plant disease. This caused reduction in the available food to red beetles and made them poorly nourished. But if the bushes will become free from any plant disease, the new generation will be healthy & of normal weight as low weight donot causes any change in the DNA of germ cells of red beetles.

@PROCBSE JOIN NOW !

@PROCBSE

TOPIC - 2
Basic Concepts of Evolution

Revision Notes

Evolution:

- Evolution is the sequence of gradual changes which takes place in the primitive organisms, over millions of years, in which new species are produced.
- Genetic drift can alter gene frequencies in small population and provide diversity without any survival benefits.
- Several factors such as environment, mutations, reproduction, etc., can cause alterations in gene frequencies in a population over generations, leading to evolution.
- Changes occurring in the DNA of germ cells are heritable whereas changes taking place in the non-reproductive tissues are not inherited.
- Charles Darwin proposed that evolution of species occurred by natural selection, but he did not know the underlying mechanism.

Scan to know more about this topic

How evolution occurs

- Natural selection, genetic drift, variations and geographical isolation can lead to speciation in sexually reproducing organisms.
- Gene flow between the members of a population prevents speciation.
- **The fundamental characteristics used to classify organisms are:**
  - **(i)** Presence of prokaryotic or eukaryotic cells.
  - **(ii)** Whether the organism is unicellular or multicellular.
  - **(iii)** Ability to perform photosynthesis.
  - **(iv)** Presence of endoskeleton or exoskeleton in heterotrophic organisms.
- Classification of living organisms is closely related to their evolution.
- Both evolution and classification are interlinked.
  1. Classification of species is reflection of their evolutionary relationship.
  2. The more characteristics two species have in common, the more closely they are related.
  3. The more closely they are related, the more recently they have a common ancestor.
  4. Similarities among organisms allow us to group them together and to study their characteristics.

Scan to know more about this topic

Darwin's Theory of evolution

- **Evidences of Evolution:**
  - **(a)** **Homologous Organs:** These are the organs that have same structural plan and origin but different functions.
  - **(b)** **Analogous Organs:** These are the organs that have different origin and structural plan but same function. Analogous organs provide mechanism for evolution. E.g., wings of bird and wings of insects.
  - **(c)** **Fossils:** Fossils help in tracing evolutionary pathways. The age of fossils can be determined by using the relative method or the isotope dating method.
- Evolution is not a one-step process, but a continuous process occurring in several stages.
- Complex organs are formed slowly over many generations, sometimes with intermediate forms playing an important role.
- Sometimes the use of certain features gets modified with time. For example: Feathers may have provided insulation initially, but later became associated with flight.
- Evolutionary studies have shown that birds are closely related to reptiles.
- Humans have carried out artificial selection for various features of cabbage and produced different vegetables.

Vegetable produced	Selected feature
Broccoli	Arrested flower development
Cauliflower	Sterile flowers
Kohlrabi	Swollen parts
Kale	Larger leaves

@PROCBSE

- Molecular phylogeny can also be used to trace evolutionary relationships. Here, the DNA of different species is compared. Greater the differences in DNA, more distantly related are the species.
- Disappearance of the existing species is not a requirement for formation of new species.
- The new species formed are better adapted to the environment but they need not be superior to the existing species.
- The common ancestor of humans and chimpanzees evolved in different ways to produce the present forms.
- Evolution produces more diverse and complex body forms over a period of time, but the newly formed species are not more progressive than the already existing ones. So, it is wrong to say that evolution produces progressive higher forms from lower ones.
- All human beings, whether fair skinned or dark skinned, belong to the same species *i.e.*, *Homo sapiens* that originated in Africa.
- The human ancestors gradually migrated from Africa to various parts of the world such as Asia, Europe, Australia and America. Thus they spread to different parts of the earth and adapted as best as they could to their environmental conditions.

Scan to know more about this topic

Evolution of human beings

Mnemonics

Concept: Homologous organs	Concept: Analogous Organs
Mnemonics: **Hi Virate How is the Bat & Ball for Test Cricket Today Lets Win the Match by Taking Catch**	Mnemonics: **All the People of Delhi & Faridabad are Sweet & Peaceful Who give Best Breads & Many Options of Egg-dishes**
Interpretation: homologous Vertebrate Heart Brain Bougainvillea Thorn Cucurbita Tendrils Limbs Whale Man Bat Cheetah	**Interpretation:** Analogous Penguins Dolphins Flippers Sweet-Potato Wings Birds Butterfly Mammals Octopus Eyes

@PROCBSE JOIN NOW !

How is it done on the GREENBOARD?

Q. (a) What is genetics ?
(b) What are genes? Where are the genes located?
(c) State and define three factors responsible for the rise of a new species. 5

Ans.

Step I: Genetics is the branch of biology that deals with the study of genes and heredity in organisms.

Step II: Genes are basic unit of heredity. They are linear segments of DNA which codes for a gene product.

Step III: Genes are located on chromosomes.

Factors responsible for the rise of a new species (speciation) are :

Step IV: Geographic isolation wherein geographic barrier prevents interaction between species. Over a period of time, the sub-populations become more and more diversified from one another and finally form two different species.

Step V: Genetic drift : The accidental change in frequency of genes in a small population is called genetic drift.

Step VI: Natural selection : It is the process that results in the increased survival and reproductive success of individuals that are well suited to their environment.

@PROCBSE

Objective Type Questions — 1 mark each

A Multiple Choice Questions

Q. 1. An example of homologous organs is

(a) our arm and a dog's fore-leg.
(b) our teeth and an elephant's tusks.
(c) potato and runners of grass.
(d) all of the above. [NCERT Exemp.]

Ans. Correct option : (b)
Explanation: An example of homologous organs is our teeth and an elephant's tusks.

Q. 2. In evolutionary terms, we have more in common with

(a) a Chinese school-boy. **(b) a chimpanzee.**
(c) a spider. **(d) a bacterium.**
[NCERT Exemp.]

Ans. Correct option : (a)
Explanation: In evolutionary terms, we have more in common with a Chinese school boy as both are humans and belong to same species.

Q. 3. The theory of evolution of species by natural selection was given by

(a) Mendel **(b) Darwin**
(c) Morgan **(d) Lamarck**
[NCERT Exemp.]

Ans. Correct option : (b)
Explanation: The theory of evolution of species by natural selection was given by Charles Darwin.

Q. 4. A basket of vegetables contains carrot, potato, radish and tomato. Which of them represent the correct homologous structures?

(a) Carrot and potato **(b) Carrot and tomato**
(c) Radish and carrot **(d) Radish and potato**
[NCERT Exemp.]

Ans. Correct option : (c)
Explanation: Radish and carrot are modified tap roots. Organs with similar origin are called **homologous organs**.

B Assertions and Reasons Type Questions

Directions: In the following questions, a statement of assertion (A) is followed by a statement of reason (R). Mark the correct choice as:

(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).
(b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).
(c) Assertion (A) is true but reason (R) is false.
(d) Assertion (A) is false but reason (R) is true.

Q. 1. Assertion (A): Fossils are remains of dead organisms.
Reason (R): It is helpful in study of evolution.

Ans. Correct option : (b)
Explanation: Fossils are remains of hard parts of the dead organisms in the strata of earth. It help in tracing evolutionary pathways. **1**

Q. 2. Assertion (A): Wings of butterfly and wings of bat are analogous organs.
Reason (R): Analogous organs have different origin and structural plan but same function.

Ans. Correct option : (a)
Explanation: Wings of butterfly and wings of bat though they perform similar function, they have different origin/basic structure. Hence, they are known as **analogous organs**. **1**

Q. 3. Assertion (A): Speciation is the process of formation of a new species from a pre-existing one.
Reason (R): Mutation plays a role in speciation.

Ans. Correct option : (a)
Explanation: Speciation is an evolutionary process by which new species arise. One of the factors that lead to speciation is mutation. **1**

C Very Short Answer Type Questions

AI **Q. 1. What is speciation?** [KVS-2014]
R [Board Term II, Delhi Set II, 2015]

Ans. Speciation is the evolution of reproductive isolation among once interbreeding populations *i.e.*, the development of one or more species from an existing species.
[CBSE Marking Scheme, 2015] **1**

Q. 2. List any two factors that could lead to speciation? U

Ans. Two factors that could lead to speciation are—
(i) Genetic drift, **(ii)** Reproductive isolation. ½ + ½

Q. 3. Write the contribution of Charles Darwin in the field of evolution. R

Ans. Charles Darwin proposed that evolution of species occurred by natural selection. **1**

AI **Q. 4. (i) Which of the following fossil is invertebrate and which one is vertebrate?**
(a) Dinosaur, (b) Ammonite. R

Ans. (a) Vertebrate, **(b)** Invertebrate. ½+½

@PROCBSE JOIN NOW !

@PROCBSE

Short Answer Type Questions-I — 2 marks each

AI **Q. 1. What are analogous organs? Why cannot the wing of a butterfly and the wing of a bat be considered homologous organs? State one reason.** R [OD Comptt. 2017]

Ans. Analogous organs: Organs with dissimilar basic structure or origin, but performing same function. **1**
Because though they perform similar function, they have different origin/basic structure. **1**

COMMONLY MADE ERROR

- Students often get confused between analogous and homologous organs and write opposite answer.

ANSWERING TIP

- Learn the differences between the two in tabular form for easy understanding and retention.

Q. 2. In an area A, the leaf material available to beetles was very less. What are the two consequences seen in the beetles? A

Ans. The consequences are as follows:
(i) They switched to new type of food and entered new niches.
(ii) This lead to arise of diverse variety of beetles as some changes in beetles will take place to make them adaptable to new niches. **1+1**

AI **Q. 3. State two methods of determining the age of fossils.**

Ans. (i) If we dig into the earth and start finding fossils, it can be assumed that the fossils closer to the surface are more recent to those found in the deeper layers.
(ii) By detecting the ratios of different isotopes of the same element in the fossil material.

Q. 4. "Geographical isolation is not a major factor in the speciation of a self pollinating plant species." Justify this statement with the help of an example. A

Ans. Geographical isolation will not be a major factor in the speciation of a self-pollinating plant species. It involves the same flower / plant in which male and female gametes are formed. **2**

Short Answer Type Questions-II — 3 marks each

Q. 1. What are homologous structures? Give an example. Is it necessary that homologous structures always have a common ancestor? Justify your answer. A [Delhi, Set- I, 2020]

Ans. Homologous Structures: Structures that are similar in origin but perform different functions. For e.g. forelimbs of humans and the wings of birds perform different functions but their skeletal structures are similar.
Yes, homology indicates common ancestry. Homologous organs follow the same basic plan of organization during their development but in the adult condition, these organs are modified to perform different functions as an adaptation to different environments. **1+1+1=3**

AI **Q. 2. (a) Classify the following as homologous or analogous pairs:**
(i) Broccoli and Cabbage
(ii) Ginger and Raddish
(iii) Fore limbs of birds and lizard
(iv) Wings of a bat and Wings of a bird
(b) State the main feature that categorises a given pair of organs as homologous or analogous. A [Outside Delhi, Set- I, 2020]

Ans. (a) (i) Analogous structure
(ii) Analogous structures
(iii) Homologous structures
(iv) Analogous structures
(b) Homologous organs are defined as the organs which have same structure but different functions while analogous organs are defined as the organs which have same functions but different structure. **2+1=3**

Q. 3. List three factors that could lead to speciation. Which of these cannot be a major factor in the speciation of a self-pollinating plant species and why? R [Outside Delhi, Set- II, 2020]

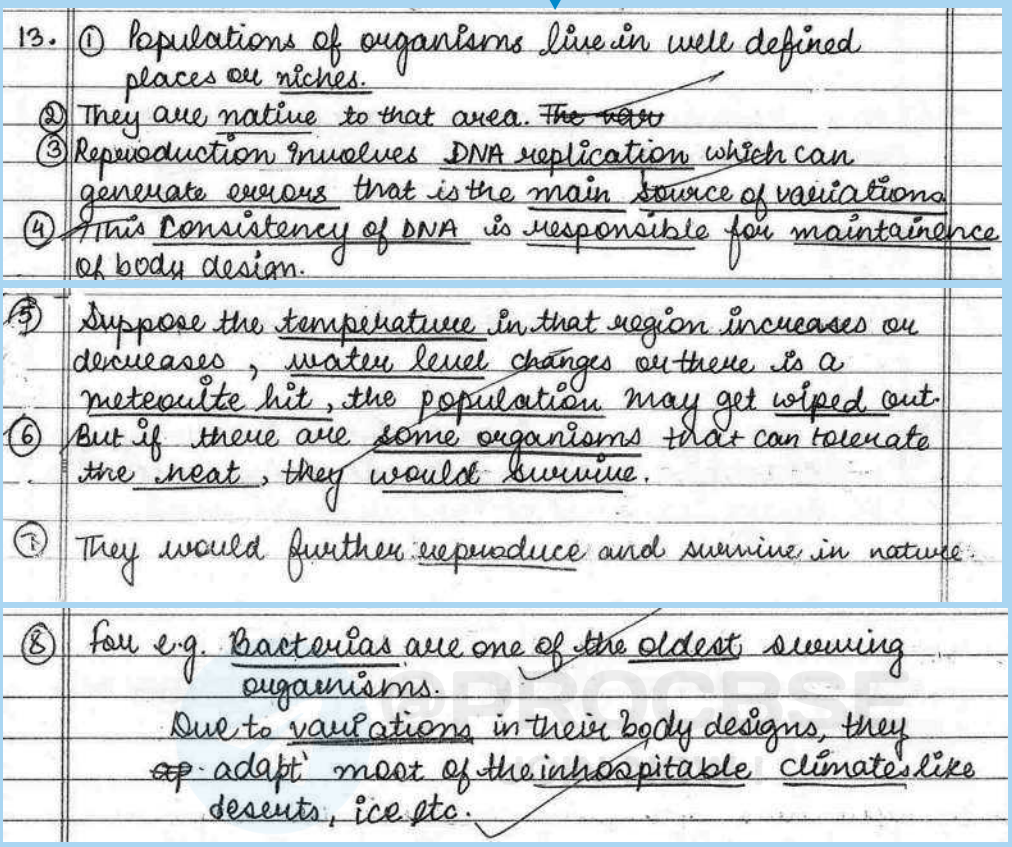
Ans. Factors which can lead to speciation are:
(a) Genetic drift
(b) Mutation / Drastic change in the genes or DNA
(c) Natural selection
(d) Geographical isolation
Geographical isolation cannot be a major factor in the speciation of a self-pollinating plant species.
Reason: Physical barrier cannot be created in self pollinating plants. **2+1=3**

@PROCBSE

Q. 4. How does the creation of variations in a species promote survival? Explain with the help of an example.

Topper's Answer, 2019

Ans.


13. (1) Populations of organisms live in well defined places or niches.
(2) They are native to that area. ~~The vary~~
(3) Reproduction involves DNA replication which can generate errors that is the main source of variations
(4) This Consistency of DNA is responsible for maintainence of body design.
(5) Suppose the temperature in that region increases or decreases, water level changes or there is a meteorite hit, the population may get wiped out.
(6) But if there are some organisms that can tolerate the heat, they would survive.
(7) They would further reproduce and survive in nature.
(8) for e.g. Bacterias are one of the oldest surviving organisms.
Due to variations in their body designs, they ~~ap~~ adapt most of the inhospitable climates like deserts, ice etc.

AI **Q. 5. (a) What is variation? How is variation created in a population? How does the creation of variation in a species promote survival?**

(b) Explain how, offspring and parents of organisms reproducing sexually have the same number of chromosomes. U **[CBSE, Comptt. Set, I, II, III, 2018]**

Ans. (a) Occurrence of differences between organisms is called **variation**.

New variation may arise during the process of DNA copying that already has variations accumulated from previous generations.

Combining variations from two or more individuals would thus create new combinations of variations.

Species having suitable variations have more chances of survival in case of change in environment conditions.

(b) In sexually reproducing organisms, male and female gametes/reproductive cells with only half the number of chromosomes (as in the parent cell) are produced. During fertilization, when male and female gametes fuse to give rise to a zygote, original number of chromosomes are restored.

[CBSE Marking Scheme, 2018]

Q. 6. 'Natural Selection and Speciation leads to evolution'. Justify this statement. R **[Delhi 31/1/2 2017]**

Ans. (a) Natural selection is defined as the change in frequency of some genes in a population, which gives survival advantage to a species.

(b) Whereas speciation is the development of a new species from pre-existing ones.

(c) This leads to a sequence of gradual change in the primitive organisms over millions of years, to form newer species which are very different from older ones. This is called **evolution**. **1 + 1 +1**

[CBSE Marking Scheme, 2017]

Detailed Answer:

Natural selection is the phenomenon by which the nature selects those species which possess survival advantage over the other species. According to theory of natural selection, there is struggle of existence within the species of a population for the environmental resources and their struggle leads to survival of certain organisms and elimination of the less competent species. The better adapted organisms would, thus, survive and pass on their traits to next generation, gradually leading to evolution.

@PROCBSE

Speciation is a process of formation of new species from the existing one due to reproductive isolation of a part of its population. This reproductive isolation can occur due to geographical isolation of a part of population. With time, the genetic drift will accumulate different variations in each of the geographically separated sub-population. Ultimately all the individuals of these two groups will isolate reproductively, thus, leading to formation and evolution of new species. Thus, we can say that both natural selection and speciation lead to the evolution of species on earth.

Q. 7. Explain with an example for each, how the following provides evidences in favour of evolution in organisms:

(i) Homologous organs

(ii) Analogous organs **[Delhi 31/1/1 2017]**

(iii) Fossils. U **[Board Term II, Delhi Set II, 2015]**

Ans. (i) Homologous organs: Forelimb of human and bird are homologous organs. They have same structural design and developmental origin, but they have different functions and appearance. Homologous organs help us to understand that the organisms have evolved from a common ancestor. The more common characteristics the two species have, the more closely they are related.

(ii) Analogous organs: Analogous organs are those organs which have different basic structural design and development origin but have similar appearance and perform similar functions.

Example: The wings of birds and bats look similar but have different design in their structure. They have a common function of flying, but their origins are not common. So, birds and bats are not closely related.

(iii) Fossils and their study is useful in knowing about the species which are no longer alive.

They provide evidence and missing links between two classes. They are helpful in forming a sequence of organisms in the pathway of evolution.

Thus, fossils have an importance in deciding evolutionary relationship. *Archaeopteryx* is a fossil bird. It had feathers, fused bones and beak which are exclusively bird structures. It also had some features which are found in reptiles *e.g.*, teeth in jaw, claws on free fingers and a long tail. This fossil provides a clue that birds have evolved from reptiles. **1+1+1** **[CBSE Marking Scheme 2015]**

Q. 8. 'Evolution and Classification of organisms are interlinked.' Give reasons to justify this statement. U **[OD 31/1 2017]**

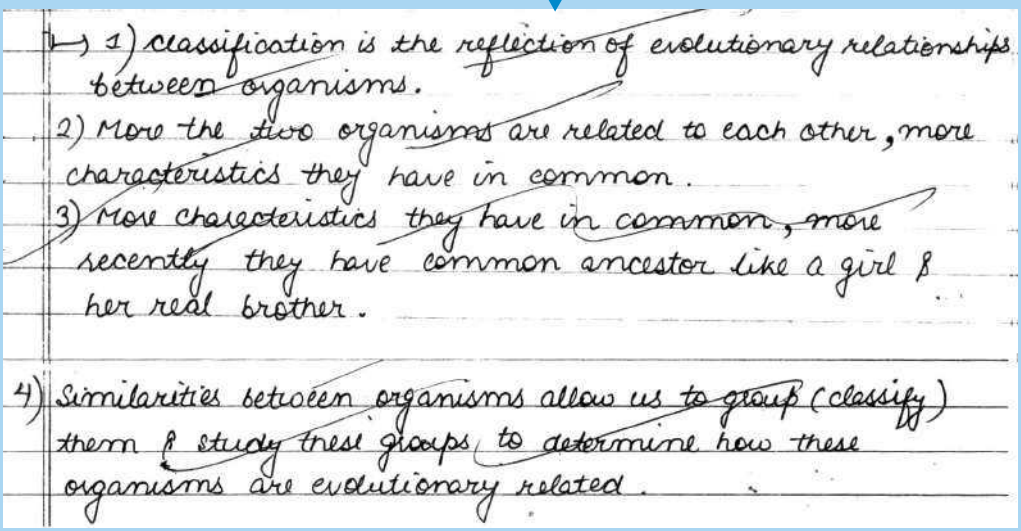
OR

'Two areas of study namely 'evolution' and 'classification' are interlinked'. Justify this statement. U **[Board Term II, O.D. Set I, 2016]** **[Board Term II, 2015]**

@PROCBSE JOIN NOW !

Topper Answer, 2017

Ans.


1) classification is the reflection of evolutionary relationships between organisms.
2) More the two organisms are related to each other, more characteristics they have in common.
3) More characteristics they have in common, more recently they have common ancestor like a girl & her real brother.
4) Similarities between organisms allow us to group (classify) them & study these groups to determine how these organisms are evolutionary related.

Detailed Answer:

"Every organism has an inbuilt tendency for genetic variation which plays an important role in the origin of new species and forms the basis for evolution. The more characteristics two species have in common, the more closely they are related. Classification of organisms involves organising them in different groups, based on the similarities and dissimilarities of characteristics. Therefore, classification of species is a reflection on their evolutionary relationship. Thus, we can say that evolution and classification of organisms are interlinked.

@PROCBSE

Q. 9. Define evolution. How does it occur? Explain how fossils provide evidences in support of evolution?
U [OD Comptt. 2017]

Ans. (a) Evolution: Gradual accumulation of variations and its selection by nature leading to formation of new species. **1**

(b) Variations may arise in a population due to mutations or sexual reproduction. Sub-populations are formed due to genetic drift and geographical isolation. When natural selection acts on them, most suitable variation survives leading to evolution of a new species. **2**

(c) Fossils provide missing link between the species/ phylogenetic relationships who has evolved from whom. They provide information about prehistoric organisms. **1, 1**

[CBSE Marking Scheme, 2017]

Q. 10. What is organic evolution? It cannot be equated with progress. Explain with the help of a suitable example. AE [OD 31/3 2017]

Ans. Organic evolution is the process or event of change in an organism by which descendants differ from their ancestors. **1**

Evolution cannot be equated to progress. From lower forms to higher forms, it gives rise to more complex body designs even while the simpler body designs continue to flourish. For example, human beings have not evolved from chimpanzees but both have common ancestor. **2**

Q. 11. What are homologous organs? Give one example. Can the wings of a butterfly and the wings of bat be regarded as homologous? Give reason in support of your answers.
U [OD Comptt. 31/1 2017]

Ans. Homologous Organs: Organs with similar basic structure/origin but modified to perform different functions. **(or any other) 1**

Example: Forelimbs of various vertebrates. ½

Wings of butterfly and the wings of a bat cannot be regarded as homologous organs. ½

Reasons: Though, they perform the similar function, they have different origin/basic structure. [CBSE Marking Scheme, 2017] **1**

AI **Q. 12. How are fossils formed? State any one role of fossils in the study of organic evolution?**
A [OD Comptt. 31/2 2017]

Ans. Formation: On certain occassions, a dead body or at least some parts may be in an environment that does not let it decompose completely and gets preserved, subsequently either the part or its impression becomes a fossil. **2**

Role of Fossil: Provides missing link between the species. **1**

They tell us about prehistoric organisms.

[CBSE Marking Scheme, 2017]

Q. 13. Give an example of the characteristics being used to determine how close two species are in evolutionary terms. R [Foreign 31/2/1, 2017]

Ans. Study of homologous organs as forelimbs of mammals, birds, reptiles and amphibian; show that though they perform different functions have similar basic / internal structure; this is because they have evolved from common ancestor and help us in determining the closeness between two species in evolutionary terms. **1 + 1 + 1**

[CBSE Marking Scheme, 2017]

Q. 14. List three factors that provide evidences in favour of evolution in organisms and state the role of each in brief. [Foreign Set II, 2017]
R [Board Term II, Foreign Set I, 2016]

Ans. Evidences of evolution are:

(i) Analogous organs: Organisms with similar looking organs may have different origin.

(ii) Homologous organs: Organisms with apparently different looking organs may have similar origin.

(iii) Fossils: Allow us to make estimates of how far back evolutionary relationships goes. Fossils when chronologically arranged help in tracing the evolutionary history of an organism. **3 × 1 = 3**

[CBSE Marking Scheme, 2016]

Q. 15. What is speciation? Explain in brief the role of natural selection and genetic drift in this process.
R [Board Term II, Foreign Set II, 2016]

Ans. (i) Speciation: Origin of new species from pre-existing ones. **1**

Role of Genetic drift and natural selection: Genetic drift is flow of genes from one population to another by chance factor or randomly. Over generation, it will accumulate different changes in different population. **1**

In addition, natural selection operates differently in different population selecting the fittest / favourable feature in both the population.

Over a long period of time, the differences in the two population may become so drastic that they no longer reproduce with each other and thus, give rise to new species. **1**

[CBSE Marking Scheme, 2016]

Q. 16. What is speciation? List four factors responsible for speciation. R [Board Term II, Delhi Set I, 2015]

Ans. Speciation is the evolution of reproductive isolation among once interbreeding population.

Factors which can lead to speciation are:

(i) Over generation, **genetic drift** may accumulate which lead to speciation.

(ii) Natural selection may work differently in different location which may give rise to speciation.

(iii) Severe **DNA change.**

(iv) A **variation** may occur which does not allow sexual act between two groups. **1 + 2**

[CBSE Marking Scheme, 2015]

@PROCBSE JOIN NOW !

@PROCBSE

AI **Q. 17. Explain the following:**

(a) Speciation

(b) Natural Selection

R **[Board Term II, Delhi Set II, 2015]**

Ans. (a) Speciation: Refer SAQ-II, Q. 16.

(b) Natural Selection: (i) There is natural variation within any population and same individuals have more favourable variations than others.

(ii) Population remains fairly constant even though all species produce a large number of offsprings.

(iii) This is due to 'competition' or 'struggle' for existence between same and different species.

(iv) The struggle for survival within population eliminates the unfit individuals and those with 'favourable variations' survive and pass on these variations to their progeny to continue. This is called **natural selection**. The favourable variations are accumulated over a long time period leading to the origin of a new species. **1½ + 1½**

[CBSE Marking Scheme, 2015]

Q. 18. Homologous organs are different from analogous organs.

(i) Mention the two basic characteristics that decide about analogy and homology between the two organs.

(ii) On what basis is the classification of organisms into prokaryotic and eukaryotic done?

U **[Board Term II, 2015]**

Ans. (i) The two basic characteristics that decide about analogy and homology are origin, structures and function.

(ii) In prokaryotic organism, no true nucleus is found. Therefore, nucleus is absent.
In eukaryotic organisms, true nucleus is found.

1 + 1 + 1

[CBSE Marking Scheme 2015]

Q. 19. There are two different types of organs, homologous and analogous. Differentiate between them by giving three points.

U **[Board Term II, 2015]**

Ans.

S. No.	Homologous Organs	Analogous Organs
(i)	They have same basic structural design.	They have different basic structural design.
(ii)	They perform different functions.	They perform similar functions.
(iii)	Their appearances are different.	They have similar appearances.

[CBSE Marking Scheme, 2015] 3

COMMONLY MADE ERROR

- Students often write differences in paragraph form.

ANSWERING TIP

- Learn the differences between analogous and homologous organs in tabular form for easy retention and understanding. Writing answers in tabular form are easy to understand than paragraph form.

Q. 20. (a) Cite the evidence on the basis of which it is concluded that birds have evolved from reptiles.

(b) Insects, *Octopus*, *Planaria* and Vertebrates also possess eyes. Can these animals be grouped together on the basis of the eyes they possess. Why or why not? Give reason to justify your answer. **[Board Term II, Delhi Set I, II, III, 2014]**

AE **[Board Term II, Foreign Set I, 2015]**

Ans. (a) (i) Fossils showing imprints of feathers along with the bones in dinosaurs/reptiles found.

(ii) They could not fly and presumably use the feathers for insulation.

(iii) Later they developed/evolved and adapted feathers for flight.

(iv) Thus, they give evidence that birds have evolved from reptiles. **½×4 = 2**

(b) Yes, eyes can be grouped together, which have evolved over generation from imperfect eyes in *Planaria* to perfect eyes in vertebrates. **½+½**

[CBSE Marking Scheme, 2015]

Long Answer Type Questions — 5 marks each

Q. 1. (a) What is genetics?

(b) What are genes? Where are the genes located?

(c) State and define three factors responsible for the rise of a new species. R **[Delhi, Set- II, 2020]**

Ans. (a) Genetics: Branch of biology that deals with the study of genes and heredity in organisms.

(b) Genes are basic unit of heredity. They are linear segments of DNA which codes for a gene product. Genes are located on chromosomes.

(c) Factors responsible for the rise of a new species (speciation) are:

(i) Geographic isolation: wherein geographic barrier prevents interaction between species. Over a

@PROCBSE

period of time, the sub-populations become more and more diversified from one another and finally form two different species.

(ii) Genetic drift: The accidental change in frequency of genes in a small population is called genetic drift.

(iii) Natural selection: It is the process that results in the increased survival and reproductive success of individuals that are well suited to their environment.

1+1+3

AI **Q. 2. (a) What are homologous structures? Give an example.**

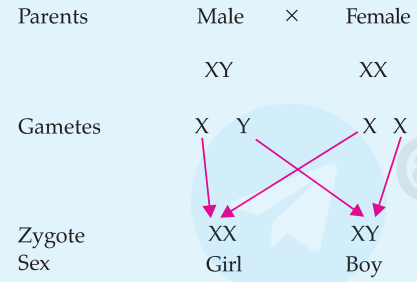
(b) "The sex of a newborn child is a matter of chance and none of the parents may be considered responsible for it." Justify this statement with the help of a flow chart showing sex-determination in human beings.

R **[Board Outside Delhi, Set-I, 2019]**

Ans. (a) The organs having similar origin / structures but performing different functions. **1**

Example: limbs of frog, limbs of lizard, bird, human **(Any two)** ½ + ½

(b)



Hence, sex determination is purely a matter of chance. **[CBSE Marking Scheme, 2019]**

Detailed Answer:

(a) Homologous structures are those structures which have a common basic structure but perform different functions. Example, forelimbs of reptiles, amphibians and mammals.

(b) In human beings, the sex of the individual is determined by the genes inherited from the parents. Women have a perfect pair of sex chromosomes i.e, XX whereas men have a mismatched pair of normal sized X and short one Y making it XY. All children will inherit an X chromosome from their mother regardless of whether they are boys or girls. Thus, the sex of children is decided by what they inherit from their father. A child who inherits an X chromosome will be a girl and one who inherits a Y chromosome from him will be a boy. So, there is an equal chance of a girl child as well as a boy child.

Q. 3. Name the phenomenon that governs the following:

(i) Green beetles living in green bushes are not eaten by the crows.

(ii) Number of blue beetles in green bushes increases only because the red beetles, living there, were trampled by a herd of elephants.

(iii) No 'medium height plants' are obtained in F_1 generation, upon crossing pure tall and drawf pea plants.

(iv) Tails of mice were surgically removed for several generations, still mice had tails in the following generations.

(v) A migrant beetle reproduces with the local population; as a result genes of migrant beetle enter the new population. C **[CBSE, SQP 2019]**

Ans. (i) Natural selection

(ii) Genetic drift

(iii) Law of dominance

(iv) Acquired characters are not inherited

(v) Gene flow. **[CBSE Marking Scheme, 2019]**

Q. 4. (a) What are fossils and how is age of fossils determined?

(b) During artificial selection, which features of wild cabbage were selected to give rise to (i) Cabbage and (ii) Cauliflower. A **[CBSE, SQP 2019]**

Ans. (a) Body or its parts that are not decomposed/ preserved traces of organisms.

- Upon digging the earth, the fossils that are found closer to the surface are more recent than the fossils in deeper layers.
- By detecting the ratios of different isotopes of the same element in the fossil material.

(b) (i) By selecting very short distances between leaves.

(ii) By selecting sterile flowers. **5**

[CBSE Marking Scheme, 2019]

Q. 5. **(a) How do the following provide evidences in favour of evolution in organisms ? Explain with an example for each.**

(i) Homologous organs

(ii) Analogous organs

(iii) Fossils

(b) Explain two methods to determine the age of fossils. U **[CBSE Board, 2019]**

@PROCBSE JOIN NOW

@PROCBSE

Topper Answer, 2019

Ans. 20. I Homologous organs

1. They are the organs that are similar in structure but have been modified to perform different functions.

20. a) For eg.
forelimbs of humans, frog and lizard have similar structures
Frog uses it to hop and as a shock absorber, humans use it to write, hold etc. and lizards use it to creep on walls.

They explain that maybe the reptiles, mammals and amphibians had common ancestors and evolved to be in the present form.

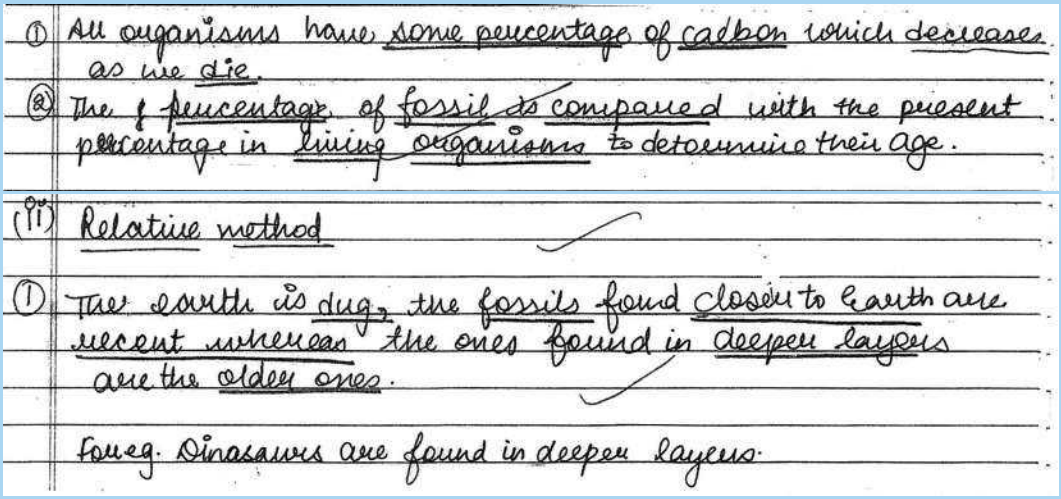
Analogous Organs
① They have different structures and appearance but perform similar function.
② For eg. wings of a bat and a bird have different structure, but perform function of flying. [birds have feathers and wings all over body; bat - thin flap like, webbed wings.]
③ They do not show common ancestory but trace evolution due to which they became capable of flying.

(iii) Fossils

① They are the remains of plants and animals found under earth that lived in remote past.
② They tell us about the evolutionary relationships in the past.
③ For eg. Archaeopteryx has round cranium and wings similar to birds but claws and beak similar to reptiles.
④ This shows relation between reptiles and aves or maybe aves evoluting from reptiles.

b) Fossils can be determined by -
(i) Carbon-14 Dating

@PROCBSE


① All organisms have some percentage of carbon which decreases as we die.
② The ¿ percentage of fossil is compared with the present percentage in living organisms to determine their age.

(ii) Relative method

① The earth is dug, the fossils found closer to Earth are recent whereas the ones found in deeper layers are the older ones.

Foreg. Dinosaurs are found in deeper layers.

AI Q. 6. What are fossils? How are they formed? List two methods of determining the age of fossils. Explain in brief the importance of fossils in deciding the evolutionary relationships.

R **[Foreign 31/2/1, 2017]**

Ans. (i) Fossils: The remains/impression of dead / decayed plants / animals of the part. ½

(ii) Formation of fossils: Formed when dead organisms are compressed under high pressure deep under the soil. **1**

(iii) Two methods of determining the age of fossils are:

(a) Relative method, ½

(b) Carbon dating method. ½

(iv) Importance of fossils: (a) The presence of fossilized remains of the organisms is the evidence of existence of the organisms millions of years ago, out of which some have become extinct. ½

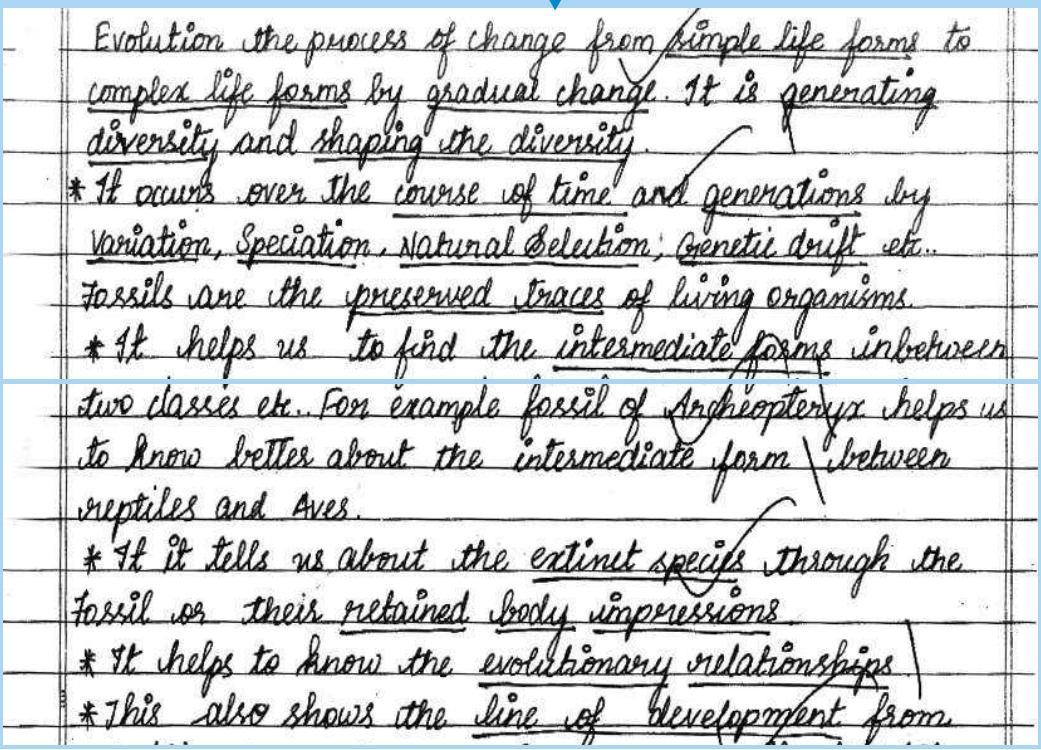
(b) Fossil also helps in the determination of the connecting links between various groups and their origin from the primitive ones. **1 + 1**

AI Q. 7. Define evolution. How does it occur? Describe how fossils provide us evidences in support of evolution.

[Board Term II, O.D. Set III, 2016]

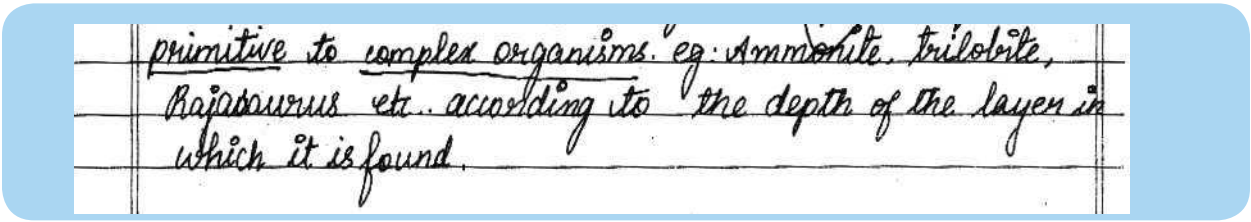
Topper Answer, 2016

Ans.


Evolution the process of change from simple life forms to complex life forms by gradual change. It is generating diversity and shaping the diversity.
* It occurs over the course of time and generations by variation, Speciation, Natural Selection, Genetic drift etc..
Fossils are the preserved traces of living organisms.
* It helps us to find the intermediate forms inbetween two classes etc. For example fossil of Archeopteryx helps us to know better about the intermediate form between reptiles and Aves.
* It it tells us about the extinct specis through the fossil or their retained body impressions.
* It helps to know the evolutionary relationships.
* This also shows the line of development from

@PROCBSE JOIN NOW !

@PROCBSE



Q. 8. What is meant by speciation? List four factors that could lead to speciation. Which of these cannot be a major factor in the speciation of a self-pollinating plant species. Give reason to justify your answer.

U **[Board Term II, Delhi Set I 2016, Foreign II 2015]**

Ans. (i) Speciation: The process of formation of a new species from a pre-existing one. **1**

(ii) Four factors that lead to speciation are:

(a) Genetic drift

(b) Mutation / Drastic change in the genes or DNA

(c) Natural selection

(d) Geographical isolation **4×½ = 2**

(iii) Geographical isolation cannot be a major factor in the speciation of a self-pollinating plant species. **1**

(iv) Reason: Physical barrier cannot be created in self-pollinating plants. **1**

COMMONLY MADE ERROR

- Students often write answers in paragraph form rather than in bullet form.

ANSWERING TIP

- Write answers point-wise rather than in the form of an essay.

Visual Case-based Questions — 4 marks each

Q. 1. Read the passage and answer any of the four questions from (a) to (e).

In a cross between plants with purple flowers and plants with white flowers, the offspring of F_1 generation all had white flowers. When the F_1 generation was self-crossed, it was observed in the F_2 generation that out of 100, 75 flowers were white. Make a cross and answer the following questions:

(a) The above cross is known as:

(i) Monohybrid cross (ii) Dihybrid cross

(iii) Test cross (iv) Back cross

(b) Show the cross.

(c) Which of these is not the genotype of F_2 progeny?

(i) WW (ii) Ww

(iii) ww (iv) Wp

(d) The ratio of 'White: Purple' flowers in the F2 generation is

(i) 3:1 (ii) 1:2

(iii) 1:3 (iv) 2:1

Ans. (a) (i) Monohybrid cross

(b) White flowers WW × Purple Flowers ww

Ww
White Flowers

(c) (iv) Genotypes of F_2 progeny are WW, Ww, ww

(d) Ratio between White: Purple flowers are 3: 1

(e) (iii) Following combinations of genotype emerge in F_2 generation: TT (1), tt (1) and Tt (2).

This shows that ratio of pure tall (TT) to pure short (tt) is 1: 1. **(Any four) 1+1+1+1**

Q. 2. Study the given cross showing self pollination in F_1 and answer any of the four questions from (a) to (e).

RRYY × rryy Parents
(Round Yellow) (Wrinkled Green)
RrYy × _____ F_1 generation
(Round Yellow)

(a) The missing black in the above cross is:

(i) RrYy (ii) RRYY

(iii) RryY (iv) rryy

@PROCBSE JOIN NOW!

(b) What is the combination of characters in the F_2 progeny?

(c) The ratio of the combination of characters in the F_2 progeny is:

(i) 3:1 **(ii) 1:2:1**

(iii) 1:1:1 **(iv) 9:3:3:1**

(e) A Mendelian experiment consists of breeding tall pea plants bearing violet flowers with short pea plants bearing white flowers. The progeny all bore violet flowers, but almost half of them were short. This suggests that the genetic make-up of the tall parent cod depicted as

(i) TTWW **(ii) TTww**

(iii) TtWW **(iv) TtWw**

Ans. (a) RrYy (Round Yellow)

(b) In F_2 generation, the combination of characters is Round Yellow: Round Green: Wrinkled yellow: Wrinkled Green

(c) (iv) Ratio is 9:3:3:1

(d) In F_1 generation, the production of all round yellow seeds explains that the round shape and yellow colour of the seeds were dominant traits over wrinkled shape and green colour of the seeds segregated during F generation.

(e) (iii) All progeny bore violet flower, so they all must have gene for violet flower. As violet colour appears in hybrids thus it must be the dominant character. So, white flowered plant should have ww genes to show recessive white character. It indicates that all progenies got allele W (violet colour) from tall-violet flowered plant, thus its all gametes should have this allele. To serve the purpose plant must have WW genes. But, tallness was found in 50% progenies thus half of its gametes contained T gene and other half contained t gene. Inclusively, the tall plant had TtWW genotype. **(Any four) 1+1+1+1**

Q. 3. Read the given passage and answer any of the four questions from (a) to (e) given below:

Seema crossed pure breed pea plants having round-yellow seeds with wrinkled green seeds and found that only A-B type of seeds were produced in the F_1 generation. When F_1 generation pea plants having A-B type of seeds were cross-breed by self pollination, then in addition to the original round yellow and wrinkled green seeds, two new varieties A-D and C-B types of seeds were also obtained.

(a) What are A-B type of seeds?

(i) Round -yellow

(ii) Round- green

(iii) Wrinkled- yellow

(iv) Wrinkled- green

(b) A and B are _____ traits.

(i) dominant

(ii) recessive

(c) A-D are _____ and C-B are _____ type of seeds.

(i) Round green and wrinkled yellow respectively

(ii) Round yellow and wrinkled green respectively

(iii) Wrinkled green and round green respectively

(iii) Wrinkled green and round yellow respectively

(d) Which one of these will be produced in minimum and maximum number in the F_2 generation?

(i) A-B

(ii) A-D

(e) The above cross is known as

(i) Monohybrid cross

(ii) Dihybrid cross

(iii) Test cross

(iv) Back cross

Ans. (a) (i) A-B type of seeds – Round in shape and yellow in colour

(b) (i) A-B type is dominant traits.

(c) (i) A-D = Round-green

C-B = Wrinkled- yellow

(d) (i) A-B is produced in maximum number while A-D will be produced in minimum number.

(e) (ii) Dihybrid cross. **1+1+1+1**

Q. 4. Read the passage and answer the following questions.

There were three animals: A, B and C. The animal A can fly but animal B can only run on ground or walls. However, the forelimbs of animal A and B, both have same basic design but they were used for different purposes such as flying and running respectively. The animal C became extinct a long time ago. The study of fossils of animal C tells us that it had some features like those of A and some like those of B. In fact, animal C is said to form a connecting link in the evolutionary chain of A and B.

@PROCBSE JOIN NOW !

@PROCBSE

(a) The animal C is

(i) Trilobite

(ii) *Archaeopteryx*

(iii) *Peripatus*

(iv) Lamprey

(b) A belongs to _____ and B belongs to _____ group respectively.

(i) Birds, Reptile

(ii) Fish, Amphibian

(iii) Birds, Mammals

(iv) Fish, Reptile

(c) _____ name is given to the forelimbs like those of A and B, which have the same basic design but different functions?

(i) Analogous organs

(ii) Homologous organs

(iii) Vestigeal organs

(iv) None of these

(d) Which is the correct evolutionary chain involving A, B and C.

(i) $C \rightarrow A \rightarrow B$

(ii) $B \rightarrow C \rightarrow A$

(e) Select the correct statement.

(i) Tendril of a pea plant and phylloclade of Opuntia are homologous

(ii) Tendril of a pea plant and phylloclade of Opuntia are analogous

(iii) Wings of birds and limbs of lizards are analogous

(iv) Wings of bird and wings of bat are homologous

Ans. (a) (ii) Animal C is *Archaeopteryx*.

(b) (i) A belongs to birds group while B belongs to reptile group.

(c) (ii) Homologous organs.

(d) (ii) $B \rightarrow C \rightarrow A$

(e) (iv) Wings of birds and wings of bat are homologous. Since they have same basic design however their origin is different. **(Any four) 1+1+1+1**

Q. 5. Read the passage and answer any of the four questions from (a) to (e).

Fossils are formed layer by layer in a sequence. It is a slow process that is totally dependent on where the organism dies. In the ocean, fossils are settled at the bottom in the soil or sand. In the course of time, these layers changed into rocks due to the presence of the water above and also due to chemical reactions. The distribution pattern of fossils shows that the ancient fossils present in the bottom rocks are simple, while the most recent fossils found in the upper strata are highly evolved. It means fossils form and become more and more complex as we proceed from earliest to recent rocks.

(a) If the fossil of an organism is found in the deeper layers of earth, then we can predict that

(i) the extinction of organism has occurred recently

(ii) the extinction of organism has occurred thousands of years ago

(iii) the fossil position in the layers of earth is not related to its time of extinction

(iv) time of extinction cannot be determined

(b) Which of these statements is correct about the importance of fossils in the study of organic evolution?

(i) It provides missing link between the species.

(ii) They tell us about the prehistoric organisms.

(iii) It help in establishing the time period in which organisms lived.

(iv) All of these

(c) Which of these organisms is fossilized?

(i) Trilobite

(ii) Crab

(iii) Lamprey

(iv) Shark

(d) Some dinosaurs had feathers although they could not fly but birds have feathers that help them to fly. In the context of evolution this means that

(i) reptiles have evolved from birds

(ii) there is no evolutionary connection between reptiles and birds

(iii) feathers are homologous structures in both the organisms

(iv) birds have evolved from reptiles

(e) Which of the following constitutes a fossil?

(i) A mineralized burrow of an extinct animal

(ii) An unidentified animal found frozen in a glacier

@PROCBSE JOIN NOW !

@PROCBSE

(iii) An ant found inside a block of amber, dating back to 110 million years

(iv) All of the above

Ans. (a) (ii) Fossils refer to the petrified remains of organisms that lived in the past and get preserved in rocks. The fossil position in the layer of earth relates to the time of extinction of organisms, If the fossil of an organism is found in the deeper layers of earth, then it is predicted that extinction of organism has occurred thousands of years ago. Whereas the fossils found closer to the surface are more recent

(b) (iv) Role of Fossil: Provides missing link between the species/who has evolved from whom. They tell us about prehistoric organisms. Also, it help in establishing the time period in which organisms lived. **(Any one)**

(c) (i) Trilobite

(d) (iv) In the context of evolution, the use of feathers by birds for flying means that birds have evolved from reptiles. Dinosaurs had feathers but could not fly using them. Birds, later adapted the feathers for flight. Since, dinosaurs were reptiles, this means that birds have evolved from them.

(e) (iv) All the given options constitute a fossil.

(Any four) 1+1+1+1

Q. 6. Read the below passage and answer the following questions.

Meena studied forelimbs of three organisms and she found that organism X had long and short bones, covered with muscles, which are used for running. The organism Y had long and short bones, covered with feathers used for flying. The organism Z has a layer of a complex chemical with supporting framework which is not made of bones and which is used for flying.

(a) To which class does the organism X, Y and Z belongs to?

(b) The name given to the forelimbs of organisms X and Y?

(i) Homologous organs

(ii) Analogous organs

(iii) Vestigial organs

(iv) Fossils

(c) The name is given to the forelimbs of organisms Y and Z is:

(i) Homologous organs

(ii) Analogous organs

(iii) Vestigial organs

(iv) Fossils

(d) Differentiate between the above two types of organs.

(e) Analogous structures are

(i) Structurally similar

(ii) Functionally similar

(iii) Structurally and functionally similar

(iv) Normally non-functional

Ans. (a) Organisms X and Y are vertebrates. X is a mammal whereas Y is a bird. Z is an insect (invertebrate).

(b) (i) Forelimbs of vertebrates are homologous organs, i.e., organs having same fundamental structure but perform different functions.

(c) (ii) Wings of insects and wings of birds are analogous organs, i.e., organs having similar functions but different in their structural details and origin.

(d)

S. No.	Homologous Organs	Analogous Organs
(i)	They have same basic structural design.	They have different basic structural design.
(ii)	They perform different functions.	They perform similar functions.
(iii)	Their appearances are different.	They have similar app-earances.

(e) (ii) Functionally similar **(Any four) 1+1+1+1**

Know the Terms

- **F_1 generations:** The generations resulting immediately from a cross of the first set of parents (parental generation).
- **F_2 generations:** Offsprings resulting from a cross of the members of F_1 generation.
- **Dominant:** The gene which expresses itself if F_1 hybrid generation is known as **dominant gene**.

@PROCBSE JOIN NOW !

@PROCBSE

- **Recessive:** The gene which is unable to express itself in presence of the dominant gene.
- **Genotype:** It is the genetic constitution of an organism which determines the phenotypic characters.
- **Phenotype:** It is the outward appearance of an individual.
- **Progeny:** The offspring produced as a result of reproduction of the parents.
- **Dominant trait:** A genetic trait is considered dominant if it is expressed in a person who has only one copy of that gene *i.e.* a trait which phenotypically expressed in heterozygote.
- **Recessive trait:** A genetic trait is considered recessive if it is expressed only when two copies of the recessive gene are present.
- **Homozygous:** Having two identical alleles of the same gene.
- **Heterozygous:** Having dissimilar alleles at corresponding chromosomal loci.
- **Monohybrid cross:** A type of cross in which only one pair of contrasting characters are considered.
- **Dihybrid cross:** A type of cross in which the inheritance of two pairs of contrasted characters is considered.
- **Allele:** Either of a pair (or series) of alternative forms of a gene that can occupy the same locus on a particular homologous pair of chromosome and that control the same character.
- **Somatic cells:** All cells forming the body of an organism, except the reproductive cells.
- **Sex chromosomes:** Either of a pair of chromosomes, usually designated X or Y, in the germ cells of most animals, that combine to determine the sex and sex-linked characteristics of an individual.
- **Gene:** A segment of DNA that is involved in producing a polypeptide chain and forms the basic unit of heredity.
- **Trait:** A trait is a distinct variant of a phenotypic character of an organism that may be inherited or environmentally determined.
- **Haploid cell:** Cell that has only one complete set of chromosomes.
- **Diploid cell:** Cell that has two sets of chromosomes, one of paternal origin, the other of maternal origin.
- **Micro-evolution:** Evolution resulting from small specific genetic changes that can lead to a new sub-species.
- **Genetic drift:** It refers to the random change in gene frequencies in a small population, presumably owing to change rather than natural selection, thereby providing diversity without any adaptations.
- **Speciation:** The process of formation of a new species.
- **Fossils:** Any naturally preserved remains of ancient life or traces of any organism that lived in geological age.
- **Molecular phylogeny:** The use of a gene's molecular characteristics to trace the evolutionary history of organisms.

@PROCBSE JOIN NOW !



❑❑❑

@PROCBSE

SELF ASSESSMENT TEST - 2

Maximum Time: 1 hour **MM: 25**

Q. 1. Choose the correct alternative from the given options.

(i) If salivary amylase is lacking in the saliva, which of the following events in the mouth cavity will be affected?

(a) Proteins breaking down into amino acids

(b) Starch breaking down into sugars

(c) Fats breaking down into fatty acids and glycerol

(d) Absorption of vitamins **1**

(ii) What prevents back flow of blood inside the heart during contraction?

(a) Valves in heart **(b)** Thick muscular walls of ventricles

(c) Thin walls of atria **(d)** All of the above **1**

(iii) Factors responsible for the rapid spread of bread mould on slices of bread are

(i) large number of spores.

(ii) availability of moisture and nutrients in bread.

(iii) presence of tubular branched hyphae.

(iv) formation of round shaped sporangia.

(a) (i) and (iii) **(b)** (ii) and (iv)

(c) (i) and (ii) **(d)** (iii) and (iv) **1**

(iv) If a round, green seeded pea plant (RRyy) is crossed with wrinkled, yellow seeded pea plant, (rrYY) the seeds produced in F_1 generation are

(a) round and yellow. **(b)** round and green.

(c) wrinkled and green. **(d)** wrinkled and yellow. **1**

Q. 2. Assertion and Reason

Directions : In the following questions, a statement of assertion (A) is followed by a statement of reason (R). Mark the correct choice as :

(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

(b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).

(c) Assertion (A) is true but reason (R) is false.

(d) Assertion (A) is false but reason (R) is true.

(i) Assertion (A) : Valves are present in the arteries.

Reason (R) : Arteries carry oxygenated blood from heart to different body parts except pulmonary artery.

(ii) Assertion (A) : Speciation is the process of formation of a new species from a pre-existing one.

Reason (R) : Mutation plays a role in speciation. **1**

Q. 3. Name the two components of peripheral nervous system.

Q. 4. Name the hormones in humans which regulate carbohydrate, protein and fat metabolism in the body. Mention the site where it is synthesized. **1**

Q. 5. Give one example of following plants:

(a) Which is (i) positively phototropic and (ii) negatively geotropic.

(b) Which is positively hydrotropic as well as positively geotropic ?

(c) Which synthesises auxin ? **3**

@PROCBSE JOIN NOW !

@PROCBSE

Q. 6. Bile juice does not have any digestive enzyme but still plays a significant role in the process of digestion. Justify the statement. **3**

Q. 7. (a) Mention the role of the following organs of human male reproductive system:

(i) Testis; (ii) Scrotum; (iii) Vas deferens; (iv) Prostate glands. (b) What are the two roles of testosterone ? **3**

Q. 8. Explain with an example for each, how the following provides evidences in favour of evolution in organisms:

(i) Homologous organs

(ii) Analogous organs

(iii) Fossils. **3**

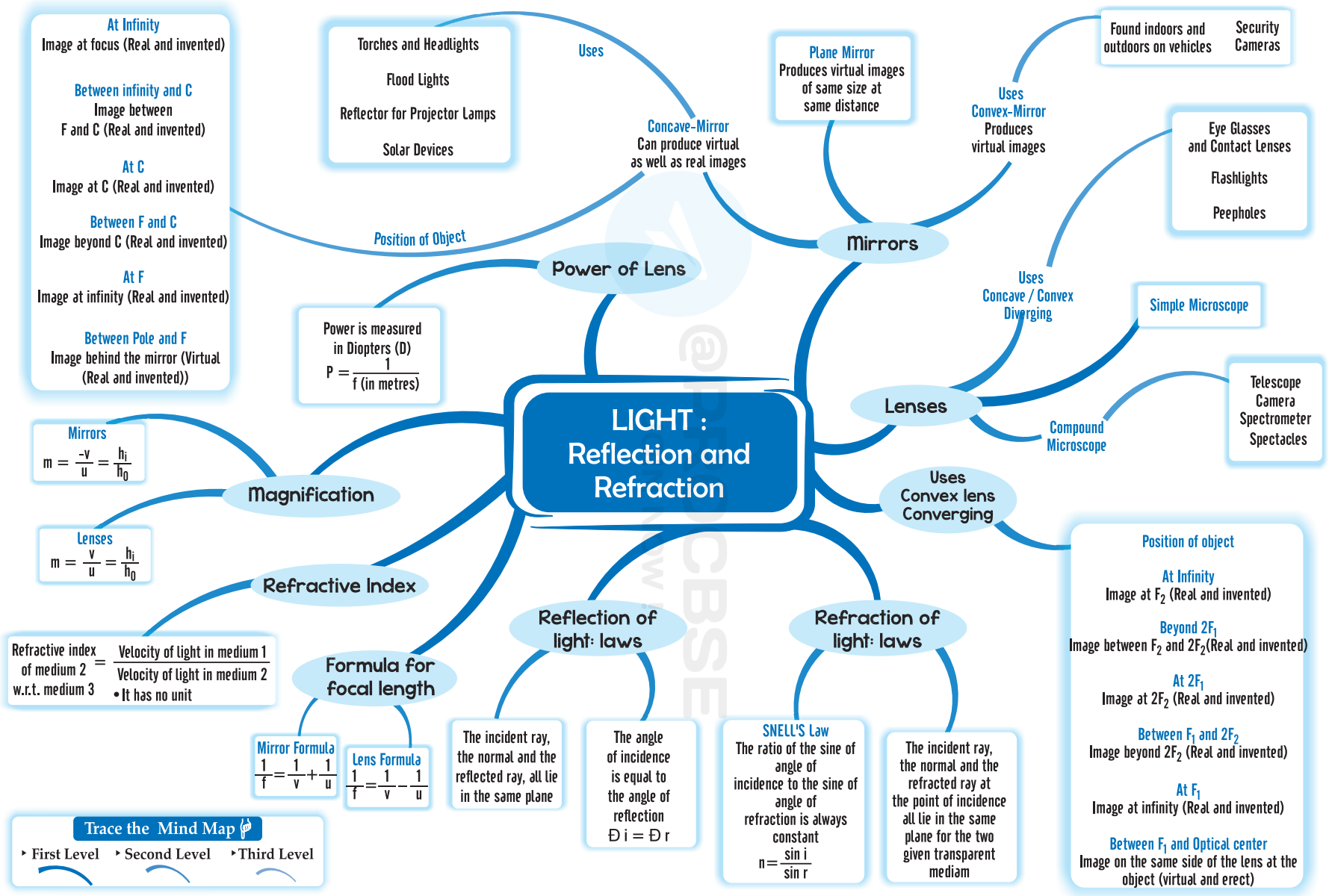
Q. 9. Give one example each of unisexual and bisexual flowers. Differentiate between the two types of pollination that occur in flowers. What happens when a pollen lands on a suitable stigma ? Write about the events that occur till the seed formation in the ovary. **5**



@PROCBSE
JOIN NOW !

■■

@PROCBSE


LIGHT : Reflection and Refraction
Mirrors
Concave-Mirror
Can produce virtual as well as real images
Uses
Torches and Headlights
Flood Lights
Reflector for Projector Lamps
Solar Devices
Position of Object
At Infinity
Image at focus (Real and invented)
Between infinity and C
Image between F and C (Real and invented)
At C
Image at C (Real and invented)
Between F and C
Image beyond C (Real and invented)
At F
Image at infinity (Real and invented)
Between Pole and F
Image behind the mirror (Virtual (Real and invented))
Plane Mirror
Produces virtual images of same size at same distance
Uses
Convex-Mirror
Produces virtual images
Found indoors and outdoors on vehicles
Security Cameras
Lenses
Uses
Concave / Convex
Diverging
Eye Glasses and Contact Lenses
Flashlights
Peepholes
Simple Microscope
Compound Microscope
Telescope
Camera
Spectrometer
Spectacles
Uses
Convex lens
Converging
Position of object
At Infinity
Image at F_2 (Real and invented)
Beyond $2F_1$
Image between F_2 and $2F_2$(Real and invented)
At $2F_1$
Image at $2F_2$ (Real and invented)
Between F_1 and $2F_2$
Image beyond $2F_2$ (Real and invented)
At F_1
Image at infinity (Real and invented)
Between F_1 and Optical center
Image on the same side of the lens at the object (virtual and erect)
Power of Lens
Power is measured in Diopters (D)
$P = \frac{1}{f \text{ (in metres)}}$
Magnification
Mirrors
$m = \frac{-v}{u} = \frac{h_i}{h_0}$
Lenses
$m = \frac{v}{u} = \frac{h_i}{h_0}$
Refractive Index
Refractive index of medium 2 w.r.t. medium 3 $= \frac{\text{Velocity of light in medium 1}}{\text{Velocity of light in medium 2}}$
• It has no unit
Formula for focal length
Mirror Formula
$\frac{1}{f} = \frac{1}{v} + \frac{1}{u}$
Lens Formula
$\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$
Reflection of light: laws
The incident ray, the normal and the reflected ray, all lie in the same plane
The angle of incidence is equal to the angle of reflection
∠i = ∠r
Refraction of light: laws
SNELL'S Law
The ratio of the sine of angle of incidence to the sine of angle of refraction is always constant
$n = \frac{\sin i}{\sin r}$
The incident ray, the normal and the refracted ray at the point of incidence all lie in the same plane for the two given transparent mediam
Trace the Mind Map
First Level
Second Level
Third Level

@PROCBSE

UNIT 3: Natural Phenomena

CHAPTER 10

LIGHT-REFLECTION AND REFRACTION

Syllabus

Reflection of light by curved surfaces; Images formed by spherical mirrors, centre of curvature, principal axis, principal focus, focal length, mirror formula (Derivation not required), magnification, Refraction; Laws of refraction, refractive index, Refraction of light by spherical lens; Image formed by spherical lenses; Lens formula (Derivation not required); Magnification, Power of a lens.

Trend Analysis

List of Concepts	2018	2019		2020	
	Delhi/Outside Delhi	Delhi	Outside Delhi	Delhi	Outside Delhi
Reflection of light, Image formed by Spherical Mirrors	1 Q (2 M)	1 Q (3 M)		1 Q (3 M) 1 Q (5 M)	1 Q (1 M) 1 Q (5 M)
Refraction, Lens and Power of a Lens.	1 Q (3 M) Or 1 Q (3 M)	1 Q (2 M) Or 1 Q (3 M)	1 Q (5 M)	1 Q (5 M)	1 Q (5 M)

@PROCBSE

TOPIC - 1

Reflection of Light, Images Formed by Spherical Mirrors

Revision Notes

Introduction

- When light falls on a body, it may be absorbed, may be transmitted or light may get reflected back to the same medium.
- **Reflection of light** is the phenomenon of bouncing back of the light rays in the same medium.
- **Laws of Reflection:**
  - **(i)** The incident ray, the reflected ray, the normal, all lie in the same plane at the point of incidence.
  - **(ii)** The angle of incidence is equal to the angle of reflection.
- **Real image** is obtained when the rays of light after reflection or refraction

TOPIC - 1

Reflection of Light, Images formed by Spherical Mirrors **Page No. 233**

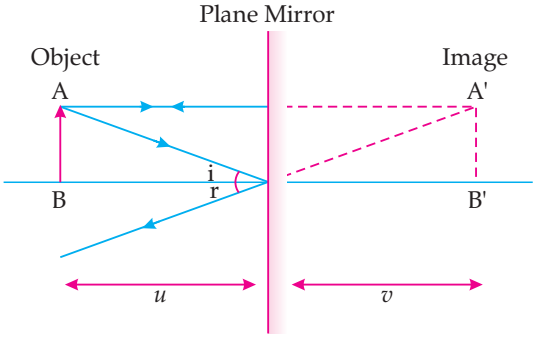
TOPIC - 2

Refraction, Lenses and Power of a Lens **Page No. 252**

@PROCBSE

actually meet at some point. It can be obtained on the screen and can be seen with the eye.

- **Virtual image** forms when rays of light do not actually meet, but appear to meet when produced backwards. It cannot be obtained on the screen.
- **Image Formed by plane Mirror:**



Scan to know more about this topic

Reflection of Light

- **Characteristics of Image:**
  (i) Virtual and erect.
  (ii) Size of image is equal to the size of object.
  (iii) Image is formed as far as behind the mirror as the object is in front of it.
  (iv) Laterally inverted.
- **Lateral Inversion:** The phenomenon due to which the right side of the object appears as left and the left side of the object appears as right. *i.e.,* the image is inverted sideways.
- A spherical mirror whose reflecting surface recessed inward, is concave mirror.
- The spherical mirror, whose reflecting surface bulges towards light source, is a convex mirror.
- Concave mirror mostly forms real images, which can be obtained on the screen. Convex mirror always forms virtual images, which cannot be obtained on the screen.
- **Differentiating between a plane mirror, a concave mirror and a convex mirror, without touching them:**
  (i) If the formed image is erect, of same size and equidistant as of object, then it is a plane mirror
  (ii) If the formed image formed is erect but smaller in size, then it is a convex mirror
  (iii) If the formed image is erect, real and magnified when the mirror is close to the object, then it is a concave mirror

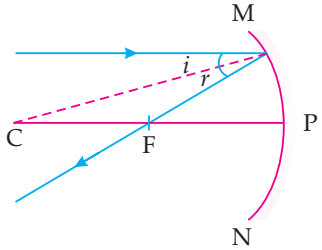
Scan to know more about this topic

Image formation in Spherical mirror

- Solar concentrators use huge concave mirrors to focus large amount of solar energy thereby producing high temperature conditions in a solar power plant.
- The centre of the reflecting surface of a spherical mirror is called the pole of the mirror and it is usually represented by P.
- The horizontal line passing through the centre of curvature and pole of the spherical mirror is known as principal axis.
- The centre of curvature of a spherical mirror is the centre of the hollow sphere of glass, of which the spherical mirror is a part and is usually represented by C.
- The radius of curvature of a spherical mirror is the radius of the hollow sphere of glass, of which the spherical mirror is a part and is usually represented by R.
- The diameter of the reflecting surface, *i.e.,* twice the radius is called its aperture.
- Radius of curvature (R) = 2 × focal length (f).
- **Rules for making ray diagrams by concave mirror:**
  (i) A ray parallel to the principal axis will pass through the principal focus, after reflection.

Scan to know more about this topic

Image formation in concave mirror

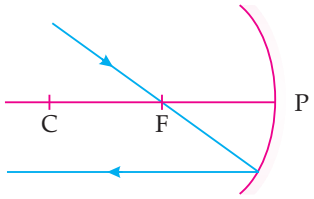


Scan to know more about this topic

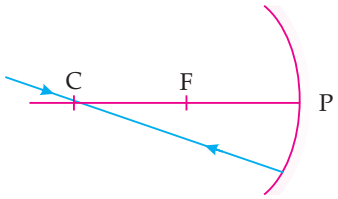
Image formation in convex mirror

@PROCBSE

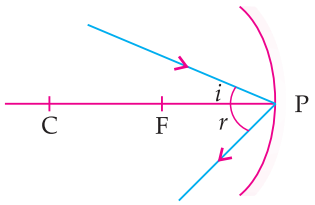
(ii) A ray passing through the principal focus of concave mirror will be parallel to principal axis after reflection.



(iii) A ray of light passing through the centre of curvature of a concave mirror is reflected back along the same path as it is a normally incident ray.



(iv) A ray incident obliquely to the principal axis of a concave mirror is reflected obliquely making equal angle.



➢ **Image formation by a concave mirror for different positions of the object:**

Position of Object	Position of Image	Size of Image	Nature of Image
At infinity	At the focus F	Highly diminished, point-sized	Real and inverted
Beyond C	Between F and C	Diminished	Real and inverted
At C	At C	Same size	Real and inverted
Between C and F	Beyond C	Enlarged	Real and inverted
At F	At infinity	Highly enlarged	Real and inverted
Between P and F	Behind the mirror	Enlarged	Virtual and erect

➢ **Image formation by a convex mirror for different positions of the object:**

Position of Object	Position of Image	Size of Image	Nature of Image
At infinity	At the focus F, behind the mirror	Highly diminished, point-sized	Virtual and erect
Between infinity and the pole P of the mirror	Between P and F, behind the mirror	Diminished	Virtual and erect

➢ **Mirror Formula:**

$$\frac{1}{u}+\frac{1}{v}=\frac{1}{f}$$

Where, v = Image distance
u = Object distance
f = Focal length

➢ **Magnification of Spherical Mirrors:**

It is the ratio of the height of image to the height of object.

$$m = \frac{\text{Height of image}}{\text{Height of object}}$$

@PROCBSE JOIN NOW !

@PROCBSE

$$m = \frac{h_i}{h_o} = -\frac{v}{u}$$

If 'm' is negative, image is real.

If 'm' is positive, image is virtual.

If $h_i = h_o$ then $m = 1$, *i.e.*, image is equal to object.

If $h_i > h_o$ then $m > 1$ *i.e.*, image is enlarged.

If $h_i < h_o$ then $m < 1$ *i.e.*, image is diminished.

- Magnification of plane mirror is always + 1.

  '+' sign indicates virtual image.

  '1' indicates that image is equal to object's size.
- If 'm' is '+ve' and less than 1, it is a convex mirror.
- If 'm' is '+ve' and more than 1, it is a concave mirror.
- If 'm' is '–ve', it is a concave mirror.
- The phenomenon of change in the path of light from one medium to another is called refraction of light.
- The angle formed between the incident ray and the normal is called angle of incidence and the angle formed between the refracted ray and the normal is called angle of refraction.
- The cause of refraction is the change in the speed of light as it goes from one medium to another medium.
- Larger the difference in speed of light between the two media across the interface, the greater will be the deviation and vice-versa.
- When a ray of light passes from a rarer medium to a denser medium, it bends towards the normal. Also, the angle of incidence is greater than the angle of refraction.
- When a ray of light passes from a denser medium to a rarer medium, it bends away from the normal. Also, the angle of incidence is less than the angle of refraction.

@PROCBSE JOIN NOW !

Mnemonics

Concept: Image formation by concave mirror

Mnemonics: Mnemonics:54321 to be converted in 12345

At F	1
Between C and F	2
At C	3
Beyond C	4
Infinity	5
Between F and P	Exception

Object	1	2	3	4	5
Image	5	4	3	2	1

Interpretation:

If object is at infinity (5) , image will be formed at F (1)

If object is at beyond C (4), image will be formed at between C and F (2)

And so on.

@PROCBSE

How is it done on the GREENBOARD?

Q. The image of a candle flame placed at a distance of 30 cm from a mirror is formed on a screen placed in front of the mirror at a distance of 60 cm from its pole. What is the nature of the mirror? Find its focal length. If the height of the flame is 2.4 cm, find the height of its image. State whether the image formed is erect or inverted.

Solution:

Step I: Since the image is formed on a screen, the image is real. So, the nature of the mirror is concave.

Step II: Given, $u = -30$ cm, $v = -60$ cm, Using mirror formula,

$$\frac{1}{f} = \frac{1}{v} + \frac{1}{u}$$

or, $$\frac{1}{f} = \frac{1}{-60} + \frac{1}{-30}$$

or, $$\frac{1}{f} = -\frac{1}{60} - \frac{1}{30}$$

or, $$\frac{1}{f} = -\frac{3}{60}$$

or, $$\frac{1}{f} = -\frac{1}{20}$$

$\therefore$ $f = -20$ cm

so, focal length $= -20$ cm.

Step III: Given, $u = -30$ cm, $v = -60$ cm, $h_0 = 2.4$ cm,

$\therefore$ Magnification, $-\frac{v}{u} = -\frac{-60}{-30} = -2$

(Negative sign indicates that the image is real and inverted.)

Again magnification $= \frac{h_i}{h_o} = -2$

or, $$\frac{h_i}{2.4} = -2$$

$\therefore$ $h_i = -4.8$ cm

So, the height of the image is 4.8 cm. (Negative sign indicates that the image is inverted and real)

Step IV: From the sign of magnification it is concluded that the image is inverted.

Objective Type Questions — 1 mark each

A Multiple Choice Questions

Q. 1. The laws of reflection hold true for:
(a) plane mirrors only
(b) concave mirrors only
(c) convex mirrors only
(d) all reflecting surfaces R [CBSE Delhi 2020]

Ans. Correct option : (d)

Q. 2. When an object is kept within the focus of a concave mirror, an enlarged image is formed behind the mirror. This image is:
(a) real **(b) inverted**
(c) virtual and inverted **(d) virtual and erect**
A [CBSE Delhi, 2020]

Ans. Correct option : (d)

Q. 3. Consider the following properties of virtual images:
(A) cannot be projected on the screen
(B) are formed by both concave and convex lens
(C) are always erect
(D) are always inverted
The correct properties are:
(a) (A) and (D) **(b) (A) and (B)**
(c) (A), (B) and (C) **(d) (A), (B) and (D)**
A [CBSE Delhi 2020, Set-3]

Ans. Correct option : (c)

Q. 4. A real image is formed by the light rays after reflection or refraction when they:

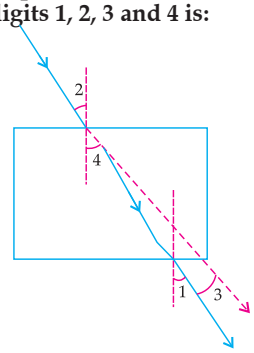
@PROCBSE

(A) actually meet or intersect with each other.
(B) actually converge at a point.
(C) appear to meet when they are produced in the backward direction.
(D) appear to diverge from a point.
Which of the above statements are correct?
(a) (A) and (D) **(b) (B) and (D)**
(c) (A) and (B) **(d) (B) and (C)**

AE **[CBSE Delhi 2020, Set-3]**

Ans. Correct option : (c)

Q. 5. The correct sequencing of angle of incidence, angle of emergence, angle of refraction and lateral displacement shown in the following diagram by digits 1, 2, 3 and 4 is: U **[Delhi Set-1, 2017]**



(a) 2, 4, 1, 3 **(b) 2, 1, 4, 3**
(c) 1, 2, 4, 3 **(d) 2, 1, 3, 4**

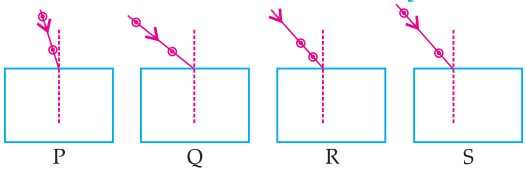
Ans. Correct option : (b)

Q. 6. A student obtained a sharp image of a candle flame placed at the distant end of the laboratory table on a screen using a concave mirror to determine its focal length. The teacher suggested him to focus a distant building about 1 km far from the laboratory, for getting more correct value of the focal length. In order to focus the distant building on the same screen the student should slightly move the:
(a) mirror away from the screen
(b) screen away from the mirror
(c) screen towards the mirror
(d) screen towards the building

AE **[CBSE Delhi Set-1, 2016]**

Ans. Correct option : (c)
Explanation : The object is at infinity , so to obtain sharp image screen should be moved towards mirror.

Q. 7. Select from the following the best experimental set-up for tracing the path of a ray of light passing through a rectangular glass slab:
[CBSE Delhi, 2016]



(a) P (b) Q
(c) R (d) S

Ans. Correct option : (b)

Q. 8. To determine the approximate value of the focal length of a given concave mirror, you focus the image of a distant object formed by the mirror on a screen. The image obtained on the screen, as compared to the object is always:
(a) Laterally inverted and diminished
(b) Inverted and diminished
(c) Erect and diminished
(d) Erect and highly diminished

[CBSE Outside Delhi Set-1, 2016]

Ans. Correct option : (b)
Explanation : When the object is at infinity, diminished, inverted and real image is formed.

Q. 9. In your laboratory you trace the path of light rays through a glass slab for different values of angle of incidence ($\angle i$) and in each case measure the values of the corresponding angle of refraction ($\angle r$) and angle of emergence ($\angle e$).
On the basis of your observation your correct conclusion is:
(a) $\angle i$ is more than $\angle r$, but nearly equal to $\angle e$
(b) $\angle i$ is less than $\angle r$, but nearly equal to $\angle e$
(c) $\angle i$ is more than $\angle e$, but nearly equal to $\angle r$
(d) $\angle i$ is less than $\angle e$, but nearly equal to $\angle r$

[CBSE Outside Delhi Set-1, 2016]

Ans. Correct option : (a)
Explanation : On passing through a glass slab emergent ray is parallel to incident ray.

Q. 10. Which of the following can make a parallel beam of light when light from a point source is incident on it?
(a) Concave mirror as well as convex lens
(b) Convex mirror as well as concave lens
(c) Two plane mirrors placed at 90° to each other
(d) Concave mirror as well as concave lens

[NCERT Exemp.]

Ans. Correct option : (a)
Explanation : When a point source of light is placed at the focus of concave mirror then all light rays after reflection through mirror will become parallel to the principal axis.
When this point source of light is placed at the focus of convex lens then after refraction by light rays convex lens will become parallel to the principal axis.

Q. 11. Magnification produced by a rear-view mirror fitted in vehicles
(a) is less than one.
(b) is more than one.
(c) is equal to one.
(d) can be more than or less than one depending upon the position of the object in front of it.

[NCERT Exemp.]

Ans. Correct option : (a)
Explanation : Convex mirror is used as rear-view mirror in vehicles. It forms virtual, erect, and diminished images of the objects.
Magnification is ratio of height of image to the height of the object, hence, magnification produced by a rear-view mirror fitted in vehicles is less than one.

Q. 12. Rays from sun converge at a point 15 cm in front of a concave mirror. Where should an object be placed so that size of its image is equal to the size of the object?
(a) 15 cm in front of the mirror
(b) 30 cm in front of the mirror
(c) Between 15 cm and 30 cm in front of the mirror
(d) More than 30 cm in front of the mirror

[NCERT Exemp.]

Ans. Correct option : (b)

@PROCBSE

Explanation : The distance of the sun is infinite as compared to the radius of curvature of concave mirror, so, light rays from sun incident parallel all the rays converge at the principal focus. So, the focal length is 15 cm.

In case of a concave mirror, the size of image and object will be same if the object is placed at $2f$. Hence, in this case object must be placed at $2f$ or $2 \times 15 = 30$ cm.

Q. 13. In torches, search lights and headlights of vehicles, the bulb is placed

(a) between the pole and the focus of the reflector.

(b) very near to the focus of the reflector.

(c) between the focus and centre of curvature of the reflector.

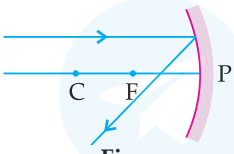
(d) at the centre of curvature of the reflector.

[NCERT Exemp.]

Ans. Correct option : (b)

Explanation : The rays of light passing through the principal focus will go parallel to principal axis after reflection thus, forming a concentrated beam of light. So, due to this reason in torches, search lights, and headlights of vehicles, the bulb is placed very near to the focus of the reflector.

Q. 14. Which of the following ray diagrams is correct for the ray of light incident on a concave mirror as shown in figure?



Fig

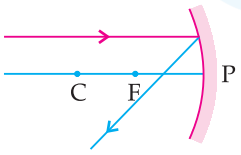


Fig. A

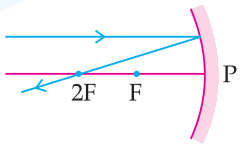


Fig. B

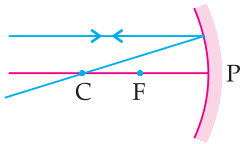


Fig. C

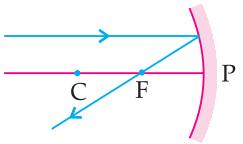


Fig. D

(a) Fig. A **(b) Fig. B**

(c) Fig. C **(d) Fig. D**

[NCERT Exemp.]

Ans. Correct option : (d)

Explanation : Ray of light incident parallel to the principal axis towards the mirror after reflection will pass through the principal focus. So, Figure D is correct.

Q. 15. A student determines the focal length of a device '*X*' by focussing the image of a distant object on a screen placed 20 cm from the device on the same side as the object. The device '*X*' is

(a) Concave lens of focal length 10 cm

(b) Convex lens of focal length 20 cm

(c) Concave mirror of focal length 10 cm

(d) Concave mirror of focal length 20 cm

[CBSE Board, Foreign Scheme, 2016]

Ans. Correct option : (d)

Explanation : Image formed by the concave mirror in this case is same as when object is at infinity. Due to the great distance, light rays will incident almost parallel to principal axis.

After reflection all the rays will converge and meet at principal focus.

So, focal length is 20 cm.

B Assertion and Reason Type Questions

Directions: In the following questions, a statement of assertion (A) is followed by a statement of reason (R). Mark the correct choice as:

(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

(b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).

(c) Assertion (A) is true but reason (R) is false.

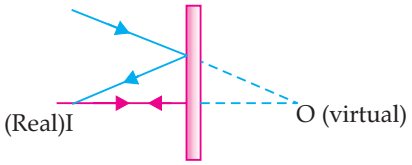
(d) Assertion (A) is false but reason (R) is true.

Q. 1. Assertion (A): Plane mirror may form real image.

Reason (R): Plane mirror forms virtual image, if object is real.

Ans. Correct option : (b)

Explanation : Plane mirror may form real image, if object is virtual.



Q. 2. Assertion (A): The focal length of the convex mirror will increase, if the mirror is placed in water.

Reason (R): The focal length of a convex mirror of radius *R* is equal to, $f = \frac{R}{2}$.

Ans. Correct option : (d)

Explanation : Focal length of the spherical mirror does not depend on the medium in which it is placed.

Q. 3. Assertion (A): The image formed by a concave mirror is certainly real if the object is virtual.

Reason (R): The image formed by a concave mirror is certainly virtual if the object is real.

Ans. Correct option : (c)

Explanation : The image of real object may be real in case of concave mirror.

Q. 4. Assertion (A): An object is placed at a distance of *f* from a convex mirror of focal length *f*, its image will form at infinity.

@PROCBSE JOIN NOW

Reason (R): The distance of image in convex mirror can never be infinity.

Ans. Correct option : (d)

Explanation : The distance of image in convex mirror is always finite.

C Very Short Answer Type Questions

Q. 1. Both a spherical mirror and a thin spherical lens have a focal length of (–)15 cm. What type of mirror and lens are these? U [SQP 2020]

Ans. Both are concave.
Alternative answer that should be given credit: Plano-concave lens. **1**
[CBSE Marking Scheme, 2020]

Q. 2. The image formed by a concave mirror is observed to be real, inverted and larger than the object. Where is the object placed? A [SQP 2020]

Ans. Between the principal focus and the centre of curvature. [CBSE Marking Scheme, 2020]

Q. 3. Define the term principal axis of a spherical mirror. R [Delhi Comptt. 31/1/3 2017]

Ans. The line which joins the pole and the centre of curvature of a spherical mirror, is the principal axis of a spherical mirror. 1

COMMONLY MADE ERROR

- Many candidates write only mirror instead of writing spherical mirror.

ANSWERING TIP

- Specification of spherical mirror in answer is must.

Q. 4. Write two different uses of concave mirrors. R [Delhi Comptt. 31/1/1 2017]

Ans. It is used in torches, searchlights, headlights of vehicles etc. ½ + ½

Q. 5. We prefer a convex mirror as a rear view mirror in vehicles. Why ? A [Delhi Comptt. 31/1/1 2017]

Ans. Due to its wide field of view. **1**

COMMONLY MADE ERROR

- Candidates get confused between plane, convex and concave mirrors.

ANSWERING TIP

- Candidates should learn that convex mirror forms small, erect and virtual image.

Q. 6. What is the magnification of the images formed by plane mirror and why ? U [Board Term II Delhi Set-I, 2015]

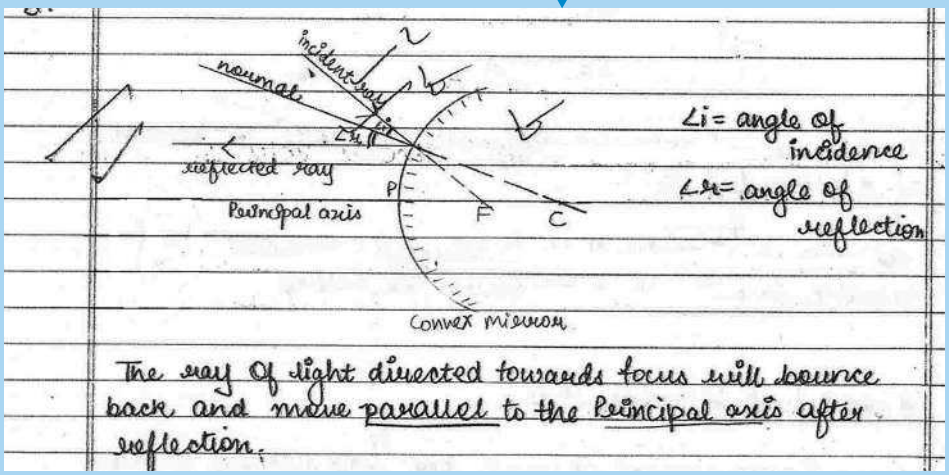
Ans. Its magnification is +1 because plane mirror always forms image equal to object's size. **1**
[CBSE Marking Scheme, 2015]

Short Answer Type Questions-I — 2 marks each

Q. 1. Draw a labelled ray diagram to show the path of the reflected ray corresponding to the ray which is directed towards the principal focus of a convex mirror. Mark the angle of incidence and angle of reflection on it. A [Delhi 2019]

Topper Answer, 2018

Ans.

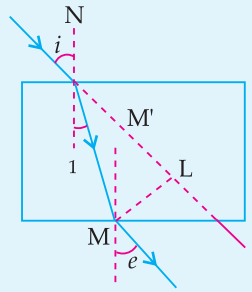


@PROCBSE

Q. 2. Draw the path of a ray of light when it enters one of the faces of a glass slab at an angle of nearly 45°. Label on it (i) angle of refraction, (ii) angle of emergence and (iii) lateral displacement.

A [OD 2019, Set-1]

Ans.



½

Labelling

- Angle or refraction (r_1)
- Angle of emergence (e)
- Lateral displacement (ML) ½×3

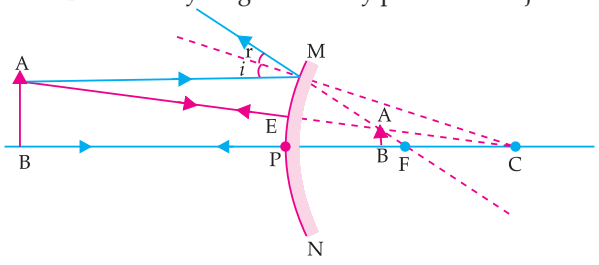
[CBSE Marking Scheme, 2019]

Q. 3. If the image formed by a spherical mirror for all position of the object placed in front of it is always erect and diminished, what type of mirror is it ? Draw a labelled ray diagram to support your answer.

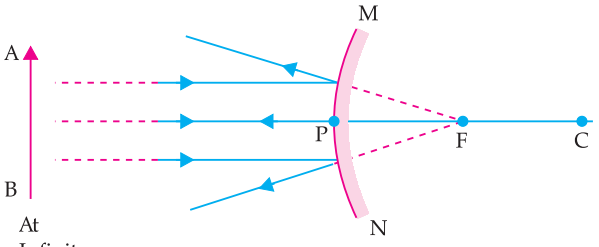
AE [CBSE, Delhi, 2018]

Ans. ● Convex Mirror

● Labelled Ray diagram for any position of object.

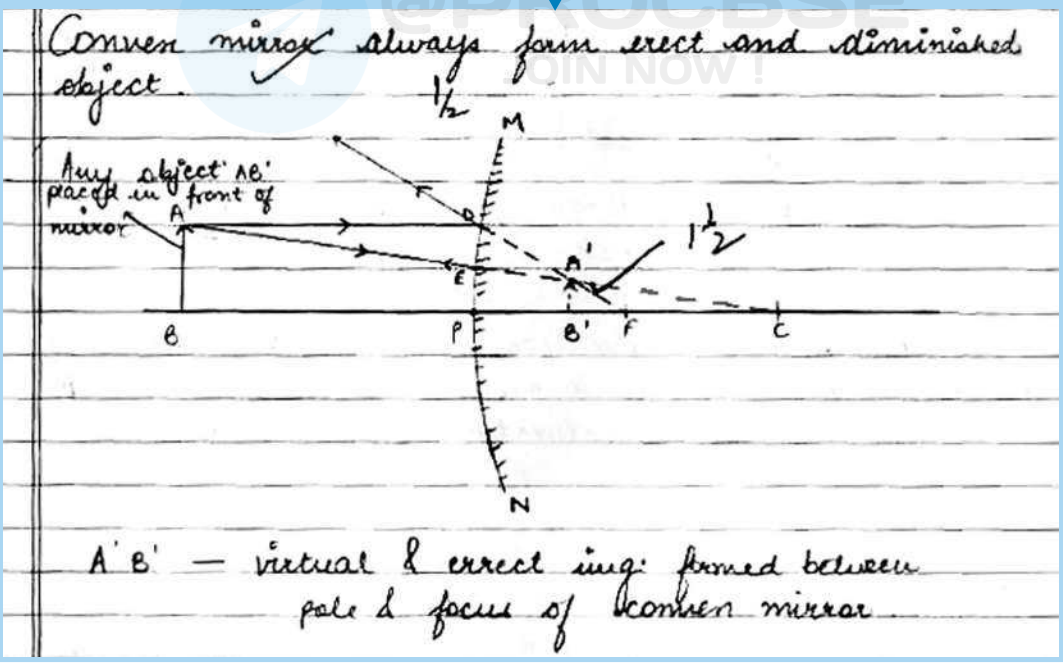


OR



Note: If arrows not marked, ½ mark to be deduced. **1+1=2**

Topper Answer, 2018



Q. 4. An object is placed at a distance of 30 cm in front of a convex mirror of focal length 15 cm. Write four characteristics of the image formed by the mirror.

A [2017,Delhi Set-1]

Ans. Virtual, erect, diminished, laterally inverted. 4×½

[CBSE Marking Scheme, 2017]

Detailed Answer:

Four properties of image formed by the given convex mirror are:

(i) Image is always erect.
(ii) Small in size
(iii) Virtual
(iv) Laterally Inverted.

Q. 5. An object is placed at a distance of 12 cm in front of a concave mirror of radius of curvature 30 cm. List four characteristics of the image formed by the mirror.

U [Delhi 2017, Set-3]

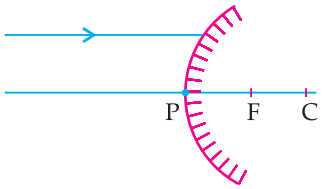
@PROCBSE

Ans. Virtual, erect, magnified, laterally inverted.
[CBSE Marking Scheme, 2017]

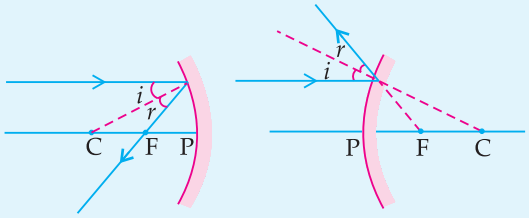
Q. 6. State two positions in which a concave mirror produces a magnified image of a given object. List two differences between the two images.
AE [Delhi 2017]

Ans. Two positions:
(i) between its pole and focus
(ii) between the focus and centre of curvature
Two differences:
(i) the image is virtual and erect
(ii) the image is real and inverted

Q. 7. A ray of light is incident on a convex mirror as shown. Redraw the diagram and complete the path of this ray after reflection from the mirror. Mark angle of incidence and angle of reflection on it.
R [Delhi 2017, Set-2]



Ans.



Tracing the reflected ray **1**
Marking $\angle i$ & $\angle r$ ½ + ½
[CBSE Marking Scheme, 2017]

Q. 8. Name the type of mirrors used in the design of solar furnaces. Explain how high temperature is achieved by this device. [OD Set-1, 2016]

Ans. Concave Mirrors / Converging Mirrors. **1**
When a solar furnace is placed at the focus of a large concave mirror/ reflector it focuses a parallel beam of light on the furnace, consequently a high temperature is achieved after some time. **1**

Q. 9. "The magnification produced by a spherical mirror is – 3". List four information you obtain from this statement about the mirror/image.
R [OD Set-2,2016]

Ans. (i) magnified
(ii) inverted
(iii) concave mirror
(iv) real image.

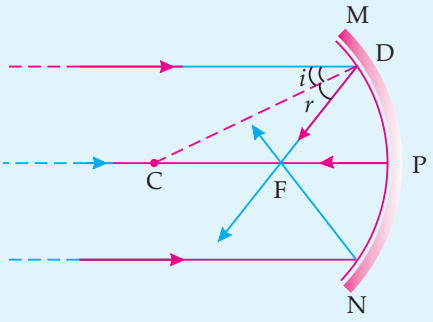
Short Answer Type Questions-II — 3 marks each

Q. 1. A student holding a mirror in his hand, directed the reflecting surface of the mirror towards the Sun. He then directed the reflected light on to a sheet of paper held close to the mirror.
(a) What should he do to burn the paper ?
(b) Which type of mirror does he have ?
(c) Will he be able to determine the approximate value of focal length of this mirror from this activity ? Give reason and draw ray diagram to justify your answer in this case.
A [Board Outside Delhi, Set-I, 2019]

Ans. (a) Move the mirror/paper to focus the rays at one point. ½

(b) Concave mirror. ½

(c) Yes, distance between mirror and the point the sharp focussed image of sun is formed gives approximate focal length. ½ + ½



[CBSE Marking Scheme, 2019] ½ + ½

Detailed Answer:

(a) He should move the sheet of paper back and forth gradually until he finds a bright and sharp spot of lights. He should hold the mirror and paper in the same position for a few minutes to burn the paper.

(b) He has a concave mirror.

(c) Yes, he will be able to determine the approximate value of focal length of this mirror from this activity because the spot of light is the image of the sun which is at the focus of the concave mirror. Therefore, the distance of this image from the position of this mirror gives the approximate value of focal length of this mirror.
Ray diagram: Same as in marking scheme answer.

Q. 2. A 5 cm tall object is placed at a distance of 30 cm from a convex mirror of focal length 15 cm. Find the position, size and nature of the image formed.
A [Comptt. Delhi, 2018]

Ans. $h = +5$ cm; $u = -30$ cm; $f = +15$ cm; $v = ?$

$$\frac{1}{f} = \frac{1}{v} + \frac{1}{u} \quad ½$$

$$\therefore \quad \frac{1}{v} = \frac{1}{f} - \frac{1}{u} = \frac{1}{(+15)} - \frac{1}{(-30)} \quad ½$$

$$= \frac{1}{15} + \frac{1}{30} = \frac{2+1}{30} = \frac{3}{30} = \frac{1}{10}$$

$$\therefore \quad v = +10 \text{ cm} \quad ½$$

@PROCBSE

$$\frac{h_2}{h_1} = -\frac{v}{u}$$

$$\therefore \quad h_2 = -\frac{(+10)}{(-30)} \times (+5) = +\frac{5}{3} = +1.67 \text{ cm}$$ ½

Nature = virtual, erect **1**

[CBSE Marking Scheme, 2018]

Q. 3. An object 4 cm in height, is placed at 15 cm in front of a concave mirror of focal length 10 cm. At what distance from the mirror should a screen be placed to obtain a sharp image of the object. Calculate the height of the image. A **[Delhi 31/1/1 2017]**

Ans. Here, $h_1 = +4$ cm, $f = -10$ cm, $u = -15$ cm, $v = ?$, $h_2 = ?$

$$\frac{1}{f} = \frac{1}{v} + \frac{1}{u}$$ ½

or, $$\frac{1}{v} = \frac{1}{f} - \frac{1}{u}$$

as, $$\frac{1}{v} = \frac{1}{-10 \text{ cm}} - \frac{1}{-15 \text{ cm}}$$ ½

$\therefore \quad v = -30$ cm **1**

$$\frac{h_2}{h_1} = -\frac{v}{u}$$ ½

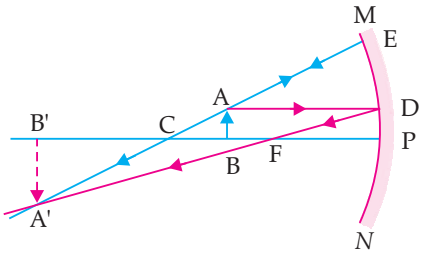
or, $$h_2 = -\frac{v}{u} \times h_1$$

or, $$h_2 = -\frac{-30 \text{ cm}}{-15 \text{ cm}} \times 4 \text{ cm}$$

$\therefore \quad h_2 = -8$ cm ½

[CBSE Marking Scheme, 2017] 1+1+1

Detailed Answer:



Using the mirror formula,

$$\frac{1}{f} = \frac{1}{v} + \frac{1}{u}$$

or, $$\frac{1}{v} + \frac{1}{-15} = \frac{1}{-10}$$

or, $$\frac{1}{v} = \frac{1}{-10} + \frac{1}{15}$$

or, $$\frac{1}{v} = \frac{(-15+10)}{150}$$

or, $$\frac{1}{v} = \frac{-5}{150}$$

$$v = -30 \text{ cm}$$

Thus, to obtain a sharp image of the object the screen should be placed in front of the mirror at a distance of 30 cm from the mirror.

Magnification,

$$m = \frac{-v}{u} = \frac{h_i}{h_o}$$

or, $$m = -\left(\frac{-30}{-15}\right) = -2$$

or, $$-2 = \frac{h_i}{4}$$

$\therefore \quad h_i = -8$ cm

-ve sign indicates image will be inverted

Hence, the height of image will be 8 cm.

Q. 4. The image of a candle flame placed at a distance of 30 cm from a mirror is formed on a screen placed in front of the mirror at a distance of 60 cm from its pole. What is the nature of the mirror ? Find its focal length. If the height of the flame is 2.4 cm, find the height of its image. State whether the image formed is erect or inverted.

A **[Delhi 31/1/3 2017]**

Ans. The nature of the mirror is concave since the image formed is real.

Given, $u = -30$ cm, $v = -60$ cm, $h = 2.4$ cm,

Using mirror formula,

$$\frac{1}{f} = \frac{1}{v} + \frac{1}{u}$$

$$\frac{1}{f} = -\frac{1}{-60} + \frac{1}{-30}$$

$$= -\frac{1}{60} - \frac{1}{30}$$

$$= -\frac{3}{60} = -\frac{1}{20}$$

Therefore; $f = -20$ cm

Magnification, $$m = \frac{v}{u} = -\frac{\text{Height of image}}{\text{Height of object}}$$

$$\frac{v}{u} = -\frac{-60}{-30} = \frac{h'}{2.4}$$

$$h' = \frac{60}{-30} \times 2.4 = -4.8 \text{ cm}$$

The required height of the image is – 4.8 cm

The image formed by the mirror is inverted. **1 + 1 + 1**

COMMONLY MADE ERROR

- Many candidates make lengthy calculations, which are not required. In some cases, incorrect formula is used to find the focal length.

ANSWERING TIP

- First write the formula, then start calculation to avoid confusion. Avoid unnecessary steps and don't have the answer without mentioning unit.

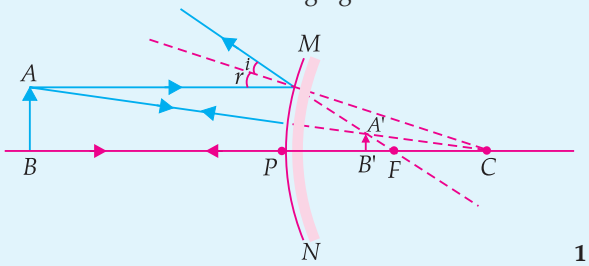
@PROCBSE JOIN NOW !

@PROCBSE

Q. 5. If the image formed by mirror for all positions of the object placed in front of it is always virtual and diminished, state the type of the mirror. Draw a ray diagram in support of your answer. Where are such mirrors commonly used and why ?

A [Board Term II O.D. Set I, 2017]

Ans. Convex mirror or diverging mirror **1**



1

Convex mirrors can be used as rear view mirror in vehicles because they always give erect image with large field of view. 1

[CBSE Marking Scheme, 2016] **1**

Q. 6. Define the magnification as referred to spherical mirrors. If a concave mirror forms a real image 40 cm from the mirror, when the object is placed at a distance of 20 cm from its pole, find the focal length of the mirror.

R [Delhi Comptt. 31/1/1 2017]

Ans. (a) Magnification is the relative extent to which the image of an object is magnified with respect to object size. It is the ratio of size of the image to the size of the object. **1**

(b) $v = -40$ cm, $u = -20$ cm, $f = ?$ ½

$$\frac{1}{f} = \frac{1}{v} + \frac{1}{u} \quad ½$$

$$\frac{1}{f} = \frac{1}{-40} + \frac{1}{-20} \quad ½$$

$$f = \frac{-40}{3}\text{ cm}$$

[CBSE Marking Scheme, 2017]

Q. 7. A 3 cm tall object is placed 18 cm in front of a concave mirror of focal length 12 cm. At what distance from the mirror should a screen be placed to see a sharp image of the object on the screen. Also calculate the height of the image formed.

U [Delhi, 2017,Set-2]

Ans. $h_1 = +3$ cm, $f = -12$ cm, $u = -18$ cm, $v = ?$, $h_2 = ?$

$$\frac{1}{f} = \frac{1}{v} + \frac{1}{u} \quad ½$$

or, $$\frac{1}{v} = \frac{1}{f} - \frac{1}{u} \quad ½$$

or, $$\frac{1}{v} = \frac{1}{-12\text{cm}} - \frac{1}{-18\text{cm}} \quad ½$$

$\therefore$ $$v = -36\text{ cm} \quad ½$$

$$m = \frac{h_2}{h_1} = -\frac{v}{u} \quad ½$$

$\therefore$ $$h_2 = -\frac{v}{u} \times h_1$$

$$= \frac{-36\text{cm}}{-18\text{cm}} = -6\text{ cm} \quad ½$$

[CBSE Marking Scheme, 2017]

Q. 8. The image of an object formed by a mirror is real, inverted and is of magnification – 1. If the image is at a distance of 40 cm from the mirror, where is the object placed ? Where would the image be if the object is moved 20 cm towards the mirror? State reason and also draw ray diagram for the new position of the object to justify your answer.

A [Board Term II O.D. Set I, 2016]

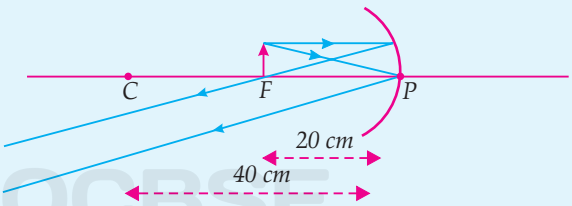
Ans. Object position: At C (Centre of curvature) ½

Object distance = 40 cm, ½

Position of the image - at infinity, ½

Reason: Focal length of the mirror = 20 cm,

If the object is moved 20 cm towards the mirror then its new position would be at the focus of the mirror. ½

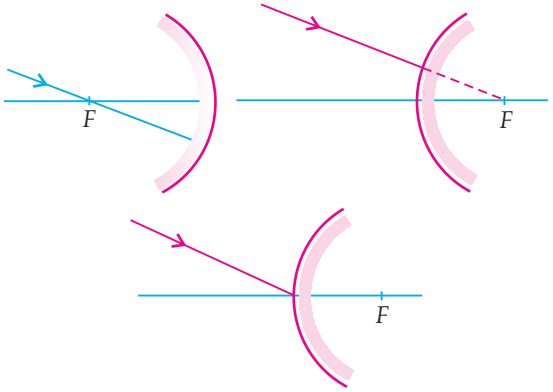


(deduct ½ mark if arrows are missing/not marked) **1**

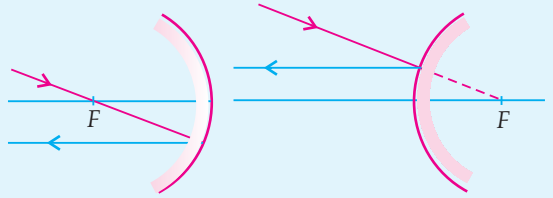
[CBSE Marking Scheme, 2016]

Q. 9. Draw the following diagram, in which a ray of light is incident on a concave/convex mirror, on your answer sheet. Show the path of this ray, after reflection, in each case.

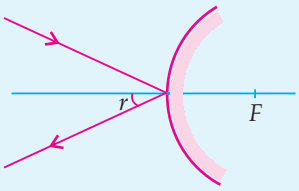
U [Board Term II Delhi Set I, 2016]



Ans.



@PROCBSE



[CBSE Marking Scheme, 2016] 3 × 1 = 3

Q. 10. The image formed by a spherical mirror is real, inverted and is of magnification – 2. If the image is at a distance of 30 cm from the mirror, where is the object placed ? Find the focal length of the mirror. List two characteristics of the image formed if the object is moved 10 cm towards the mirror.

A [OD 2016,Set -3]

Ans. $m = -2$, $\frac{v}{u} = 2$, $v = -30$ cm, u = – 15 **1**

$$f = \frac{uv}{u+v}$$

$$= \frac{-15\text{cm} \times -30\text{ cm}}{-15\text{cm} + (-30)\text{cm}} = \frac{450}{-45}$$

$$= -10\text{ cm}$$ **1**

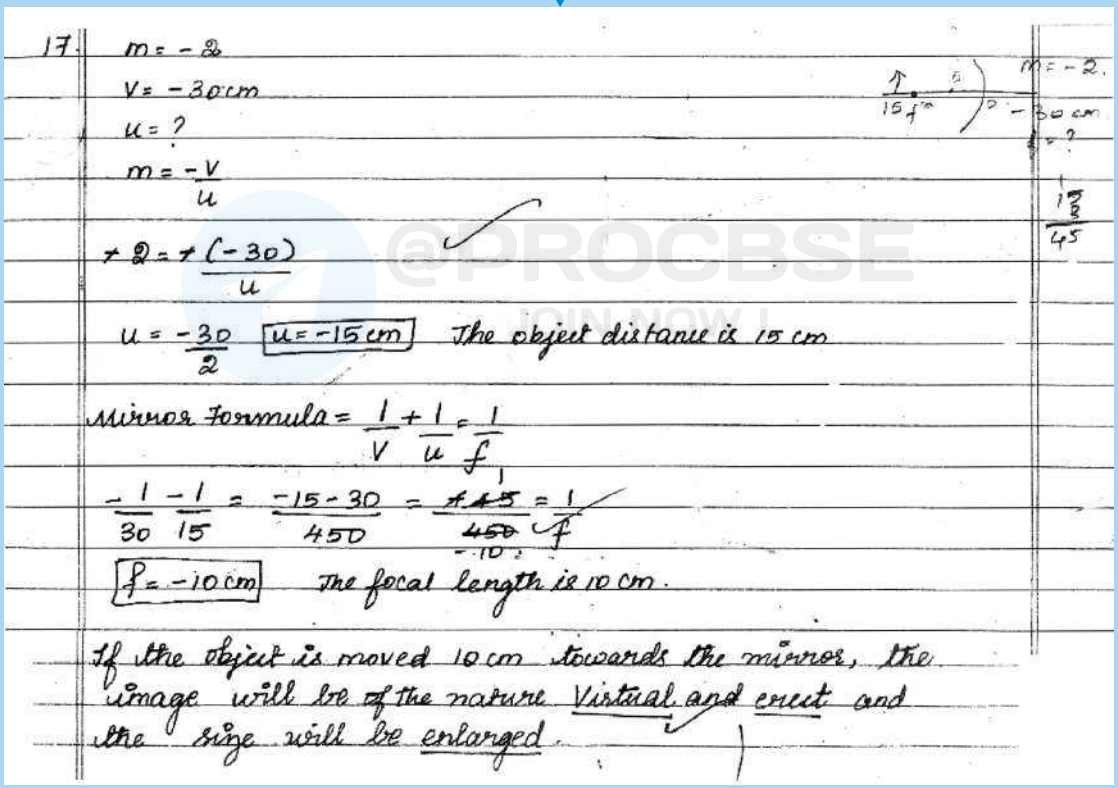
If the object is shifted 10 cm towards the mirror $u = -5$ cm

Therefore the object is between pole and focus and the image formed is

(i) Virtual **(ii)** Erect

(iii) Magnified **(Any two)** ½+½

Topper Answer, 2016



Q. 11. A student wants to project the image of a candle flame on a screen 80 cm in front of a mirror by keeping the candle flame at a distance of 20 cm from its pole.

(i) Which type of mirror should the student use ?

(ii) Find the magnification of the image produced.

(iii) Find the distance between the object and its image.

(iv) Draw a ray diagram to show the image formation in this case and mark the distance between the object and its image.

C [Board Term II Foreign Set I, 2015]

Ans. (i) Concave mirror ½

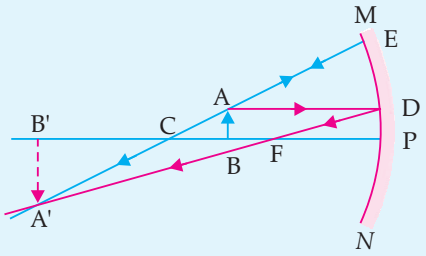
(ii) $u = -20$ cm, $v = -80$ cm and $m = ?$

$$m = \frac{-v}{u} = \frac{-(-80\text{cm})}{(-20\text{ cm})} = -4$$ **1**

(iii) $v - u = -60$ cm ½

@PROCBSE

(iv)



1

In diagram B' to B = 60 cm (distance between object and image)

[CBSE Marking Scheme, 2015]

COMMONLY MADE ERROR

- Mostly errors are found in ray diagrams.

ANSWERING TIP

- Students should carefully do the calculation. Practice drawing the ray diagram with correct labelling.

Q. 12. Draw a ray diagram to show the path of the reflected ray in each of the following cases. A ray of light incident on a convex mirror.

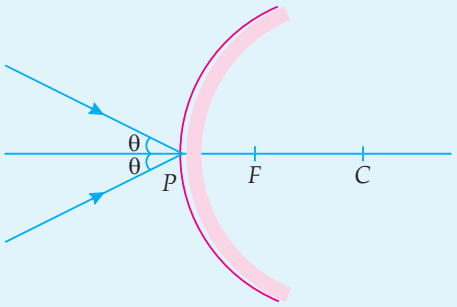
(i) Strikes at its pole making an angle θ from the principal axis.

(ii) Is directed towards its principal focus.

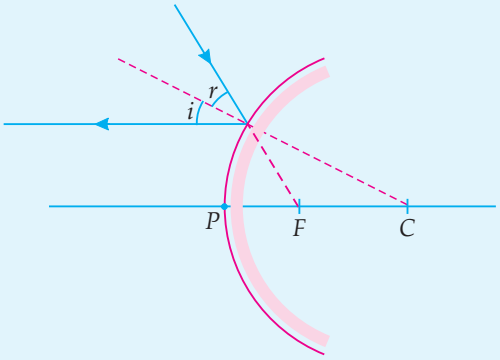
(iii) Is parallel to its principal axis.

C [Board Term II, Foreign Set I, 2015]

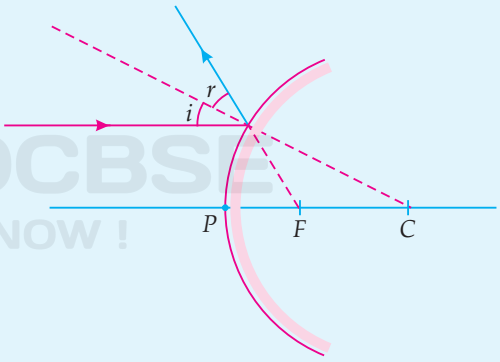
Ans. (i)



(ii)



(iii)



[CBSE Marking Scheme, 2015] 3

@PROCBSE JOIN NOW !

Long Answer Type Questions — 5 marks each

Q. 1. A security mirror used in a big showroom has radius of curvature 5 m. If a customer is standing at a distance of 20 m from the cash counter, find the position, nature and size of the image formed in the security mirror.

(b) Neha visited a dentist in his clinic. She observed that the dentist was holding an instrument fitted with a mirror. State the nature of this mirror and reason for its use in the instrument used by dentist.

[CBSE OD Set-1,2020]

Ans. (a) Given, R = 5 m, $f = \frac{5}{2}$ m, $u = -20$ m and $v = ?$

Hence, on applying the values,

$$\frac{2}{R} = \frac{1}{v} + \frac{1}{u}$$

$$\frac{2}{5} = \frac{1}{v} - \frac{1}{20}$$

or $$\frac{1}{v} = \frac{2}{5} + \frac{1}{20}$$

or $$\frac{1}{v} = \frac{8+1}{20}$$

or $$\frac{1}{v} = \frac{9}{20}$$

or $$v = \frac{20}{9}$$

$\therefore$ $$v = 2.2 \text{ m}$$

Nature of the image: Erect, virtual, small and diminished.

(b) Mirror used by dentist is: Concave mirror.

Reason: It produces enlarged, erect and virtual images of the object, so it is used to see the large image of teeth of patients.

@PROCBSE

Q. 2. A 6 cm tall object is placed perpendicular to the principal axis of a concave mirror of focal length 30 cm. The distance of the object from the mirror is 45 cm. Use mirror formula to determine the position, nature and size of the image formed. Also, draw labelled ray diagram to show the image formation in this case.

A [Board Outside Delhi, Set- III, 2019]

Ans. Given:

$h = 6$ cm

$f = -30$ cm

$u = -45$ cm

By mirror formula,

$$\frac{1}{f} = \frac{1}{v} + \frac{1}{u}$$ ½

$$\frac{1}{v} = \frac{1}{f} - \frac{1}{u}$$

$$= -\frac{1}{30} - \frac{1}{(-45)} = -\frac{1}{30} + \frac{1}{45} = -\frac{1}{90}$$ ½

$v = -90$ cm from the pole of mirror

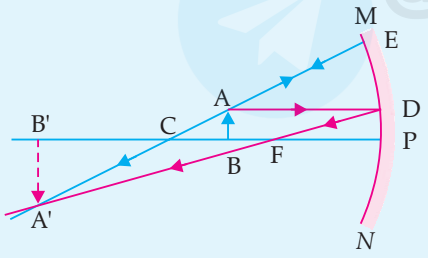
Size of the image

$$m = \frac{-v}{u}$$ ½

$$= -\frac{90}{45} = -2$$

$h' = -2 \times 6$ cm $= -12$ cm ½

Image formed will be real, inverted and enlarged. **1**



2

Well labelled diagram

[CBSE Marking Scheme, 2019]

COMMONLY MADE ERROR

➲ Students sometimes start solving the numerical without writing the formula.

ANSWERING TIP

➲ While solving numerical it is advisable that the formula need to be written in the beginning. Essential steps need to be shown and final answer needs to be expressed along with a proper unit.

Q. 3. (a) To construct a ray diagram we use two rays which are so chosen that it is easy to know their directions after reflection from the mirror. List two such rays and state the path of these rays after reflection in case of concave mirrors. Use these two rays and draw ray diagram to locate the image of an object placed between pole and focus of a concave mirror.

(b) A concave mirror produces three times magnified image on a screen. If the object is placed 20 cm in front of the mirror, how far is the screen from the object?

A [Delhi 31/1/1 2017]

Ans. (a) (i) Listing of any two (out of four) rays and stating their path after reflection from a concave mirror. **1 + 1**

(ii) Ray diagram:

Using these two rays for the ray diagram when the object is in between the pole and the focus of the mirror. **1**

(b) $u = -20$ cm, m $= -3$

$$m = \frac{-v}{u}$$ ½

$$\therefore \quad -3 = -\left(\frac{v}{-20}\right)$$ ½

$v = -3 \times 20 = -60$ cm ½

Distance between the object and the screen is 40 cm

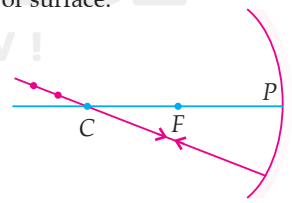
$= -60$ cm $- (-20$ cm$) = -40$ cm ½

[CBSE Marking Scheme, 2017]

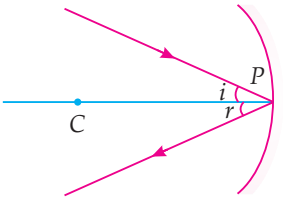
Detailed Answer:

(a) Two light rays whose path of reflection are known are:

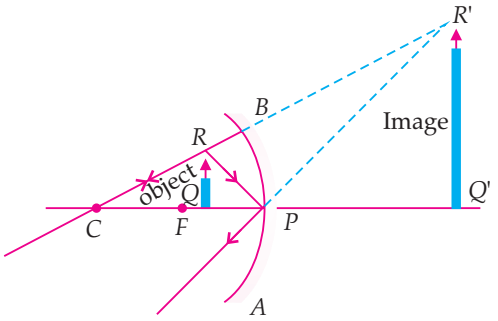
(i) The incident ray passing through the centre of curvature: In this case, light after reflecting from the concave mirror moves back in the same path. This happens because light is incident perpendicular on the mirror surface.



(ii) The ray incident obliquely to the principal axis: In this case, the incident ray will be reflected back by the reflecting surface of the concave mirror obliquely and making equal angle with the principal axis.



Let an object is placed between the focus and pole of the concave mirror. Then using above two rays, image of the candle can be located as shown below:



@PROCBSE

The image is formed behind the mirror. The image is virtual, erect and magnified. **1 + 1 + 1**

(b) Given, $m = -3$, $u = -20$ cm, $v = ?$

As we know,

$$m = -\frac{v}{u}$$

$$-3 = -\left(\frac{v}{-20}\right)$$

$$v = -60 \text{ cm}$$

The screen is placed in front of the mirror at a distance of 60 cm from the pole of the mirror. Thus, the screen is placed 40 cm away from the object. **2**

COMMONLY MADE ERROR

- Sometimes students do not make fully labelled diagram and also arrows are not put on the rays of light.

ANSWERING TIP

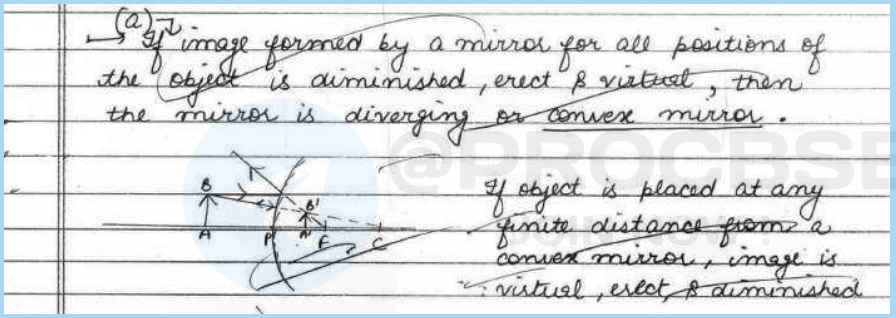
- Draw full labelled diagram and do not forget to put arrows on the rays of light.

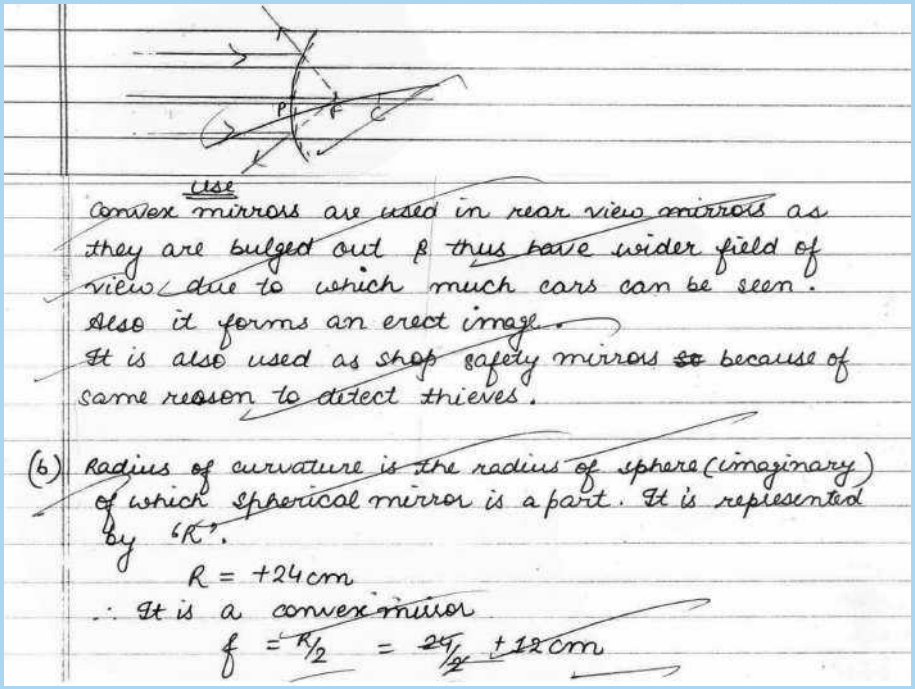
Q. 4. (a) If the image formed by a mirror for all positions of the object placed in front of it is always diminished, erect and virtual state the type of the mirror and also draw a ray diagram to justify your answer. Write one use of such mirrors are put to and why.

(b) Define the radius of curvature of spherical mirrors. Find the nature and focal length of a spherical mirror whose radius of curvature is + 24 cm. AE **[OD 31/1 2017]**

Topper Answer, 2016

Ans.

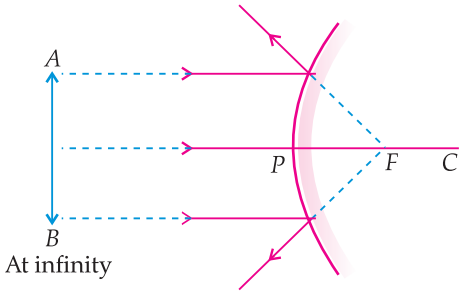




@PROCBSE

Detailed Answer:

(a) A convex mirror forms an erect, diminished and virtual image for all the positions of the object placed in front of it. **1**



Convex mirrors are commonly used as rear-view mirrors in vehicles as they always give an erect, diminished image. **1**

(b) The radius of the sphere of which the reflecting surface of spherical mirror forms a part is called the radius of curvature of the mirror. **1**

$$f = \frac{R}{2}$$

Radius of curvature, $R = 24$ cm

So, $f = \frac{+24}{2} = +12$ cm

Thus, the focal length of a convex spherical mirror is +12 cm. and convex is nature. **2**

Q. 5. (a) Define the following terms in the context of spherical mirrors:

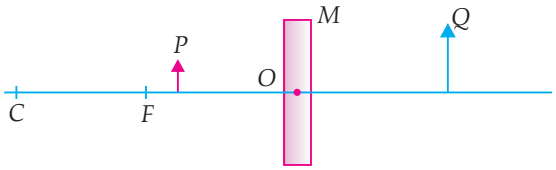
(i) Pole **(ii) Centre of curvature**

(iii) Principal axis **(iv) Principal focus**

(b) Draw ray diagrams to show the principal focus of a:

(i) Concave mirror **(ii) Convex mirror**

(c) Consider the following diagram in which M is a mirror and P is an object and Q is its magnified image formed by the mirror.



State the type of the mirror M and one characteristic property of the image Q.

R [Board Term II Delhi Set I, 2016]

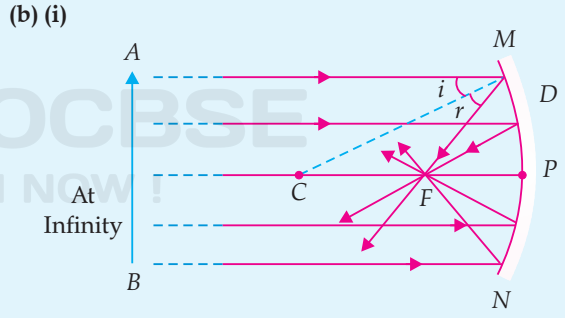
Ans. (a) (i) Pole – Centre of the reflecting surface of the mirror.

(ii) Centre of curvature – The centre of the hollow sphere of which the reflecting surface is a part.

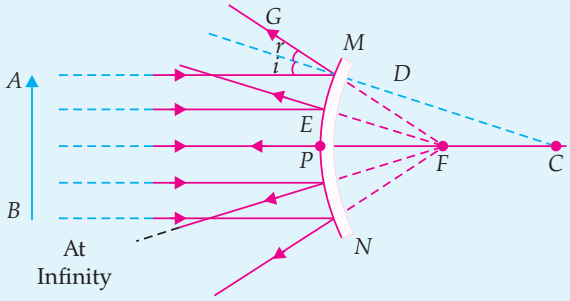
(iii) Principal axis – Straight-line passing through the pole and the centre of curvature of a spherical mirror.

(iv) Principal focus – Incident rays parallel to principal axis, after reflection, either converge or appear to diverge from a fixed point on the principal axis called principal focus of the spherical mirror. **4×½**

(b) (i)



(ii) **1**



1

(c) Concave mirror **½**

Image formed is virtual. **½**

[CBSE Marking Scheme, 2016]

COMMONLY MADE ERROR

- Students mostly commit errors in drawing ray diagrams of convex and concave mirror.

@PROCBSE

ANSWERING TIP

➲ Students should practice ray diagrams of concave mirror and convex mirror. Putting arrows on the rays should be stressed upon.

Q. 6. Suppose you have three concave mirrors A, B and C of focal lengths 10 cm, 15 cm and 20 cm. For each concave mirror, you perform the experiment of image formation for three values of object distances of 10 cm, 20 cm and 30 cm. By giving reason, answer the following:

(i) For the three object distances, identify the mirror/ mirrors which will form an image of magnification – 1.

(ii) Out of the three mirrors identify the mirror which would be preferred to be used for shaving purposes / makeup.

(iii) For the mirror B draw ray diagram for image formation for object distances 10 cm and 20 cm.

C [Board Term II Foreign I, 2016]

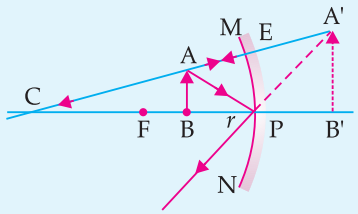
Ans. $f_a = -10$ cm; $f_b = -15$ cm; $f_c = -20$ cm
$u_1 = -10$ cm; $u_2 = -20$ cm; $u_3 = -30$ cm

(i) Mirror A will form image of $m = -1$ for object distance 20 cm since $u_2 = 2f_a$ **3 × ½ = 1½**

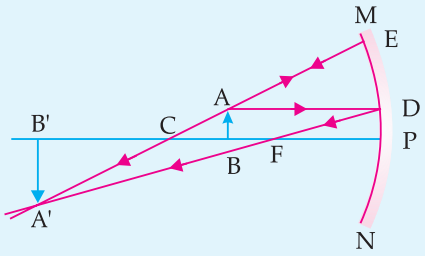
(ii) Mirror B or C - distance should be less than focal length for erect and magnified image, face is generally kept at a distance more than 10 cm.

3 × ½ = 1½

(iii)



1



1

[CBSE Marking Scheme, 2016]

Q. 7. It is desired to obtain an erect image of an object, using concave mirror of focal length of 12 cm.

(i) What should be the range of distance of an object placed in front of the mirror ?

(ii) Will the image be smaller or larger than the object ? Draw ray diagram to show the formation of image in this case.

(iii) Where will the image of this object be, if it is placed 24 cm in front of the mirror ? Draw ray diagram for this situation also to justify your answer.

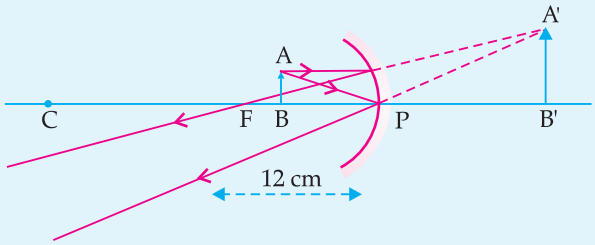
Show the positions of pole, principal focus and the centre of curvature in the above ray diagrams.

U [Board Term II, O.D. Set I, 2016]

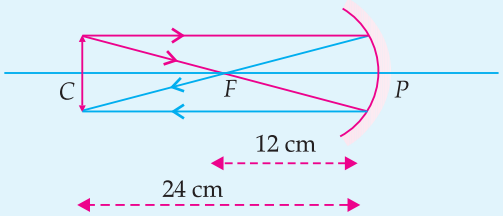
Ans. (i) Range of distance – between 0 cm to 12 cm **1**

(ii) Larger than the object **½**

1½



(iii) Image is also at 24 cm in front of the mirror, **½**



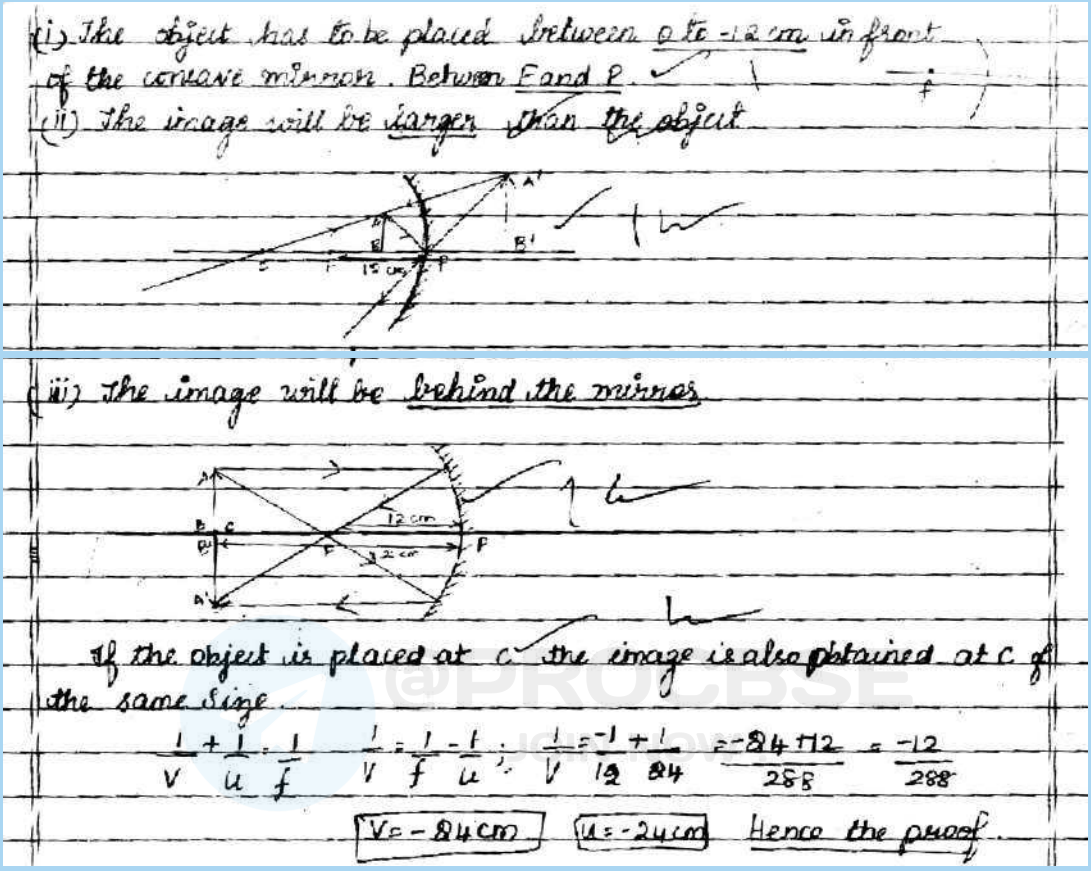
[CBSE Marking Scheme, 2016] **1½**

@PROCBSE JOIN NOW !

@PROCBSE

OR

Topper Answer, 2016



Q. 8. A student has focussed the image of a candle flame on a white screen using a concave mirror. The situation is as given below:

Length of the flame = 1.5 cm

Focal length of the mirror = 12 cm

Distance of flame from the mirror = 18 cm

If the flame is perpendicular to the principal axis of the mirror, then calculate the following:

(i) Distance of the image from the mirror

Length of the image

(ii) If the distance between the mirror and the flame is reduced to 10 cm, then what would be observed on the screen ? Draw ray diagram to justify your answer for this situation.

AE **[Board Term II Foreign Set I, 2015]**

Ans. (i) $h = +1.5$ cm; $f = -12$ cm; $u = -18$ cm; $v = ?$ $h' = ?$

(a) $\frac{1}{f} = \frac{1}{v} + \frac{1}{u}$ ½

or, $\frac{1}{v} = \frac{1}{f} - \frac{1}{u}$

or, $\frac{1}{v} = \frac{1}{(-12)} - \frac{1}{(-18)}$ ½

or, $\frac{1}{v} = \frac{-1}{12} + \frac{1}{18} = \frac{-3+2}{36}$

or, $\frac{1}{v} = \frac{-1}{36}$

$\therefore$ $v = -36$ cm **1**

(b) $h' = -\frac{v}{u} \times h$

$\therefore$ $h' = -\frac{-36\text{cm}}{-18\text{ cm}} \times 1.5 = -3$ cm

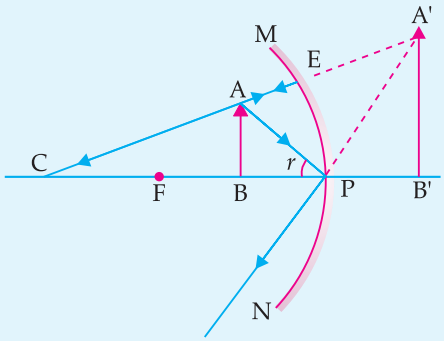
(Magnified inverted image)

@PROCBSE

(ii) Now, $u = -10$ cm **1**

No image would be formed on the screen. In this case, the image formed will be virtual. (Since the object will be between focus & pole) **1**

(iii)



1

[CBSE Marking Scheme, 2015]

TOPIC - 2
Refraction, Lenses and Power of Lens

Revision Notes

- **Laws of refraction:**
  First law: The incident ray, the refracted ray and the normal at the point of incidence all lie in the same plane.
  Second law: The ratio of sine of angle of incidence to the sine of angle of refraction is a constant, for the light of a given color and for the given pair of media. This law is also known as **Snell's law** of refraction.

$$n = \frac{\sin i}{\sin r}$$

- **Refractive index (n):** The ratio of speed of light in a given pair of media,

$$n = \frac{\text{Velocity of light in medium 1}}{\text{Velocity of light in medium 2}}$$

n_{21} means refractive index of second medium with respect to first medium and,

$$n_{21} = \frac{v_1}{v_2}$$

n_{12} means refractive index of first medium with respect to second medium.

$$n_{12} = \frac{v_2}{v_1}$$

Scan to know more about this topic

Refraction of Light

- **Absolute Refractive Index:** Refractive index of a medium with respect to vacuum or air.

$$n = \frac{c}{v} \text{ where, } c = 3 \times 10^8 \text{ ms}^{-1}$$

- Refractive index of one medium is reciprocal of other's refractive index in a given pair.

$$n_{12} = \frac{1}{n_{21}}$$

- If refractive index of medium 1 w.r.t. air is given as ${}_1n^{air}$ and if refractive index of medium 2 w.r.t. air is given as ${}_2n^{air}$, then refractive index of medium 1 w.r.t. medium 2 $= \frac{{}_1n^{air}}{{}_2n^{air}} = {}_1n^2$
- Refractive index of diamond is the highest till date. It is 2.42. It means speed of light is $\frac{1}{2.42}$ times less in diamond than in vacuum.
- **Lens Formula:** $\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$

@PROCBSE JOIN NOW !

@PROCBSE

- **Magnification:** $m = \frac{h_i}{h_o} = \frac{v}{u}$

Scan to know more about this topic

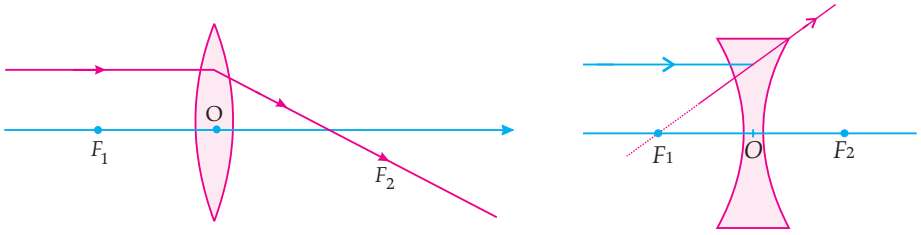
Magnification, power of lens

- **Power of a lens:** It is defined as the reciprocal of focal length in meter.
- The degree of convergence or divergence of light rays is expressed in terms of power.

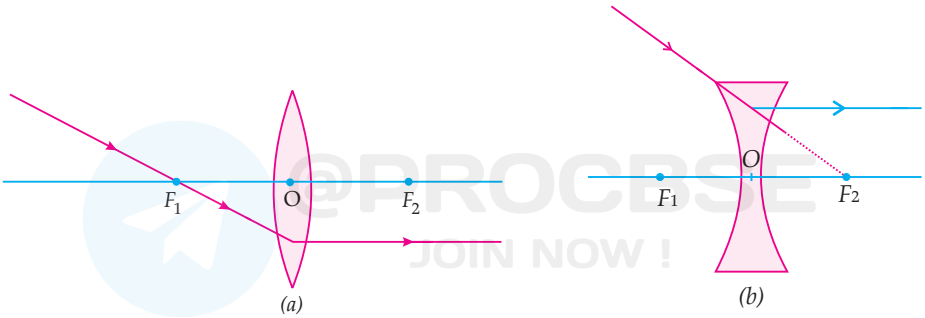
$$\text{Power} = \frac{1}{\text{Focal length (in meter)}} \text{ or } P = \frac{1}{f}$$

- SI unit of Power = dioptre = D, 1 D = 1 m^{-1}
- 1 dioptre is the power of lens whose focal length is one meter.
- **Rules for making ray diagrams by lens:**

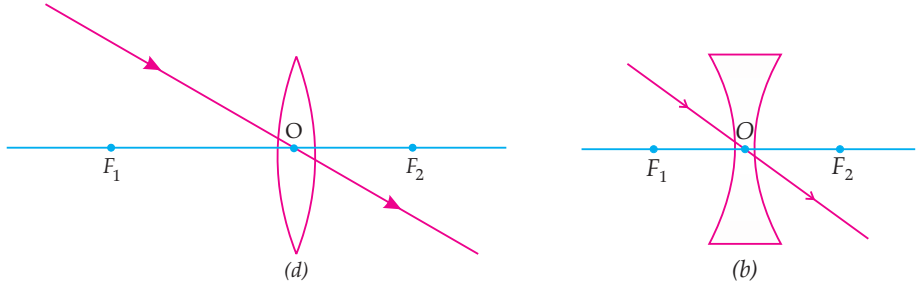
(i) A ray of light from the object parallel to the principal axis passes through the focus after refraction.



(ii) A ray of light passing through a principal focus becomes parallel to the principal axis after refraction.



(iii) A ray of light passing through the optical centre travels undeviated even after refraction.



- **Nature, position and relative size of the image formed by a convex lens for various positions of the object:**

Position of the object	Position of the image	Relative size of the image	Nature of the image
At infinity	At focus F_2	Highly diminished, point-sized	Real and inverted
Beyond $2F_1$	Between F_2 and $2F_2$	Diminished	Real and inverted
At $2F_1$	At $2F_2$	Same size	Real and inverted
Between F_1 and $2F_1$	Beyond $2F_2$	Enlarged	Real and inverted
At focus F_1	At infinity	Infinitely large or highly enlarged	Real and inverted
Between focus F_1 and optical centre	On the same side of the lens as the object	Enlarged	Virtual and erect

@PROCBSE JOIN NOW !

@PROCBSE

➢ **Nature, position and relative size of the image formed by a concave lens for various positions of the object:**

Position of the object	Position of the image	Relative size of the image	Nature of the image
At infinity	At focus F_1	Highly diminished, point-sized	Virtual and erect
Between infinity and optical centre O of the lens	Between focus F_1 and optical centre O	Diminished	Virtual and erect

How is it done on the GREENBOARD?

Q. A 10 cm tall object is placed perpendicular to the principal axis of a convex lens of focal length 12 cm. The distance of the object from the lens is 18 cm. Find the nature, position and size of the image formed.

Solution:

Step I: Given, focal length = f = 12 cm
Object distance = u = – 18 cm
using lens formula

$$\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$$

or, $$\frac{1}{v} = \frac{1}{u} + \frac{1}{f}$$

or, $$\frac{1}{v} = \frac{1}{-18} + \frac{1}{12}$$

or, $$\frac{1}{v} = \frac{1}{36}$$

$\therefore$ v = 36 cm
$\therefore$ Image distance = 36 cm.

Step II: Given, h_0 = 10 cm,
u = – 18 cm
v = 36 cm

$$\text{Magnification} = \frac{v}{u} = \frac{36\text{ cm}}{-18\text{ cm}} = -2$$

(Negative sign indicates that the image is real and inverted)

Again magnification = $\frac{h_i}{h_o}$ = – 2

or, $$\frac{h_i}{10} = -2$$

$\therefore$ h_i = – 20 cm
So, the image size is 20 cm.
It is two times magnified, real and inverted.

Objective Type Questions — 1 mark each

A Multiple Choice Questions

Q. 1. A student obtains a blurred image of a distant object on a screen using a convex lens. To obtain a distinct image on the screen he should move the lens

(a) away from the screen
(b) towards the screen
(c) to a position very far away from the screen
(d) either towards or away from the screen depending upon the position of the object

[CBSE Board, All India Region, 2017]

Ans. Correct option : (d)

Explanation : The incident rays coming from the distant object will be parallel to the principal axis and as we know the rays parallel to the principal axis, after refraction by convex lens, will pass through the principal focus. Hence, a distinct image will be obtained immediately when distance between screen and lens is equal to focal length, so option (d) is correct choice.

Q. 2. A student very cautiously traces the path of a ray through a glass slab for different values of the angle of incidence ($\angle i$). He then measures the corresponding values of the angle of refraction ($\angle r$) and the angle of emergence ($\angle e$) for every value of the angle of incidence. On analyzing these measurements of angles, his conclusion would be

@PROCBSE

(a) $\angle i > \angle r > \angle e$ (b) $\angle i = \angle e > \angle r$
(c) $\angle i < \angle r < \angle e$ (d) $\angle i = \angle e < \angle r$

[CBSE Board, All India Region, 2017]

Ans. Correct option : (b)

Explanation : (Angle of incidence) $\angle i = \angle e$ (angle of emergence) because the direction of incident ray and emergent ray is parallel to each other. $\angle e > \angle r$ (angle of refraction) because at point of emergence light is entering into optically rarer medium (air) from optically denser medium (glass), so light will bend away from the normal making the angle bigger.

Q. 3. An optical device has been given to a student and he determines its focal length by focusing the image of the sun on a screen placed 24 cm from the device on the same side as the sun. Select the correct statement about the device

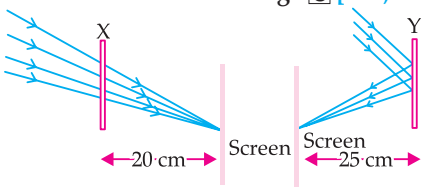
(a) Convex mirror of focal length 12 cm
(b) Convex lens of focal length 24 cm
(c) Concave mirror of focal length 24 cm
(d) Convex lens of focal length 12 cm

[CBSE Board, Foreign Scheme, 2017]

Ans. Correct option : (c)

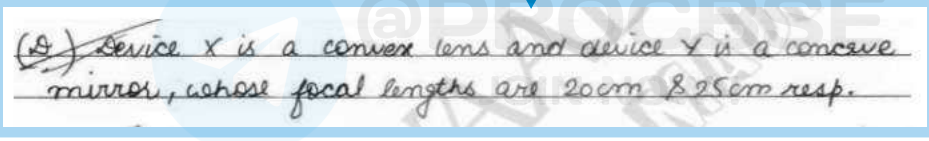
Explanation : Because the screen is on the same side of the object which means it cannot be a lens because it happens behind the lenses in such case. Moreover, concave mirror forms real images, that is, image can be obtained on a screen.

Q. 4. Study the given ray diagrams and select the correct statement from the following: U [OD, Set-1, 2017]



(a) Device X is a concave mirror and device Y is a convex lens, whose focal lengths are 20 cm and 25 cm respectively
(b) Device X is a convex lens and device Y is a concave mirror, whose focal lengths are 20 cm and 25 cm respectively
(c) Device X is a concave lens and device Y is a convex mirror, whose focal lengths are 20 cm and 25 cm respectively
(d) Device X is a convex lens and device Y is a concave mirror, whose focal lengths are 20 cm and 25 cm respectively

Topper Answer, 2017

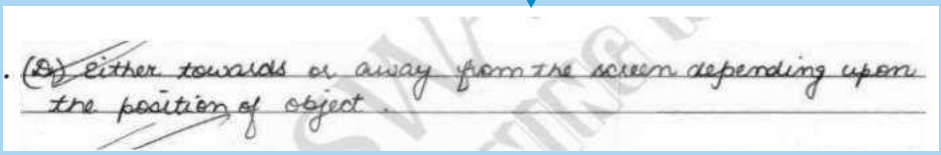

(d) Device X is a convex lens and device Y is a concave mirror, whose focal lengths are 20cm & 25cm resp.

Q. 5. A student obtains a blurred image of a distant object on a screen using a convex lens. To obtain a distinct image on the screen he should move the lens:

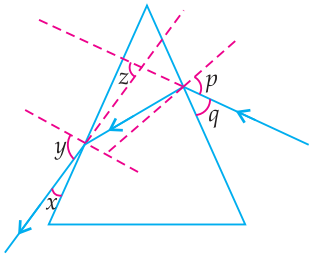
(a) away from the screen
(b) towards the screen
(c) to a position very far away from the screen
(d) either towards or away from the screen depending upon the position of the object.

R [OD, Set-1, 2017]

Topper Answer, 2017


(d) either towards or away from the screen depending upon the position of object

Q. 6. Study the following ray diagram: U [OD, Set-1, 2017]



In this diagram, the angle of incidence, the angle of emergence and the angle of deviation respectively have been represented by:

(a) y, p, z **(b)** x, q, z
(c) p, y, z **(d)** p, z, y

@PROCBSE

Topper Answer, 2017



Q. 7. A teacher sets up the stand carrying a convex lens of focal length 15 cm at 42.7 cm mark on the optical bench. He asks four students *A*, *B*, *C* and *D* to suggest the position of screen on the optical bench so that a distinct image of a distant tree is obtained almost immediately on it. The positions suggested by the students were as :

A. 12.7 cm **B. 29.7 cm**

C. 57.7 cm **D. 72.7 cm**

The correct position of the screen was suggested by

(a) *A* **(b) *B***

(c) *C* **(d) *D***

[CBSE Board, Foreign Scheme, 2016]

Ans. Correct option : (c)

Explanation : The incident rays coming from the distant tree placed will be parallel to the principal axis and as we know the rays parallel to the principal axis, after refraction by convex lens, will pass through the principal focus. Hence, a distinct image will be obtained immediately when distance between screen and lens is equal to focal length.

42.7 cm (position of lens on optical bench) + 15 cm (focal length of lens) = 57.7 (the position of screen on optical bench)

Q. 8. To determine the approximate focal length of the given convex lens by focussing a distant object (say, a sign board), you try to focus the image of the object on a screen. The image you obtain on the screen is always: A **[CBSE,Delhi-2016]**

(a) erect and laterally inverted

(b) erect and diminished

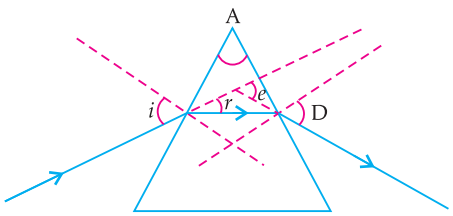
(c) inverted and diminished

(d) virtual, inverted and diminished

Ans. Correct option : (c)

Q. 9. Study the following figure in which a student has marked the angle of incidence (∠*i*), angle of refraction (∠*r*), angle of emergence (∠*e*), angle of prism (∠A) and the angle of deviation (∠D). The correctly marked angles are:

U **[CBSE, Delhi-2016, Set-1]**



(a) ∠A and ∠*i* **(b) ∠A, ∠*i* and ∠*r***

(c) ∠A, ∠*i*, ∠*e* and ∠D **(d) ∠A, ∠*i*, ∠*r* and ∠D**

Ans. Correct option : (a)

Q. 10. Suppose you have focussed on a screen the image of candle flame placed at the farthest end of the laboratory table using a convex lens. If your teacher suggests you to focus the parallel rays of sun, reaching your laboratory table, on the same screen, what you are expected to do is to move the:

(a) lens slightly towards the screen

(b) lens slightly away from the screen

(c) lens slightly towards the sun

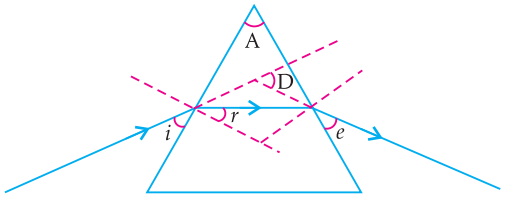
(d) lens and screen both towards the sun

A **[OD set-1, 2016]**

Ans. Correct option : (a)

Explanation : The candle is at the farthest end of the laboratory. So, it may be considered at a distance greater that $2F_1$ and hence the image of formed between F_2 and $2F_2$. when the sun will be focussed, the image will be formed as F_2. So, the lens is to the shifted towards the screen.

Q. 11. In the following ray diagram, the correctly marked angle are: AE **[OD-Set-1, 2016]**



Ans. Correct option : (b)

Q. 12. A spherical mirror and a thin spherical lens have each a focal length of –15 cm. The mirror and the lens are likely to be

(a) both concave.

(b) both convex.

(c) the mirror is concave and the lens is convex.

(d) the mirror is convex, but the lens is concave.

[NCERT Exemp.]

Ans. Correct option : (a)

Explanation : As per the sign convention, the focal length of a concave mirror and a concave lens are taken as negative. Hence, both the spherical mirror and the thin spherical lens are concave in nature.

@PROCBSE

Q. 13. Which of the following lenses would you prefer to use while reading small letters found in a dictionary?

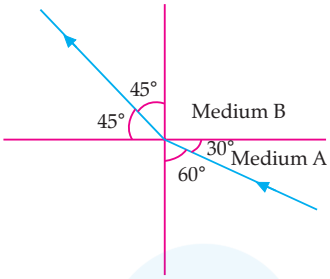
(a) A convex lens of focal length 50 cm
(b) A concave lens of focal length 50 cm
(c) A convex lens of focal length 5 cm
(d) A concave lens of focal length 5 cm

[NCERT Exemp.]

Ans. Correct option (c)

Explanation : A magnified image of an object will be obtained when it is placed between the optical centre and focus of a convex lens. Magnification is also higher for convex lenses having shorter focal length. Therefore, for reading small letters, a convex lens of focal length 5 cm should be used.

Q. 14. Figure shows a ray of light as it travels from medium A to medium B. Refractive index of the medium B relative to medium A is



(a) $\frac{\sqrt{3}}{\sqrt{2}}$ **(b)** $\frac{\sqrt{2}}{\sqrt{3}}$

(c) $\frac{1}{\sqrt{2}}$ **(d)** $\sqrt{2}$

[NCERT Exemp.]

Ans. Correct option : (a)

Explanation : Here, angle of incidence = 60°

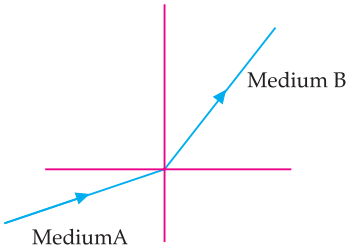
Angle of refraction = r = 45

Refractive index of the medium B relative to medium A

$$= n_{BA} = \frac{\sin i}{\sin r} = \frac{\sin 60°}{\sin 45°}$$

$$= \frac{\frac{\sqrt{3}}{2}}{\left(\frac{1}{\sqrt{2}}\right)} = \frac{\sqrt{3}}{\sqrt{2}}$$

Q. 15. A light ray enters from medium A to medium B as shown in the figure. The refractive index of medium B relative to A will be



(a) Greater than unity **(b) Less than unity**
(c) Equal to unity **(d) Zero**

[NCERT Exemp.]

Ans. Correct option : (a)

Explanation : Since, light rays in medium B go towards normal, so it has greater refractive index and lesser velocity of light with respect to medium A. So refractive index of medium B with respect to medium A is greater than unity.

Q. 16. Which of the following statements is true?

(a) A convex lens has 4 dioptre power having a focal length 0.25 m
(b) A convex lens has – 4 dioptre power having a focal length 0.25 m
(c) A concave lens has 4 dioptre power having a focal length 0.25 m
(d) A concave lens has – 4 dioptre power having a focal length 0.25 m [NCERT Exemp.]

Ans. Correct option : (a)

Explanation : The power (P) of a lens of focal length (f) is given by $P = 1/f$ where f is the focal length meter and power in dioptre.

Now, $P = 1/f$

or, $4 = \frac{1}{f}$

or $f = \frac{1}{4}$ m = 0.25 m.

@PROCBSE JOIN NOW !

B Assertions and Reasons Type Questions

Directions: In the following questions, a statement of assertion (A) is followed by a statement of reason (R). Mark the correct choice as:

(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).
(b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).
(c) Assertion (A) is true but reason (R) is false.
(d) Assertion (A) is false but reason (R) is true.

Q. 1. Assertion (A): If the rays are diverging after emerging from a lens; the lens must be concave.

Reason (R): The ST lens can give diverging rays.

Ans. Correct option : (d)

Explanation : If the rays crossing focal point of convex lens, become diverging.

Q. 2. Assertion (A): Refractive index of glass with respect to air is different for red light and violet light.

Reason (R): Refractive index of a pair of media depends on the wavelength of light used.

Ans. Correct option : (a)

@PROCBSE

Explanation : Refractive index of any pair of media is inversely proportional to wavelength of light.

Hence, $\lambda_v < \lambda_r$

so, $\mu_r < \mu_v$

where, λ_v and λ_r are the wavelengths of violet and red light. μ_v and μ_r are refractive index of violet and red light.

Q. 3. Assertion (A): The refractive index of diamond is $\sqrt{6}$ and refractive index of a liquid is $\sqrt{3}$. If the light travels from diamond to the liquid, it will be initially reflected when the angle of incidence is 30°.

Reason (R): $\mu = \frac{1}{\sin C}$, where μ is the refractive index of diamond with respect to liquid.

Ans. Correct option : (a)

Explanation : Refractive index of diamond *w.r.t.* liquid

$$^{d}\mu_l = \frac{1}{\sin C} = \frac{\mu_d}{\mu_l} \Rightarrow \frac{\sqrt{6}}{\sqrt{3}} = \frac{1}{\sin C}$$

$$\Rightarrow \quad \sin C = \frac{1}{\sqrt{2}} = \sin 45°$$

$$\therefore \quad C = 45°.$$

C Very Short Answer Type Questions

Q. 1. Name the part of a lens through which a ray of light passes without suffering any deviation.

[SQP 2020]

Ans. Optical centre.

[CBSE Marking Scheme, 2020]

Q. 2. What is meant by power of a lens ?

R [Board Term II Delhi Set I, 2015]

Ans. The ability of a lens to converge or diverge the rays of light, is called power of a lens. It is equal to the reciprocal of the focal length (*i.e.*, $P = \frac{1}{f}$).

[CBSE Marking Scheme, 2015] **1**

AI **Q. 3. How does the size of the image change as the object is brought closer from infinity towards the convex lens ?** AE

Ans. The size of the image is formed keeps on increasing as the object is brought closer towards the convex lens. **1**

AI **Q. 4. The refractive index of diamond is 2·42. What is the meaning of this statement ?** U

Ans. The refractive index of diamond 2·42 suggests that the speed of light in diamond will reduce by a factor 2.42 as compared with its speed in air. **1**

AI **Q. 5. Arrange the following common substances in the increasing order of refractive indices, Ice, Kerosene, Glass, Diamond, Alcohol and Water.** AE

Ans. Order of increasing refractive indices:

Ice, Water, Alcohol, Kerosene, Glass, Diamond. **1**

COMMONLY MADE ERROR

➲ Students usually get confused in increasing and decreasing order of refractive index.

ANSWERING TIP

➲ Understand the increasing and decreasing order of refractive indices of common substances.

@PROCBSE JOIN NOW !

Short Answer Type Questions-I — 2 marks each

Q. 1. A teacher gives a convex lens and a concave mirror of focal length of 20 cm each to his student and asks him to find their focal lengths by obtaining the image of a distant object. The student uses a distant tree as the object and obtains its sharp image, one by one, on a screen.

The distances d_1 and d_2 between the lens/ST and the screen in the two cases and the nature of their respective sharp images are likely to be

(a) (20 cm, 40 cm) and (erect and erect)

(b) (20 cm, 40 cm) and (inverted and inverted)

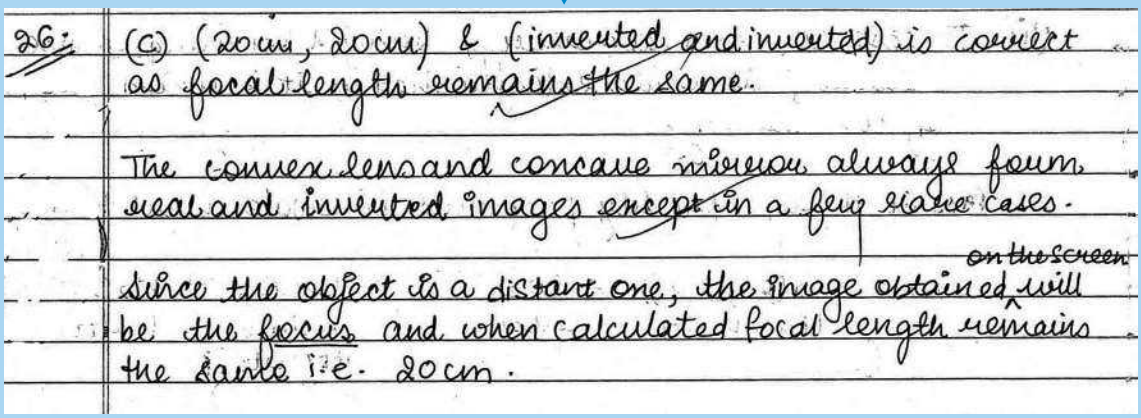
(c) (20 cm, 20 cm) and (inverted and inverted)

(d) (20 cm, 40 cm) and (erect and inverted)

Give reason for your answer. A [Delhi 2019]

@PROCBSE

Topper Answer, 2019



Q. 2. List four precautions which a student should observe while determining the focal length of a given convex lens by obtaining image of a distant object on a screen. R [Delhi 2019]

Ans. Precautions:

(1) Lens should be held in vertical position with its faces parallel to the screen.

(2) Clear and sharpest image should be obtained by adjusting the position of lens.

(3) Three observations should be taken at least.

(4) Base of lens, screen and measuring scale should be in straight line. **(or any other)**

[CBSE Marking Scheme, 2019] ½×4 = 2

Q. 3. The absolute refractive index of Ruby is 1.7. Find the speed of light in Ruby. The speed of light in vacuum is 3×10^8m/s. C [OD, 2019, Set-1]

Ans. $\mu = \dfrac{\text{Speed of light in vacuum}}{\text{Speed of lught in Ruby}} = \dfrac{c}{v}$ ½

$v = \dfrac{c}{\mu}$

Where, c = velocity of light in vacuum

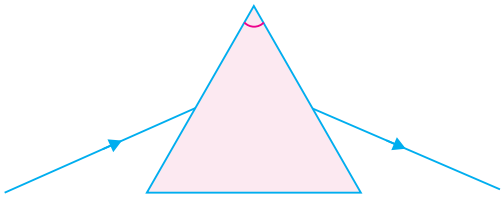
μ = refractive of light

$v = \dfrac{3\times10^8}{1.7} = 17.76 \times 10^8$ m/s ½×4 = 2

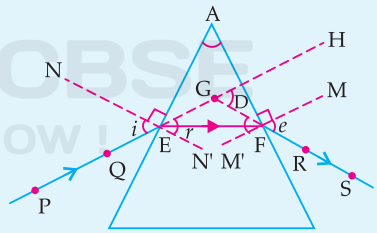
[CBSE Marking Scheme, 2019]

Q. 4. A student traces the path of a ray of light through a glass prism as shown in the diagram but leaves it incomplete and unlabelled. Redraw and complete the diagram. Also label on it $\angle i$, $\angle e$, $\angle r$ and $\angle D$.

AE [OD-2019, Set-1]



Ans.



Labelling of $\angle i$, $\angle e$, $\angle r$ & $\angle D$

[CBSE Marking Scheme, 2019] ½×4 = 2

Q. 5. The power of a lens is +5 dioptres. What is the nature and focal length of this lens? At what distance from this lens should an object be placed so as to get its inverted image of the same size ?

C [OD,Set-2, 2019]

Ans. P = +5D

f = 1/P = 100 /5 = 20cm

Nature of lens = convex (converging)

Distance is 40 cm (at C)

[CBSE Marking Scheme, 2019] ½×4 = 2

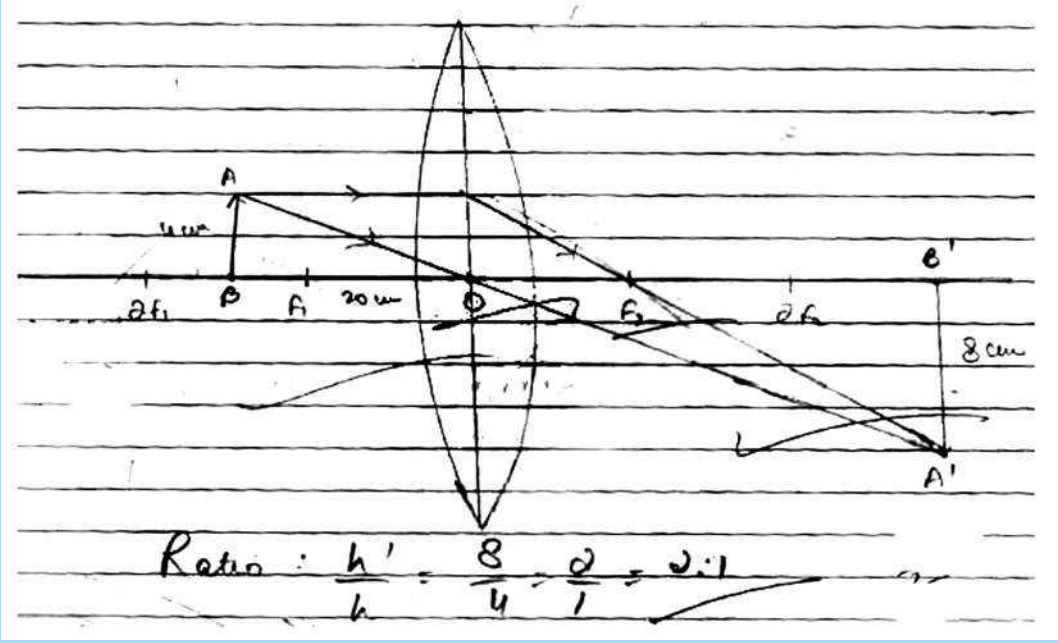
Q. 6. An object of height 4.0 cm is placed at a distance of 30 cm from the optical centre 'O' of a convex lens of focal length 20 cm. Draw a ray diagram to find the position and size of the image formed. Mark optical centre 'O' and principal focus 'F' on the diagram. Also find the approximate ratio of size of the image to the size of the object.

C [2018, Toppers answer]

@PROCBSE JOIN NOW !

@PROCBSE

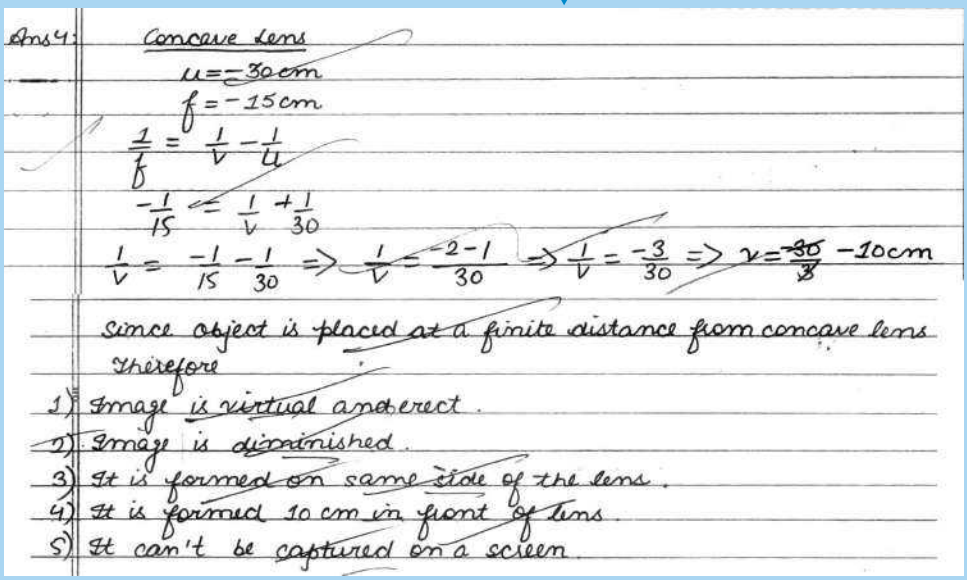
Topper Answer, 2018



Q. 7. An object is placed at a distance of 30 cm from a concave lens of focal length 15 cm. List four characteristics (nature, position, etc.) of the image formed by the lens. R **[Outside Delhi, 2017, set 1]**

Ans. (a) Virtual
(b) Erect
(c) Diminished
(d) On the same side as the object / or any other characteristic. **[CBSE Marking Scheme, 2017]**

Topper Answer, 2017



Q. 8. The refractive indices of glass and water with respect to air are 3/2 and 4/3 respectively. If speed of light in glass is 2×10^8 m/s, find the speed of light in water. C **[OD 2016,Set -3]**

Ans. Refractive index of a medium

$$= \frac{\text{Speed of light in air}}{\text{Speed of light in the medium}}$$

@PROCBSE

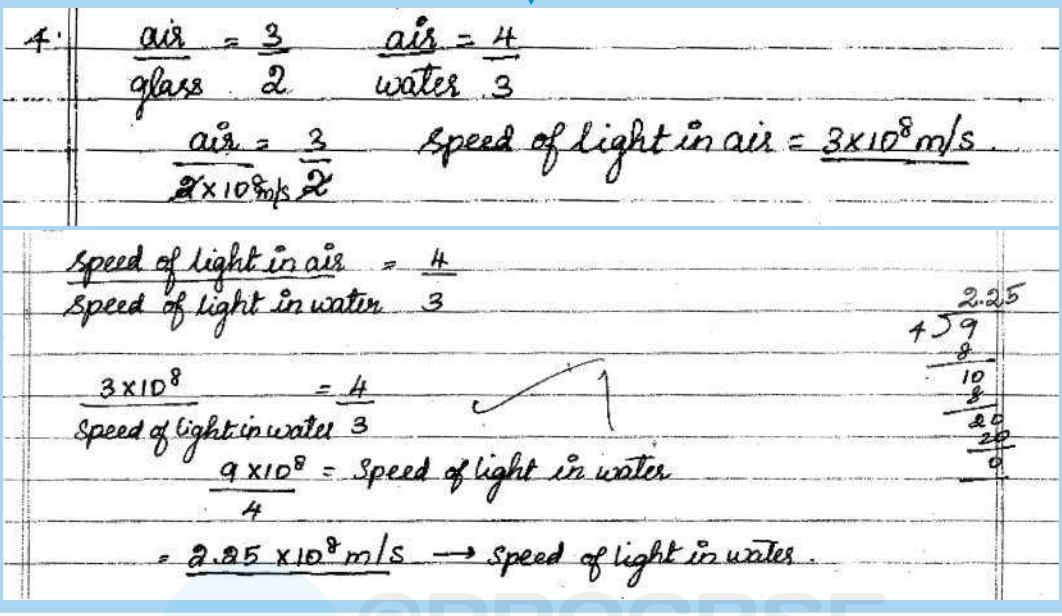
$$\frac{3}{2} = \frac{\text{Speed of light in air}}{2\times10^8 \text{ m/s}}$$ **1**

Speed of light in air = 3×10^8 m/s

Speed of light in water

$$= \frac{3\times10^8 \text{ m/s}}{4/3} = 2.25 \times 10^8 \text{ m/s}$$ **1**

Topper Answer, 2016



Short Answer Type Questions-II — 3 marks each

Q. 1. Refractive index of water with respect to air is 1.33 and that of diamond is 2.42.

(i) In which medium does the light move faster, water or diamond?

(ii) What is the refractive index of diamond with respect to water? C [SQP-2020]

Ans. Refractive index = speed of light in vaccum/speed of light in medium.

Since the refractive index of diamond is more, hence the speed of light is lesser in diamond.

Let speed of light in water v_w and in diamond be v_d.

Refractive index of diamond w.r.t. water is say n = Speed of light in water/speed of light in diamond.

$$n = v_w/v_d$$

Dividing both numerator and denominator by speed of light (c) we get

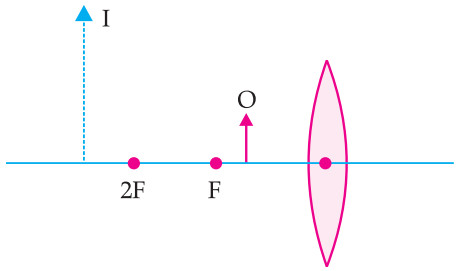
$$n = \frac{v_{w/c}}{v_{d/c}}$$

$\therefore n = 2.42/1.33 = 1.82$ (approx.)

[CBSE Marking Scheme, 2020]

Q. 2. The diagram given below shows an object O and its image I.

Without actually drawing the ray diagram state the following:



(i) Type of lens (Converging / Diverging)

(ii) Name two optical instruments where such an image is obtained.

(iii) List three characteristic of the image formed if this lens is replaced by a concave mirror of focal length f and an object is placed at a distance *f*/2 in front of the mirror. AE [CBSE, OD Set-1, 2020]

Ans. (i) Converging lens ½

(ii) Microscope and Telescope **1**

(iii) Characteristic of the image formed are: **1½**

(a) Virtual image

(b) Magnified image

(c) Image behind the mirror

@PROCBSE

Q. 3. (a) Water has refractive index 1.33 and alcohol has refractive index 1.36. Which of the two medium is optically denser ? Give reason for your answer.

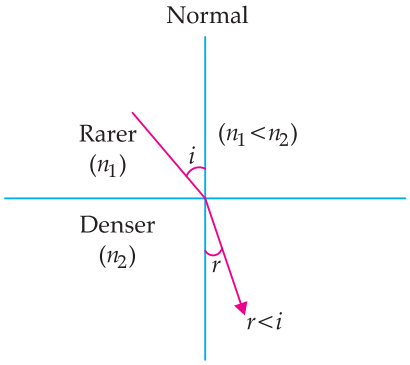
(b) Draw a ray diagram to show the path of a ray of light passing obliquely from water to alcohol.

(c) State the relationship between angle of incidence and angle of refraction in the above case.

C **[OD 2020,Set 2]**

Ans. (a) Refractive index of alcohol > refractive index of water. So, alcohol is optically denser than water.

(b) When a ray of light enters from water to alcohol, it bends towards the normal.



(c) Angle of incidence is greater than angle of refraction.

AI **Q. 4. A 10 cm tall object is placed perpendicular to the principal axis of a convex lens of focal length 12 cm. The distance of the object from the lens is 18 cm. Find the nature, position and size of the image formed.** A **[Board Outside Delhi, Set-I, 2019]**

Ans. $\frac{1}{v}-\frac{1}{u}=\frac{1}{f} \therefore \frac{1}{v}=\frac{1}{f}+\frac{1}{u}$ ½

$\frac{1}{v}=\frac{1}{12}+\frac{1}{(-18)}$ **1**

$\therefore \quad v = 36$ cm ½

$m=\frac{v}{u}=\frac{h'}{h}$

$\Rightarrow \quad \therefore \quad m=\frac{36}{-18}=\frac{h'}{10}$ ½

$\Rightarrow \quad h' = -20$ cm (size of the image) ½

Nature of image : Real and inverted

[CBSE Marking Scheme, 2019]

Detailed Answer :

Given, object size, $h = +10$ cm ; focal length, $f = +12$ cm (f is positive for a convex lens); object distance, $u = -18$ cm

Using lens formula,

$$\frac{1}{v}-\frac{1}{u}=\frac{1}{f}$$

$$\frac{1}{v}=\frac{1}{u}+\frac{1}{f}$$

$$=\frac{1}{-18}+\frac{1}{12}=\frac{-2+3}{36}$$

$$\frac{1}{v}=\frac{1}{36}$$

Therefore, $v = 36$ cm → Image distance

Magnification, $m=\frac{h'}{h}=\frac{v}{u}$

Therefore, $m=\frac{36\,\text{cm}}{-18\,\text{cm}}=-2$

So, image size $h' = \frac{v\times h}{u}$

$$=\frac{36\times 10}{(-18)}=20$$

That image is 36 cm on right side of lens. So, the image is real.

Negative sign of h' signifies that the image is inverted. The image is two times enlarged in size than the object.

Q. 5. State the laws of refraction of light. Explain the term 'absolute refraction index of a medium' and write an expression to relate it with the speed of light in vacuum. U **[CBSE Delhi/OD, 2018]**

Ans. 1st law: The incident ray, refracted ray and normal to the interface at the point of incidence lie in the same plane.

2nd law: The sine of angle of incidence bears a constant ratio with sine of angle of refraction for a given pair of media.

$\frac{\sin i}{\sin r}$ = constant

Absolute refractive index of a medium,

$$=\frac{\text{speed of light in air } (c) \text{ or vacuum}}{\text{speed of light in medium } (v)}$$

(Award full marks if the same thing is given in the form of statement) **1 + 1 + 1**

[CBSE Marking Scheme, 2018]

Q. 6. What is meant by power of a lens ? Write the SI unit. A student uses a lens of focal length 40 cm and another of – 20 cm. Write the nature and power of each lens. U **[CBSE Delhi/OD, 2018]**

Ans. Power of lens = Ability to converge/diverge light rays passing through it/ reciprocal of the focal length in meters $\frac{1}{f}$ (in meters),

SI unit of power is Dioptre

Power of 1st lens $P_1 = \frac{100}{f}=\frac{100}{40\text{ cm}} = +2.5\text{D}$

Nature: Converging lens/Convex lens,

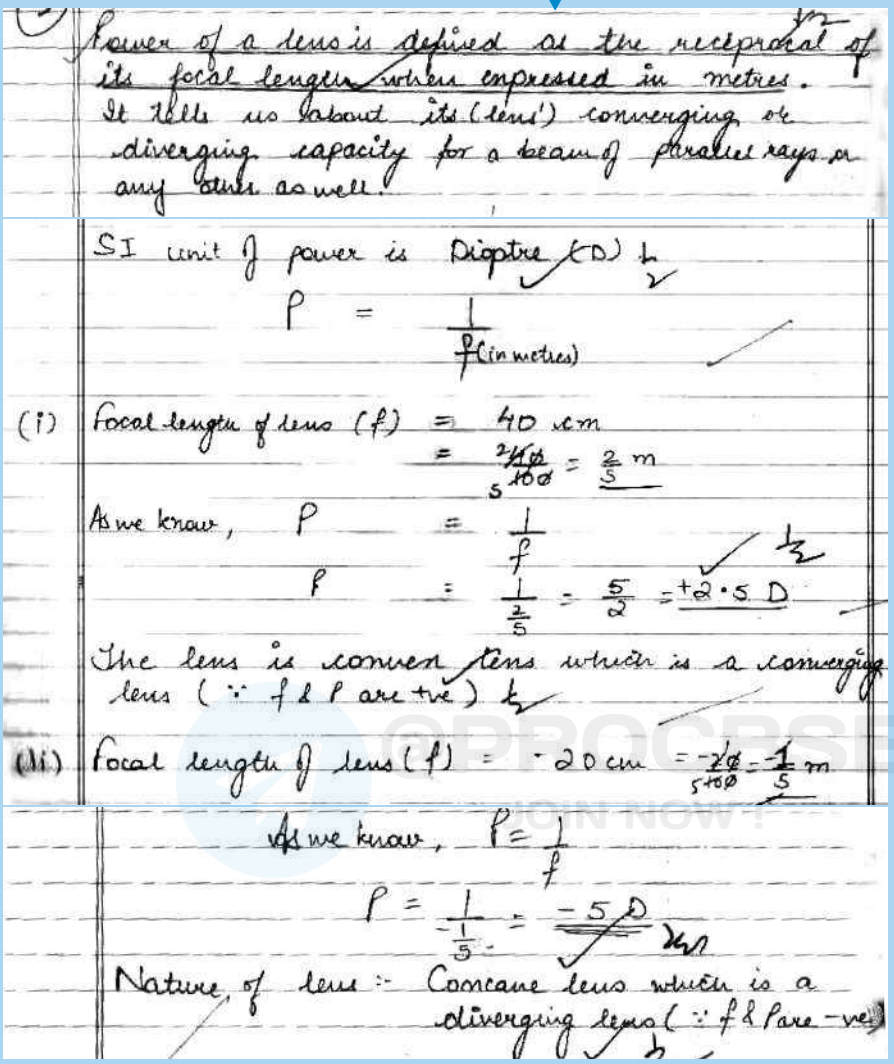
Power of 2nd lens $P_2 = \frac{100}{f}=\frac{100}{-20\text{ cm}} = -5\text{D}$

Nature: Diverging lens / Concave lens **1 + 1 + 1**

[CBSE Marking Scheme, 2018]

@PROCBSE

Topper Answer, 2017


Power of a lens is defined as the reciprocal of its focal length when expressed in metres. It tells us about its (lens') converging or diverging capacity for a beam of parallel rays or any other as well.

SI unit of power is Dioptre (D) ½

$P = \frac{1}{f \text{ (in metres)}}$

(i) Focal length of lens (f) = 40 cm = $\frac{40}{100} = \frac{2}{5}$ m

As we know, $P = \frac{1}{f}$ ½

$P = \frac{1}{\frac{2}{5}} = \frac{5}{2} = +2.5$ D

The lens is convex lens which is a converging lens (∵ f & P are +ve) ½

(ii) Focal length of lens (f) = −20 cm = $\frac{-20}{100} = -\frac{1}{5}$ m

As we know, $P = \frac{1}{f}$

$P = \frac{1}{-\frac{1}{5}} = -5$ D ½

Nature of lens :- Concave lens which is a diverging lens (∵ f & P are −ve) ½

Q. 7. State the laws of refraction of light. If the speed of light in vacuum is 3×10^8 m/s, find the absolute refractive index of a medium in which light travels with a speed of 1.4×10^8 m/s.

A [Board Term II, Outside Delhi Set I, III, 2015] [DDE, 2017]

Ans. (i) Two laws of refraction:

Try yourself. Refer Q.No. 4 of Short Answer Type Question-II.

(ii) Given $c = 3 \times 10^8$ m/s

$v = 1.4 \times 10^8$ m/s

Absolute refractive index

$= \frac{\text{Speed of light in vacuum}}{\text{Speed of light in medium}}$ ½

$= \frac{3 \times 10^8 \text{ m/s}}{1.4 \times 10^8 \text{ m/s}} = 2.14$ ½

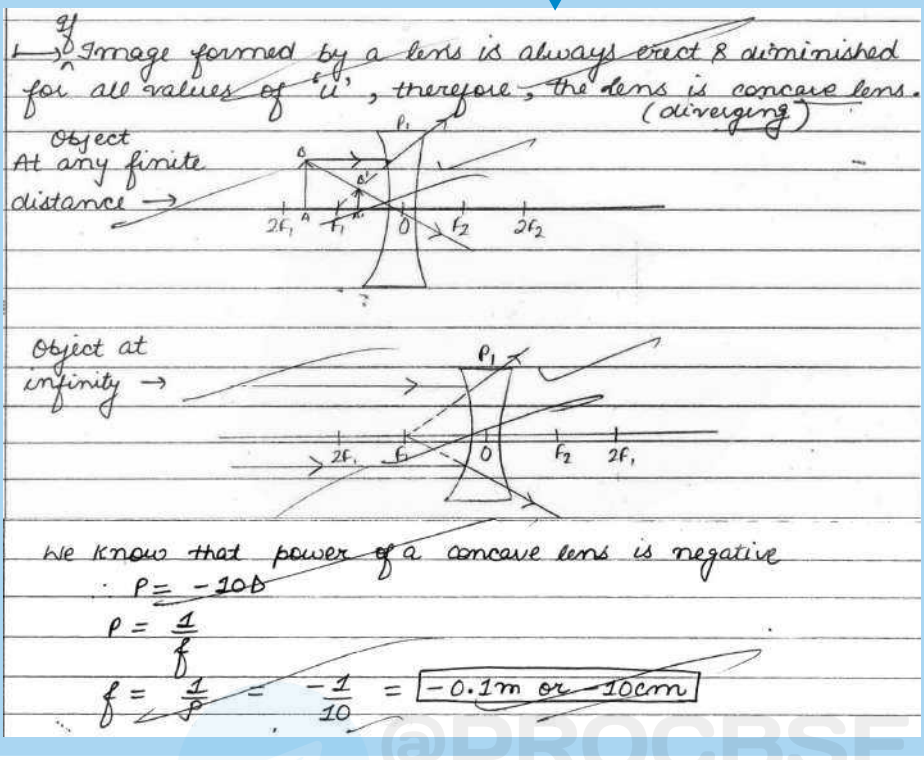
[CBSE Marking Scheme, 2015]

Q. 8. If the image formed by a lens for all positions of an object placed in front of it is always erect and diminished, what is the nature of this lens ? Draw a ray diagram to justify your answer. If the numerical value of the power of this lens of 10 D, what is its focal length in the Cartesian system ? AE [OD 31/1 2017]

@PROCBSE

Topper Answer, 2017

Ans.



COMMONLY MADE ERROR

- Students often forget to convert focal length to meter while finding out the power.

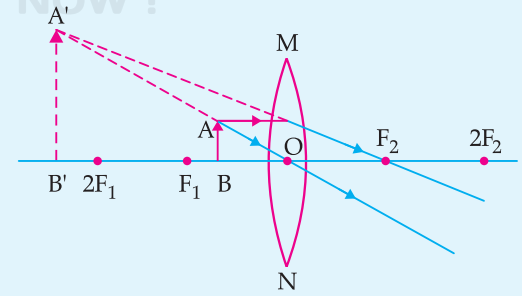
ANSWERING TIP

- Always convert focal length to meter for power calculation and use proper sign i.e. 'f' for convex lens and '–' concave lens.

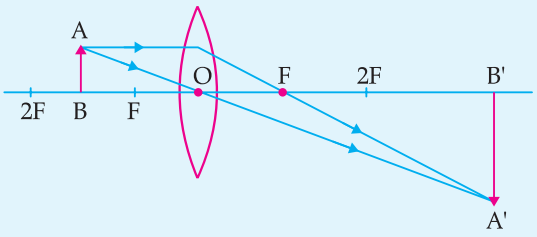
Q. 9. "A lens can form a magnified erect image as well as magnified inverted image of an object placed in front of it." State the nature of this lens and draw ray diagrams to justify the above statement. Mark the positions of O, F and 2F in the diagram.

U [CBSE, Marking Scheme, 2017]

Ans.



1



1

Labelling O, F and 2F. ½

Types of lens : Convex/Converging. ½

[CBSE Marking Scheme, 2017]

Q. 10. An object of height 5 cm is placed perpendicular to the principal axis of a concave lens of focal length 10 cm. If the distance of the object from the optical centre of the lens is 20 cm, determine the position,

@PROCBSE JOIN NOW !

@PROCBSE

nature and size of the image formed using the lens formula. A [Board Term II O.D. III, 2015]

Ans. $f = -10$ cm, $u = -20$ cm, $v = ?$

Using, $\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$, we get

or, $\frac{1}{v} = \frac{1}{f} + \frac{1}{u}$

or, $\frac{1}{v} = \frac{1}{-10} + \frac{1}{(-20)}$

or, $\frac{1}{v} = \frac{-2-1}{20} = -\left(\frac{3}{20}\right)$

$\therefore \quad v = \frac{-20}{3}$ cm

$m = \frac{h_i}{h_0} = -\frac{v}{u}$

$= h_1 = -\frac{v}{u} \times h_0$

$= -\frac{-20}{3 \times 20} \times -5$

$= \frac{5}{3} = 1.6$ cm

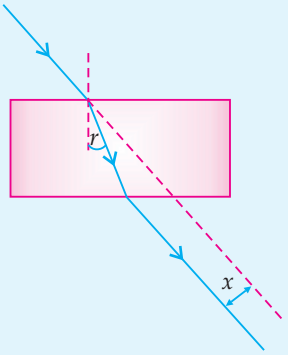
Image is virtual and diminished. 3

[CBSE Marking Scheme, 2015]

Q. 11. (i) Draw a ray diagram to show the refraction of light through a glass slab and mark angle of refraction and the lateral shift suffered by the ray of light while passing through the slab. U

(ii) If the refractive index of glass for light going from air to glass is 3/2, find the refractive index of air for light going from glass to air. [Delhi Set III, 2016]

Ans. (i)



1

Marking $\angle r$ and x ½+½

(ii) $_an_g = \frac{3}{2}$

$\therefore \quad _gn_a = \frac{1}{_an_g} = \frac{1}{3/2} = \frac{2}{3}$

Alternately, $\frac{c_{air}}{c_{glass}} = \frac{3}{2}$

$\therefore \quad \frac{c_{glass}}{c_{air}} = \frac{2}{3}$ 1

[CBSE Marking Scheme, 2016]

Q. 12. If the image formed by a lens for all positions of the object placed in front of it is always virtual, erect and diminished, state the type of the lens. Draw a ray diagram in support of your answer. If the numerical value of focal length of such a lens is 20 cm, find its power in new cartesian sign conventions. A [Board Term II Foreign Set I, 2016]

Ans. Try yourself. Refer Question No. 8 of Short Answer Type Qustion-II.

Focal length = −20 cm (lens is concave, hence f is – *ve*) ½

Power = P

or, $P = \frac{1}{f}$

or, $P = -\frac{100}{20}$ cm

$\therefore \quad = -5$D ½ + ½

[CBSE Marking Scheme, 2016]

Q. 13. What is meant by power of a lens ? What does its sign (+ve or –ve) indicate ? State its S.I. unit. How is this unit related to focal length of a lens ? A [2016, Delhi Set-3]

Ans. Ability of lens to converge or diverge the light rays. ½

+ve sign → converging lens/ convex lens

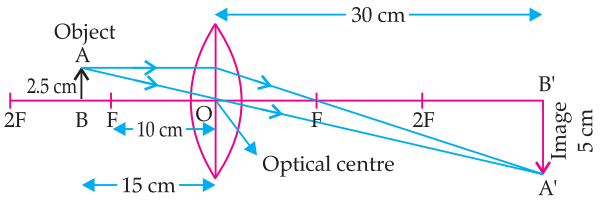
− ve sign → diverging lens/ concave lens

S.I. unit is dioptre ½

1 dioptre = 1/ focal length (m)

Q. 14. An object of height 2.5 cm is placed at a distance of 15 cm from the optical centre 'O' of a convex lens of focal length 10 cm. Draw a ray diagram to find the position and size of the image formed. Mark optical centre 'O', principal focus F and height of the image on the diagram. R [OD, Set -2,2016]

Ans.



Size of the image formed is 5 cm beyond 2F.

Q. 15. The image of an object formed by a lens is of magnification – 1. If the distance between the object and its image is 60 m, what is the focal length of the lens ? If the object is moved 20 cm towards

@PROCBSE JOIN NOW !

@PROCBSE

the lens, where would the image be formed ? State reason and also draw a ray diagram in support of your answer. [OD Set -2, 2016]

Ans. Image with magnification –1 means image is inverted and of the same size.

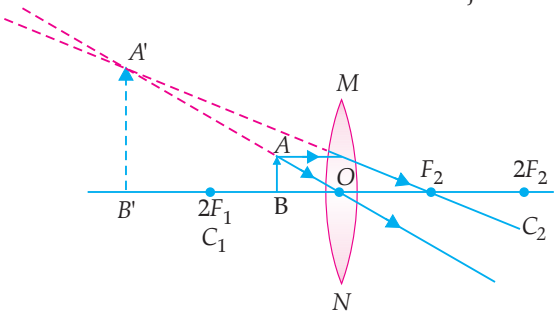
Therefore, object is at 2F and the image is also at 2F on the other side of the lens.

Therefore, distance between the object and its image is $4f = 60$ cm **1**

$\therefore \quad f = 15$ cm ½

Object distance $2f = 30$ cm, if the object is shifted towards the lens by 20 cm, the new object distance $= 30 \text{ cm} - 20 \text{ cm} = 10$ cm. ½

This distance is less than the focal length, and the image formed in this case would be virtual, erect and will form on the same side as the object. **1**

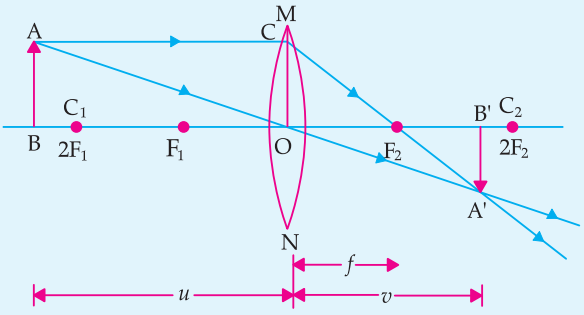


Long Answer Type Questions — 5 marks each

AI **Q. 1. (i) A lens produces a magnification of –0.5. Is this a converging or diverging lens? If the focal length of the lens is 6 cm, draw a ray diagram showing the image formation in this case.**

(ii) A girl was playing with a thin beam of light from a laser torch by directing it from different directions on a convex lens held vertically. She was surprised to see that in a particular direction, the beam of light continues to move along the same direction after passing through the lens. State the reason for her observation. Draw a ray diagram to support your answer. A [Board SQP, 2020]

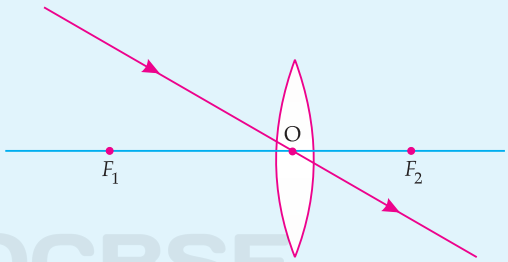
Ans. (i) The image will be real and inverted, since the magnification has negative value. The lens that can produce a real and inverted image is a converging/ convex lens.



In the figure $OF_1 = OF_2 = 6$ cm.

(*Marks will be deducted if arrows are not shown*)

(ii) The girl must have directed the ray of light along the direction of the optical centre of the lens because the ray of light passes straight through the optical centre of the lens.



3 + 2

[CBSE Marking Scheme, 2020]

AI **Q. 2. (i) On entering in a medium from air, the speed of light becomes half of its value in air. Find the refractive index of that medium with respect to air?**

(ii) A glass slab made of a material of refractive index n_1 is kept in a medium of refractive index n_2. A light ray is incident on the slab. Draw the path of the rays of light emerging from the glass slab, if (i) $n_1 > n_2$ (ii) $n_1 = n_2$ (iii) $n_1 < n_2$

U [Board SQP, 2020]

Ans. (i) Refractive Index of a medium (μ)

$$= \frac{\text{Velocity of light in vacuum}}{\text{Velocity of light in the medium}}$$

Let the velocity of light in vacuum be v_1 and velocity of light in the medium be v_2.

$$\frac{v_1}{2} = v_2 .$$

Hence $\mu = \frac{v_1}{v_2}$.

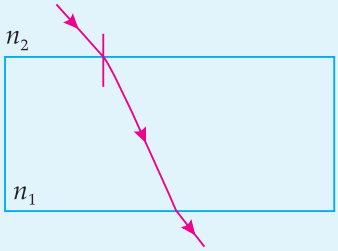
@PROCBSE JOIN NOW !

@PROCBSE

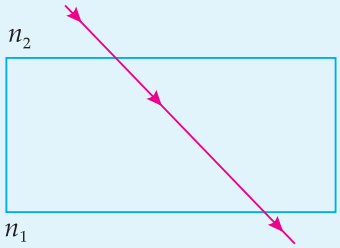
or, $\mu = \dfrac{v_1}{\frac{v_1}{2}}$.

$\therefore \quad \mu = 2$

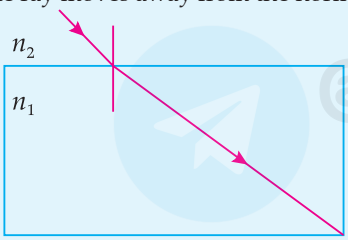
(ii) (a) The ray moves towards the normal. ½



(b) The ray moves undeviated.



(c) The ray moves away from the normal.



5

[CBSE Marking Scheme, 2019]

Q. 3. Draw a ray diagram in each of the following cases to show the formation of image, when the object is placed:

(i) between optical centre and principal focus of a convex lens.

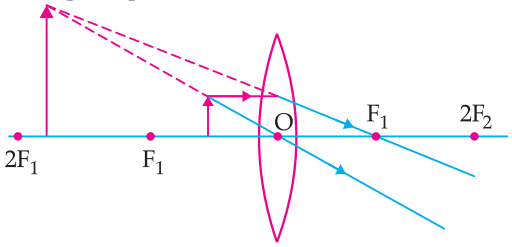
(ii) anywhere in front of a concave lens.

(iii) at 2F of a convex lens.

State the signs and values of magnifications in the above-mentioned cases (i) and (ii).

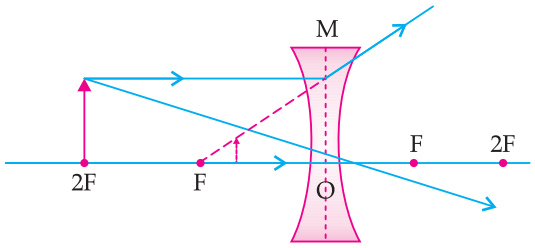
AE **[CBSE Delhi 2020]**

Ans. (i) When object is placed between optical centre and principal focus of a convex lens:



The image formed is virtual and erect, so the sign of magnification is positive. Also, since, image formed is magnified, so value of magnification is greater than one.

(ii) When object is placed anywhere in front of a concave lens:



The image formed is virtual and erect, so the sign of magnification is positive. Also, since, image formed is diminished, so value of magnification is less than one.

(iii) When an object is placed at 2F of a convex lens:

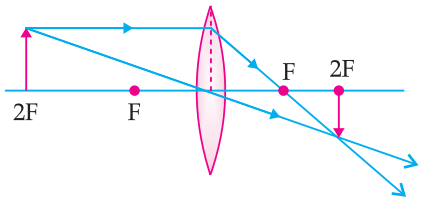


Image is formed at 2F, A real inverted image of same size is produced.

Q. 4. Rishi went to a palmist to show his palm. The palmist used a special lens for this purpose.

(i) State the nature of the lens and reason for its use.

(ii) Where should the palmist place/hold the lens so as to have a real and magnified image of an object ?

(iii) If the focal length of this lens is 10 cm and the lens is hold at a distance of 5 cm from the palm, use lens formula to find the position and size of the image.

A **[CBSE OD Set-1, 2020]**

Ans. (i) Nature of the lens used is convex lens because it produces a magnified image of the palm.

(ii) Real and magnified image of the object can be obtained in convex lens, when the object is placed between focus and centre of curvature of the lens.

(iii) Given, $f = +10$ cm

$u = -5$ cm

$v = ?$

By lens formula, $\dfrac{1}{f} = \dfrac{1}{v} = \dfrac{1}{u}$

Or $\dfrac{1}{10} = \dfrac{1}{v} - \left(-\dfrac{1}{5}\right)$

Or $\dfrac{1}{v} = \dfrac{1}{10} - \dfrac{1}{5}$

Or $\dfrac{1}{v} = -\dfrac{1}{10}$

$\therefore \quad v = -10$ cm

By using magnification formula, $m = \dfrac{v}{u}$

@PROCBSE

Or $$m = \frac{-10}{-5}$$

$$m = 2 \text{ cm}$$

Image is formed twice the size of the object.

AI **Q. 5. An object is placed at a distance of 60 cm from a concave lens of focal length 30 cm.**

(i) Use lens formula to find the distance of the image from the lens.

(ii) List four characteristics of the image (nature, position, size, erect/inverted) formed by the lens in this case.

(iii) Draw ray diagram to justify your answer of part (ii). A [CBSE Board Delhi, Set- I, 2019]

Ans. (i) $u = -60$ cm, $f = -30$ cm, $v = ?$

$$\frac{1}{f} = \frac{1}{v} - \frac{1}{u} \quad ½$$

$$\frac{1}{v} = \frac{1}{f} + \frac{1}{u}$$

$$\frac{1}{v} = \frac{1}{(-30\,\text{cm})} + \frac{1}{(-60\,\text{cm})} = \frac{-3}{60}$$

$\therefore \quad v = -20$ cm **1**

$$m = \frac{v}{u} = \frac{-20\text{ cm}}{-60\text{ cm}} = \frac{1}{3} \quad ½$$

Distance of the image will be 20 cm in front of lens. ½

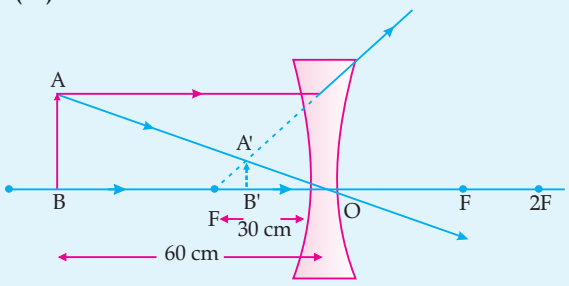
(ii) Nature: Virtual ½

Position: 20 cm from lens on the same side as the object ½

Size: Diminished ½

Erect/Inverted: Erect

(iii)



1

[CBSE Marking Scheme, 2019] **5**

AI **Q. 6. An object is placed at a distance of 30 cm from a concave lens of focal length 30 cm.**

(i) Use lens formula to determine the distance of the image from the lens.

(ii) List four characteristics of the image (nature position, size, erect/inverted) in this case.

(iii) Draw a labelled diagram to justify your answer of part (ii). A [CBSE Board Delhi, Set- II, 2019]

Ans. (i) $u = -30$ cm, $f = -30$ cm, $v = ?$ ½

$$\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$$

or, $$\frac{1}{v} = \frac{1}{f} + \frac{1}{u}$$

or, $$\frac{1}{v} = \frac{1}{(-30\,\text{cm})} + \frac{1}{(-30\,\text{cm})}$$

or, $$\frac{1}{v} = \frac{-2}{30}\ \text{cm}$$

$\therefore \quad v = -15$ cm **1**

$$m = \frac{v}{u}$$

$$\frac{(-15\text{ cm})}{(-30\text{ cm})} = -\frac{1}{2} \quad ½$$

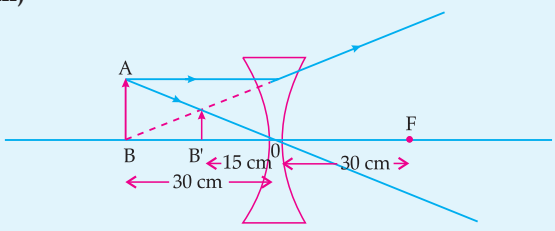
(ii) Nature — Virtual ½

Position — 15 cm away from the lens, on the same side as the object ½

Size — Diminished ½

Erect / inverted – Erect ½

(iii)



[CBSE Marking Scheme, 2019] **1**

Q. 7. A concave lens of focal length 60 cm is used to form an image of an object of length 9 cm kept at a distance of 30 cm from it. Use lens formula to determine the nature, position and length of the image formed. Also draw labelled ray diagram to show the image formation in the above case. AE [Delhi, 2019]

@PROCBSE JOIN NOW !

@PROCBSE

Topper Answer, 2019

Ans.

16. Concave lens

~~f = −60 cm~~

~~h' = 9 cm~~

$f = -60$ cm

$h' = +\ ?$

$h = +9$ cm

$u = -30$ cm

$v = -\ ?$

According to lens formula,

$$\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$$

$$\frac{1}{60} = \frac{1}{v} - \frac{1}{(-30)}$$

$$\frac{-1}{60} = \frac{1}{v} + \frac{1}{30}$$

$$\frac{-1}{60} - \frac{1}{30} = \frac{1}{v}$$

$$\frac{1}{v} = \frac{-1}{60} - \frac{1}{30}$$

$$\frac{1}{v} = \frac{-1-2}{60}$$

$$\frac{1}{v} = \frac{-3}{60_{20}}$$

$$v = (-20)\ \text{cm}$$

According to linear magnification of lens,

$$m = \frac{v}{u} = \frac{h'}{h}$$

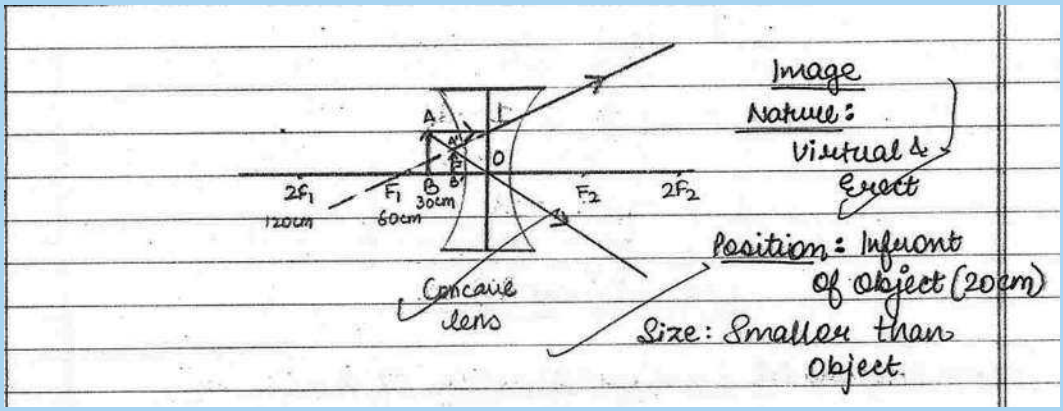
$$\frac{+20}{+30} = \frac{h'}{9}$$

$$h' = \frac{2 \times 9^{3}}{3}$$

$$h' = 6\ \text{cm}$$

@PROCBSE JOIN NOW !

@PROCBSE



Q. 8. Analyse the following observation table showing variation of image distance (v) with object distance (u) in case of a convex lens and answer the questions that follow, without doing any calculations:

S. No.	Object distance u (cm)	Image distance v (cm)
1	– 90	+18
2	– 60	+ 20
3	– 30	+ 30
4	– 20	+ 60
5	– 18	+ 90
6	– 10	+ 100

(a) What is the focal length of the convex lens? Give reason in support of your answer.

(b) Write the serial number of that observation which is not correct. How did you arrive at this conclusion?

(c) Take an appropriate scale to draw ray diagram for the observation at S. No. 4 and find the approximate value of magnification.

AE **[Delhi 31/1/1 2017]**

Ans. (a) $f = +15$ cm ½

Reason: Objects at S. No. (3) indicates $u = -30$ cm, $v = +30$ cm

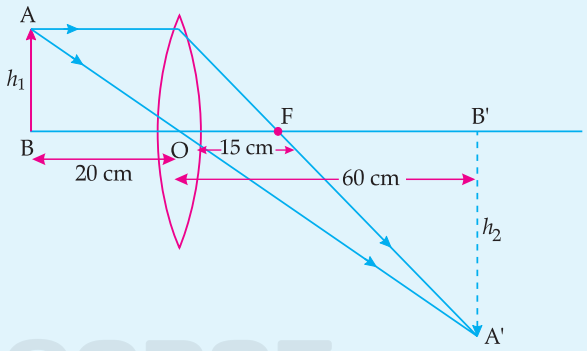
Thus, object is at 2F ($2f = 30$ cm)

$\therefore$ $f = 15$ cm **1**

(b) Observation at S. No. (6) ½

The value, $u = -10$ cm, indicates that the object is in between the optical centre and the focus (*i.e.*, less than the focal length) of the lens and hence the image should be on the same side as the object. Thus the image distance cannot be positive. **1**

(c) u = – 20 cm ; v = + 60 cm: f = + 15 cm



$m = \frac{h_2}{h_1} = \frac{-4.5\text{ cm}}{+1.5\text{ cm}} = -3$ ½

[CBSE Marking Scheme, 2017]

Detailed Answer:

(i) From S. No- 3, we can say that the radius of curvature of the lens is 30 cm because when an object is placed at the centre of curvature of a convex lens, its image is formed on the other side of the lens at the same distance from the lens. And, we know that focal length is half of the radius of curvature. Thus, the focal length of the lens is + 15 cm.

(ii) S. No- 6 is not correct as the object distance is between focus and pole so for such cases the image formed is always virtual but in this case a real image is forming as the image distance is positive.

(iii) For Diagram refer page 53.

Q. 9. Analyse the following observation table showing variation of image-distance (v) with object-distance (u) in case of a convex lens and answer the questions that follow without doing any calculations:

S. No.	Object-Distance u (cm)	Image-Distance v (cm)
1	– 100	+25
2	– 60	+ 30
3	– 40	+ 40
4	– 30	+ 60
5	– 25	+ 100
6	– 15	+ 120

@PROCBSE JOIN NOW !

@PROCBSE

(a) What is the focal length of the convex lens ? Give reason to justify your answer.

(b) Write the serial number of the observation which is not correct. On what basis have you arrived at this conclusion ?

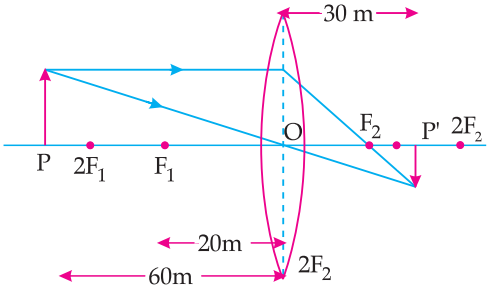
(c) Select an appropriate scale and draw a ray diagram for the observation at S.No. 2. Also find the approximate value of magnification.

AE **[OD 31/1 2017]**

Ans. (a) The focal length of the convex lens can be calculated from S.No. 3 as when an object is placed at a distance from the convex lens its image is formed on the other side of the lens at the same distance from the lens. So, the focal length is + 20 cm.

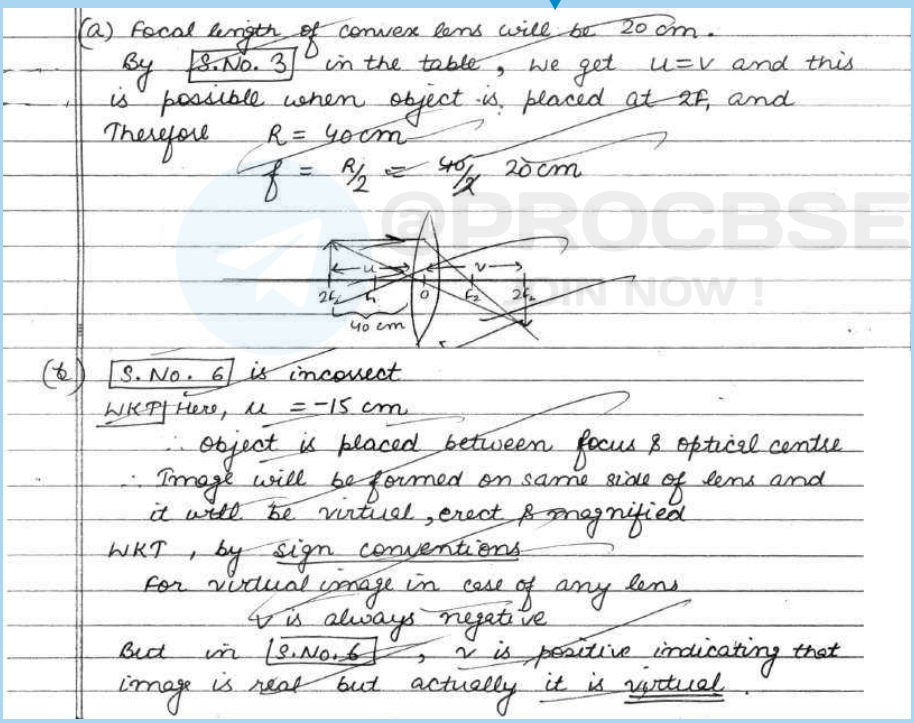
(b) S.No. 6 is incorrect as the object distance is between focus and pole and here the real image is formed as the image distance is positive. But in such situation virtual image should form.

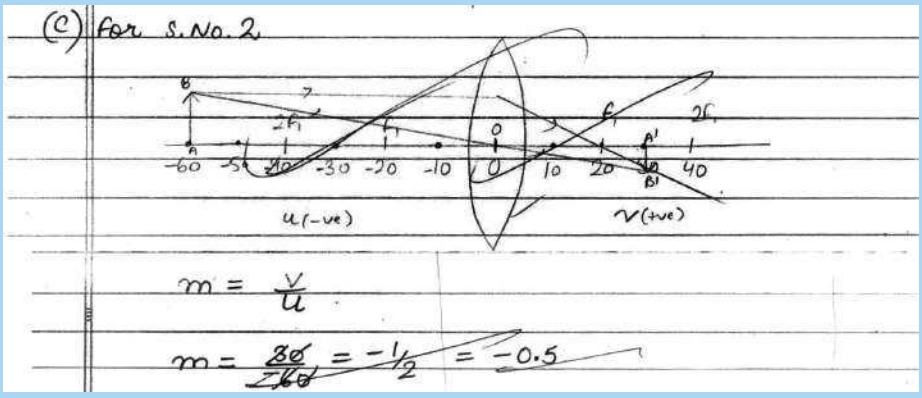
(c) Approximate value magnification for object distance – 60 cm and image distance +30 cm is – 0.5.



OR

Topper Answer, 2017





@PROCBSE

Q. 10. (a) Define focal length of a divergent lens.

(b) A divergent lens of focal length 30 cm forms the image of an object of size 6 cm on the same side as the object at a distance of 15 cm from its optical centre. Use lens formula to determine the distance of the object from the lens and the size of the image formed.

(c) Draw a ray diagram to show the formation of image in the above situation.

U **[Board Term II O.D. Set II, 2016]**

Topper Answer, 2016

Ans.

(a) The distance between the principal focus and the optical centre of the concave lens or diverging lens is called the focal length of a diverging lens.

(b) $f = -30$ cm.

$h = 6$ cm

$v = -15$ cm. $u = ?$ $h' = ?$

Lens formula:

$$\frac{1}{v} - \frac{1}{u} = \frac{1}{f} \qquad \frac{-1}{u} = \frac{1}{f} - \frac{1}{v}$$

$$\frac{-1}{15} - \frac{1}{u} = \frac{-1}{30} \qquad \frac{-1}{u} = \frac{-1}{30} - \left(\frac{-1}{15}\right)$$

$$-\frac{1}{u} = -\frac{1}{30} + \frac{1}{15}$$

$$-\frac{1}{u} = \frac{-15+30}{450}$$

$$-\frac{1}{u} = \frac{15}{450} \quad \frac{1}{30}$$

$$-u = 30$$

$u = -30$ cm The object distance is -30 cm.

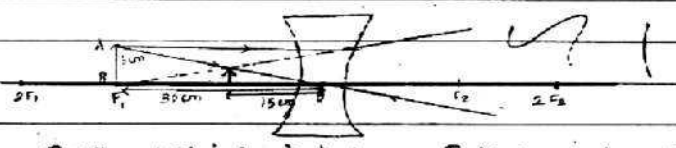
$$m = \frac{v}{u} = \frac{h'}{h}$$

$$\frac{+15}{-30} = \frac{h'}{6} \qquad \frac{6}{2} = h'$$

$h' = 3$ cm

The height of the image is 3 cm

(c)



Position of object is between Infinity and optical centre.

Image position is between Focus, and optical centre.

@PROCBSE JOIN NOW !

@PROCBSE

COMMONLY MADE ERROR

- Students get confused between divergent and convergent lens.
- Mistakes are also made by candidates in simplifying the calculations.

ANSWERING TIPS

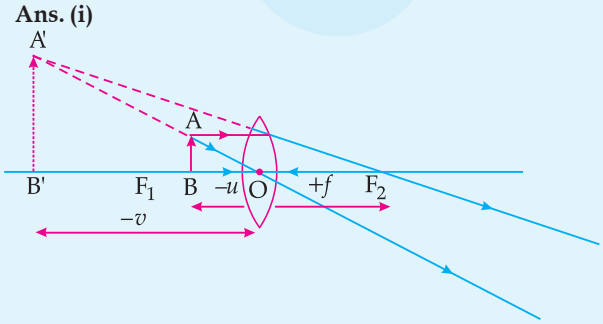
- Diverging lens is concave lens and converging lens is convex lens.
- Lens formula should be correctly mentioned and calculated.

Q. 11. (i) Draw a ray diagram to show the formation of image by a convex lens when an object is placed in front of the lens between its optical centre and principal focus.

(ii) In the above ray diagram mark the object-distance (u) and the image-distance (v) with their proper signs (+ve or – ve as per the new Cartesian sign convention) and state how these distances are related to the focal length (f) of the convex lens in this case.

(iii) Find the power of a convex lens which forms a real, and inverted image of magnification –1 of an object placed at a distance of 20 cm from its optical centre. A [Board Term II Delhi Set I, 2016]

Ans. (i)



(ii) Relation: $\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$ ½ + ½

(iii) $m = -1$; $u = -20$ cm; $v = ?$, $f = ?$

Marking of u & v, ½

$$m = \frac{v}{u}$$

$\therefore$ $v = +20$ cm ½

Thus, object is at 2F

i.e., $2f = 20$ cm

$\therefore$ $f = 10$ cm $= 0.1$ m **1**

$$p = \frac{1}{f} = \frac{1}{0.1} = +10 \text{ D}$$ **1**

[CBSE Marking Scheme, 2016]

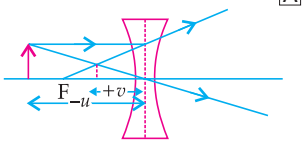
Q. 12. (a) Draw a ray diagram to show the formation of image by a concave lens when an object is placed in front of it.

(b) In the above diagram mark the object-distance (u) and the image-distance (v) with their proper signs (+ve or –ve as per the new Cartesian sign convention) and state how these distances are related to the focal length (f) of the concave lens in this case.

(c) Find the nature and power of a lens which forms a real and inverted image of magnification –1 at a distance of 40 cm from its optical centre.

A [Delhi,Set-2, 2016]

Ans. (a)



(b) Marking $-u$ and $-v$ ½+½

Relation:

$$\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$$

(c) As, $m = -1$ hence, the lens is convex ½

$\because$ $m = \frac{v}{u}$

$\therefore$ $v = -u$ ½

This, object is at 2F

$2f = 40$ cm

$\therefore$ $f = 10$ cm $= 0.2$ m

$$P = \frac{1}{f} = \frac{1}{0.2}$$

$= +5$D (convex lens) **1**

Q. 13. (a) Define optical centre of a spherical lens.

(b) A divergent lens has a focal length of 20 cm. At what distance should an object of height 4 cm from the optical centre of the lens be placed so that its image is formed 10 cm away from the lens. Find the size of the image also.

(c) Draw a ray diagram to show the formation of image in above situation. R [OD, Set-1, 2016]

Ans. (a) Optical centre: The optical centre of a spherical lens is defined as a point on the principal axis through which light ray from undeviated. It is the centre point of the lens. **1**

(b) $f = -20$ cm

$h_1 = 4$ cm, $v = -10$, $u = ?$, $h_2 = ?$ ½

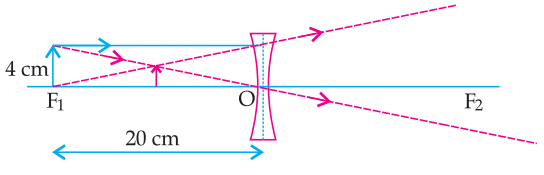
$$\frac{1}{f} = \frac{1}{v} - \frac{1}{u} = \frac{-1}{-10} - \frac{1}{-20} = \frac{-1}{10} + \frac{1}{20}$$ ½

or, $$\frac{1}{f} = \frac{-2+1}{20} = -\frac{1}{20}$$

$u = -20$ cm **1**

$$h_i = \frac{v}{u} h_0 = \frac{-10\text{cm}}{-20\text{cm}} \times 4 = 2 \text{ cm}$$ ½

(c)



1

Q. 14. (a) Define focal length of a divergent lens.

(b) A divergent lens of focal length 30 cm forms the image of an object of size 6 cm on the same side

@PROCBSE

as the object at a distance of 15 cm from its optical centre. Use lens formula to determine the distance of the object from the lens and the size of the image formed.

(c) Draw a ray diagram to show the formation of image in the above situation. U **[OD, Set -3, 2016]**

Ans. (a) Focal length is the distance between optical centre pole and principal focus of a divergent lens.

(b) $f = -30$ cm, $u = ?$, $v = -15$ cm, $h_1 = 6$ cm, $h_2 = ?$ **1**

$$\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$$

or, $$\frac{1}{u} = \frac{-1}{f} + \frac{1}{v}$$ ½

or, $$u = \frac{vf}{f - v}$$

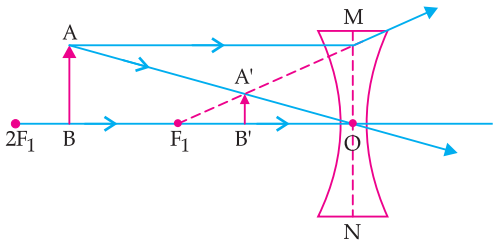
or, $$= \frac{-15 \text{ cm} \times -30 \text{ cm}}{-30 \text{ cm} - (-15) \text{ cm}}$$

or, $$= \frac{450}{-15} = -30 \text{ cm}$$ **1½**

$$h_2 = \frac{v}{u} \times h_1 = \frac{-15\text{cm}}{-30\text{cm}} \times 6 \text{ cm}$$

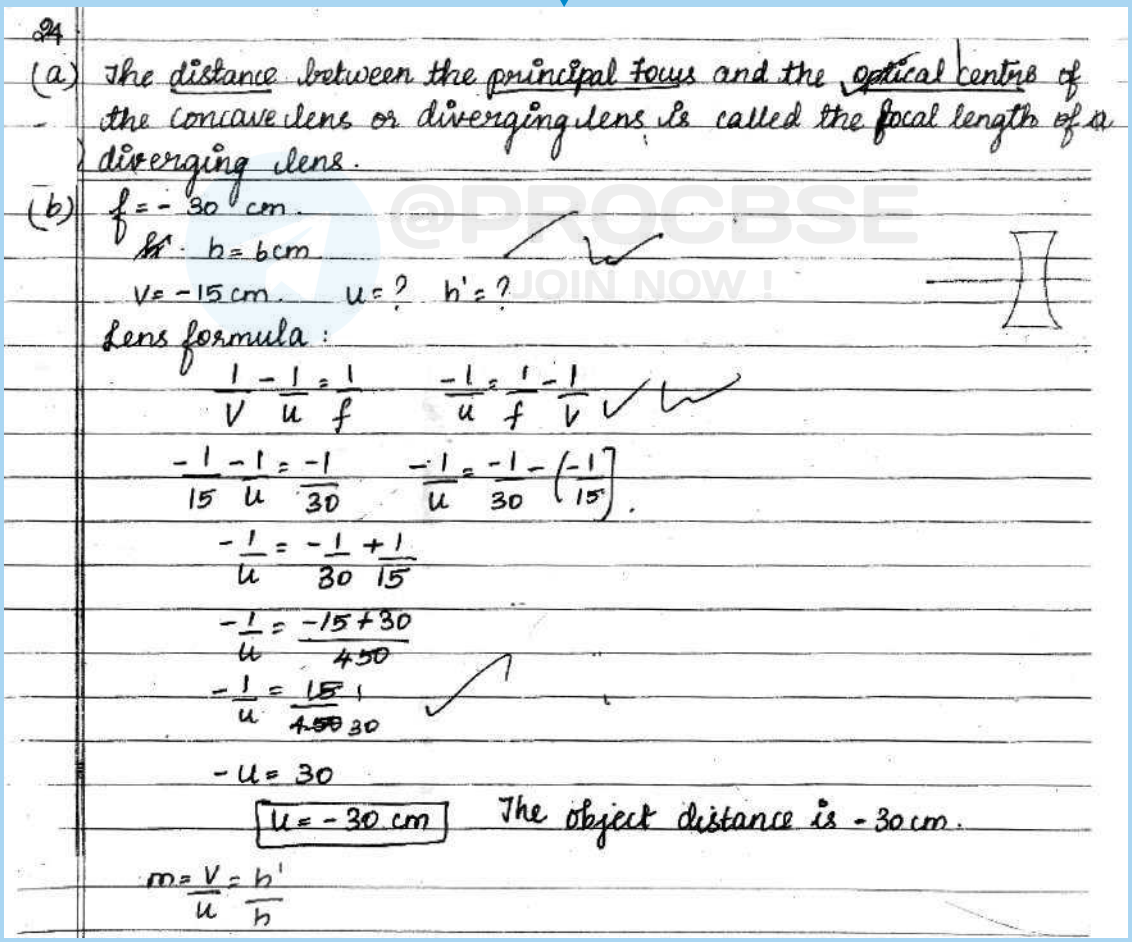
$\therefore$ $= 30$ cm **1**

(c)



1

Topper Answer, 2016



Q4

(a) The distance between the principal focus and the optical centre of the concave lens or diverging lens is called the focal length of a diverging lens.

(b) $f = -30$ cm.

$h = 6$ cm

$v = -15$ cm. $u = ?$ $h' = ?$

Lens formula:

$$\frac{1}{v} - \frac{1}{u} = \frac{1}{f} \qquad \frac{-1}{u} = \frac{1}{f} - \frac{1}{v}$$

$$\frac{-1}{15} - \frac{1}{u} = \frac{-1}{30} \qquad \frac{-1}{u} = \frac{-1}{30} - \left(\frac{-1}{15}\right)$$

$$-\frac{1}{u} = -\frac{1}{30} + \frac{1}{15}$$

$$-\frac{1}{u} = \frac{-15 + 30}{450}$$

$$-\frac{1}{u} = \frac{15}{450} \quad 30$$

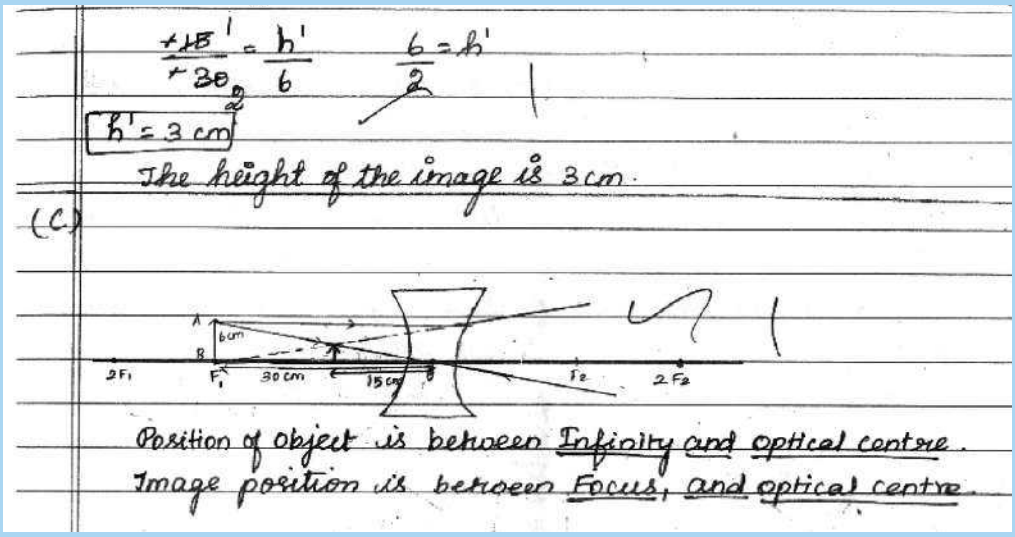
$$-u = 30$$

$u = -30$ cm The object distance is -30 cm.

$$m = \frac{v}{u} = \frac{h'}{h}$$

@PROCBSE JOIN NOW !

@PROCBSE



Q. 15. (a) State the laws of refraction of light. Explain the term absolute refractive index of a medium and write an expression to relate it with the speed of light in vacuum.

(b) The absolute refractive indices of two media 'A' and 'B' are 2.0 and 1.5 respectively. If the speed of light in medium 'B' is 2×10^8 m/s, calculate the speed of light in:

(i) vacuum,

(ii) medium 'A' U **[Board Term II Delhi Set II, 2015]**

Ans. (a) Laws of refraction of light:

Try Yourself. Refer Q.No. 4 of Short Answer Type Questions-II.

(b) Given $n_A = 2.0$ and $n_B = 1.5$

Speed of light in medium B $= 2\times10^8$ m/s

$$n_B = \frac{\text{Speed of light in vacuum (c)}}{\text{Speed of light in media B}}$$

$$1.5 = \frac{c}{2\times10^8}$$

Speed of light in vacuum $c = 2\times10^8\times1.5$

$= 3.0\times10^8$ m/s

Speed of light in medium 'A'

$$n_A = \frac{\text{Speed of light in vacuum}}{\text{Speed of light in medium 'A'}}$$

$$2.0 = \frac{3\times10^8}{\text{Speed of light in media 'A'}}$$

$$\text{Speed of light in medium A} = \frac{3\times10^8}{2}$$

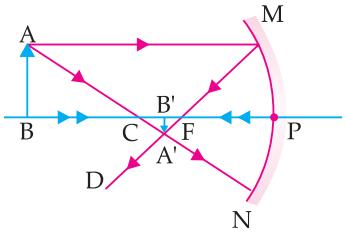
$= 1.5\times10^8$ m/s **2 + 3**

[CBSE Marking Scheme, 2015]

@PROCBSE JOIN NOW

Visual Case-based Questions — 4 marks each

Q. 1. Following figure illustrates the ray diagram for the formation of image by a concave mirror. The position of the object is beyond the centre of curvature of the concave mirror. On the basis of given diagram answer any four questions from (a) to (e).



(a) If the focal length of the concave mirror is 10 cm, the image formed will be at a distance _____.

(i) Between 10cm and 15cm

(ii) Between 10cm and 20cm

(iii) Beyond 20cm

(iv) At 20 cm

(b) In case of concave mirror, the image distance is _____ when image is formed in front of the mirror and _____ when the image is formed behind the mirror.

(a) positive, negative

(b) negative, negative

@PROCBSE

(c) negative, positive
(d) positive , positive

(c) If the size of the object in the given figure is 5 cm and the magnification produced is –0.5. The size of the image is (in cm) _____
(i) –2.5 **(ii) –0.1**
(iii) 2.5 **(iv) 0.1**

(d) A negative sign in the magnification value indicate that the image is _____
(i) Real and inverted
(ii) Real and erect
(iii) Virtual and erect
(iv) Virtual and inverted

(e) An image formed by concave mirror is virtual, when the object is placed:
(i) at infinity **(ii) at C**
(iii) Between C and F **(iv) Between P and F**

Ans. (a) (ii) Between 10 cm and 20 cm
(b) (iii) negative, positive
(c) (i) – 2.5

As we know, magnification,

$$m = \frac{h_2}{h_1}$$

$$h_2 = \frac{-0.5 \times 5}{10}$$

$$h_2 = -2.5 \text{ cm}$$

(d) (i) Real and inverted
(e) (iv) Between P and F **1+1+1+1+1**

Q. 2. Read the following passage and answer any four questions from (a) to (e).

A student wants to project the image of a candle flame on the walls of the school laboratory by using a mirror.

(a) Which type of mirror should he use and why ? U
(i) Convex mirror, it forms virtual image
(ii) Concave mirror, it forms virtual image
(iii) Concave mirror, it forms real image
(iv) Convex mirror, it forms real image

(b) At what distance, in terms of focal length '*f*' of the mirror, should he place the candle flame to get the magnified image on the wall ? C
(i) At F **(ii) Between F and C**
(iii) At C **(iv) At infinity**

(c) To get the diminished image of the candle flame, the object must be placed at: U
(i) infinity **(ii) at C**
(iii) between F and C **(iv) At F**

(d) If the image formed by this mirror is inverted and real, the magnification will be: A
(i) Positive **(ii) Negative**
(iii) Either of them **(iv) None of the above**

(e) A virtual image formed by concave mirror is: C
(i) erect and enlarged
(ii) erect and diminished
(iii) inverted and diminished
(iv) inverted and enlarged

Ans. (a) (iii) Concave mirror, it forms real image.
(b) (ii) Between F and C
(c) (i) at infinity
(d) (ii) negative
(e) (i) erect and enlarged **1+1+1+1+1**

Q. 3. Read the following passage and answer any four questions from (a) to (e)

A student wants to project the image of a candle flame on a screen 30 cm in front of a mirror by keeping the flame at a distance of 15 cm from its pole.

(a) Suggest the type of mirror he should use:
(i) convex mirror **(ii) plane mirror**
(iii) concave mirror **(iv) none of the above**

(b) Find the linear magnification of the image produced.
(i) – 4 **(ii) + 4**
(iii) – 900 **(iv) + 900**

(c) When object distance is less than focal length the image is _____ and when object distance is more than focal length the image is _____.
(i) real, real **(ii) virtual. Virtual**
(iii) real, virtual **(iv) virtual, real**

(d) What is the distance between the object and its image ?
(i) 15 cm **(ii) 35 cm**
(iii) 75 cm **(iv) 0 cm**

(e) The image formed in the above case is:
(i) virtual, inverted and magnified.
(ii) real, erect and magnified
(iii) real , inverted and magnified
(iv) real, erect and diminished

Ans. (a) (iii) Concave mirror
(b) (i) – 4
(c) (iv) virtual, real
(d) (i) 15 cm
(e) (i) real, inverted and magnified **1+1+1+1+1**

Q. 4. Read the following passage and answer any four questions from (a) to (e).

A student focuses the image of a candle flame, placed at about 2 m from a convex lens of focal length 10 cm, on a screen. After that he moves gradually the flame towards the lens and each time focuses its image on the screen.

U **[OD 2017,Set-1]**

(a) In which direction does he move the lens to focus the flame on the screen ?
(i) away from screen
(ii) towards the screen
(iii) should not move the screen
(iv) away from flame

@PROCBSE JOIN NOW !

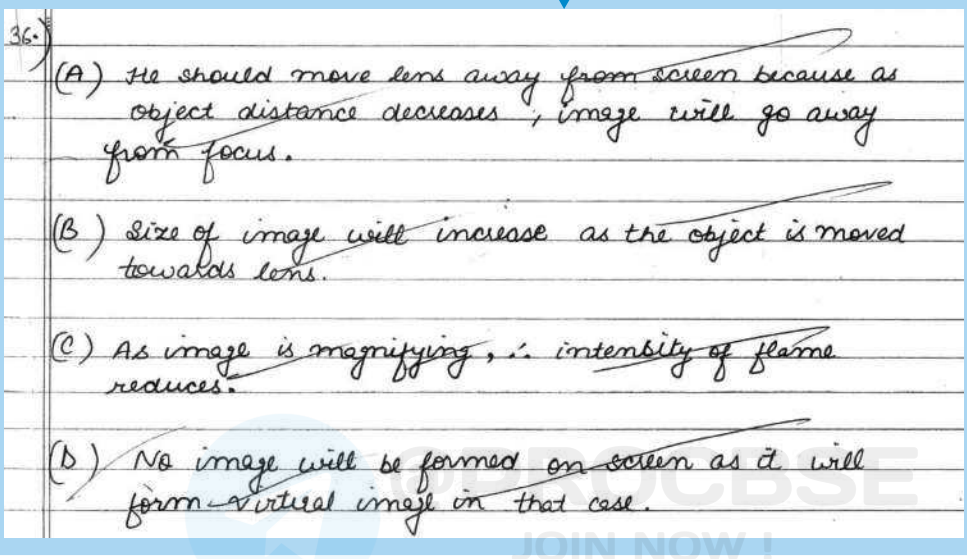
@PROCBSE

(b) What happens to the size of the image of the flame formed on the screen?
(i) size of image will decrease
(ii) size of image will increase
(iii) remains unchanged
(iv) size will become too small

(c) What difference is seen in the intensity (brightness) of the image of the flame on the screen ?
(i) intensity of flame increases
(ii) intensity of flame remains same
(iii) intensity of flame reduces
(iv) the flame disappears

(d) What is seen on the screen when the flame is very close (at about 5 cm) to the lens ?
(i) a bright image (ii) a magnified image
(iii) diminished image (iv) no image

Topper Answer, 2017


36.
(A) He should move lens away from screen because as object distance decreases, image will go away from focus.
(B) Size of image will increase as the object is moved towards lens.
(C) As image is magnifying, ∴ intensity of flame reduces.
(D) No image will be formed on screen as it will form virtual image in that case.

@PROCBSE JOIN NOW !

Q. 5. Read the passage and note the following observations. Answer any four questions from (a) to (e)
A student focussed the image of a candle flame on a white screen by placing the flame at various distances from a convex lens. He noted his observations as:

S. No.	Distance of flame from the lens (cm)	Distance of the screen from the lens (cm)
(i)	60	20
(ii)	40	24
(iii)	30	30
(iv)	24	40
(v)	15	70

(a) From the above table, find the focal length of lens without using lens formula: AE
(i) 15cm (ii) 30cm
(iii) 40cm (iv) 60cm

(b) Which set of observations is incorrect and why? A
(i) Object distance can not be smaller than image distance
(ii) Image should form at 15cm only
(iii) Image should form at infinity
(iv) Object is kept at optical centre

(c) In which case, the size of the object and image will be same: U
(i) In (iv) case (ii) In (ii) case
(iii) In (iii) case (iv) In (i) case

(d) What is the change in image observed as the object is moved from infinity towards the concave lens? U
(i) Size of image decreases
(ii) Size of image becomes highly diminished
(iii) Size of the image remains unchanged
(iv) Size of the image increases slightly

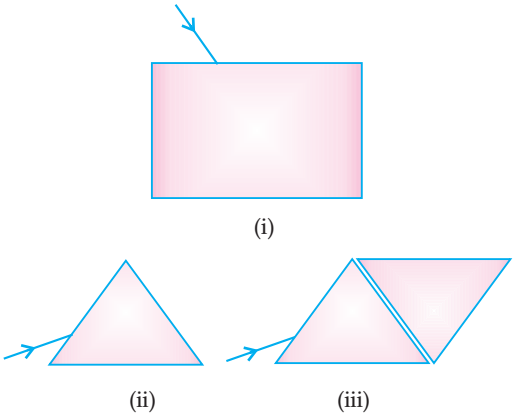
(e) Which of the following statement is false for the formation of images by convex lens: R
(i) It forms real,inverted and diminished image.
(ii) It forms virtual erect and enlarged image.
(iii) It forms virtual, erect, and diminished image.
(iv) It forms real,inverted and enlarged image.

Ans. (a) (i) 15 cm
(b) (iii) Image should form at infinity
(c) (iii) In (iii) case
(d) (iv) Size of the image increases slightly
(e) (iii) It forms virtual, erect and diminished image.
1+1+1+1+1

Q. 6. Study the given diagram and answer any four questions from (a) to (e).
A very thin narrow beam of white light is made incident on three glass objects shown below.

@PROCBSE

Study the nature and behaviour of the emergent beam in all the three cases.



(i) (ii) (iii)

(a) Following are the possibility of two emergent beams being similar. Choose the correct answer: C

(i) (i) and (ii)
(ii) (i) and (iii)
(iii) (ii) and (iii)
(iv) No similar emergent beams

(b) When light enters from air to glass, the angles of incidence and refraction in air and glass are 45° and 30°, respectively. Find the refractive index of glass. (Given that $\sin 45° = \frac{1}{\sqrt{2}}$; $\sin 30° = \frac{1}{2}$) A

(i) √2 **(ii) 2 √2**
(iii) 1/(√2) **(iv) 1**

(c) The light changes its path as its medium changes. Which of the following is incorrect statement. U

(i) Speed of light is different in different media.
(ii) Light changes its path because light only travels in straight line.
(iii) Speed of light is dependent on medium through which it is passing.
(iv) The light chooses the path with minimum time, as it changes its medium.

(d) What is the unit of refractive index? R

(i) Pascal **(ii) Joule**
(iii) No unit **(iv) μ m**

(e) Light travel fastest in: R

(i) Air **(ii) Vacuum**
(iii) Glass **(iv) diamond**

Ans. (a) (ii) (i) and (iii)
Explanation: In (i) emergent beam is white and laterally displaced.
In (ii) emergent beam is a spectrum of seven colours bent in different angles.
In (iii) emergent beam from the second prism is white only.
Similarity between (i) and (iii) as both emergent rays are white in colour

(b) (i) √2
(c) (ii) Light changes its path because light only travels in straight line.
(d) (iii) No unit
(e) (ii) vacuum. **1+1+1+1+1**

Q. 7. An object is kept at a distance of 18 cm, 20 cm, 22 cm and 30 cm, from a lens of power + 5D.

(a) The focal length of the given lens is: C

(i) 0.2 cm **(ii) 20 cm**
(iii) 5cm **(iv) 0.5 cm**

(b) In which case or cases would you get a magnified image ? U

(i) 18cm **(ii) 20cm**
(iii) 22cm **(iv) All the above**

(c) Which of the magnified image can we get on a screen ? AE

(i) At 18 cm
(ii) At 18 cm and 22 cm
(iii) At 20 cm and 22 cm
(iv) At 22 and 30 cm

(d) The power of a lens of focal length 1 metre is called as: R

(i) Refractive index **(ii) 1 dioptre**
(iii) Speed of light **(iv) Wavelength**

(e) Name the lens/mirror used in film projectors and telescopes: R

(i) Convex lens **(ii) Concave lens**
(iii) Convex mirror **(iv) Concave mirror**

Ans. (a) (ii) 20 cm
(b) (iv) all the above
(c) (iv) at 22 cm and 30 cm, image can be obtained on a screen.
(d) (ii) 1 dioptre
(e) (i) Convex lens **1+1+1+1+1**

Know the Terms

- **Ray and beam:** Rectilinear propagation light travels in a straight line. The straight line indicating the path of the light (arrow–direction) is called a ray. A bundle of rays originating from the same source of light in a particular direction is called a beam of light.
- **Parallel beam:** When the rays which constitute the beam are parallel to one another, then it is called a parallel beam of light.
- **Convergent beam:** When the rays actually meet or appear to meet at a point, then the beam is called convergent beam and rays are called convergent rays.

@PROCBSE JOIN NOW

- **Divergent beam:** When the rays actually diverge or appear to diverge from a point, then the beam is called divergent beam and rays are called divergent rays.
- **Image:** The point of convergence or the point from where the light appears to diverge after reflection or refraction is called an image.
- **Aperture:** The width of the reflecting refractions surface from which reflection refraction takes place is called aperture.
- **Pole:** The central point of the reflecting spherical surface is called pole (P). It lies on the surface of the mirror.
- **Centre of curvature:** The centre of the hollow sphere of which the spherical mirror lens is a part, is called centre of curvature (C).
- **Radius of curvature:** The separation between the pole optical centre and the centre of the hollow sphere, of which the mirror lens is a part, is called radius of curvature (R).
- **Principal axis:** The straight line joining the pole optical centre and the centre of curvature is called principal axis.
- **Focus:** The point F on the principal axis, where a beam of light parallel to the principal axis actually meet after reflection refraction or appear to come from it is called its principal focus.
- **Focal length:** The distance between the pole optical centre and the focus is called focal length.



❑❑❑

@PROCBSE
JOIN NOW !

@PROCBSE

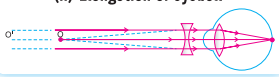
Human Eye and The Colourful World

Eye Defects

Presbyopia
Causes
(i) Causes Gradual weakening of ciliary muscles
(ii) Diminishing flexibility of eye lens

Correction
Use of bifocal lens

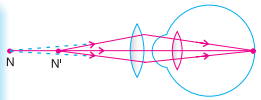
Myopia (Near Sightedness)
Causes
(i) Excessive Curvature of eye lens
(ii) Elongation of eyeball



Hypermetropia (Far Sightedness)
Correction
Use of Concave lens of appropriate power

Causes
(i) Focal length of the eye lens becomes too long
(ii) Eye ball becomes too small

Correction
Use of Convex lens of appropriate power



Structure of Eye

Retina
Delicate membrane having enormous number of light sensitive cells

Cornea
Controls and focuses the entry of light into the eye.

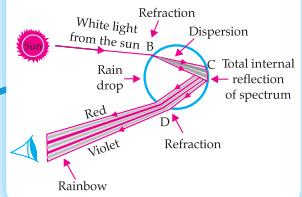
Iris
Control the size of the pupil

Pupil
It regulates and controls the amount of light entering the eye

Lens
Provide the focused real and inverted image of the object on the retina

Formation of Rainbow

Phenomenon associated are dispersion, refraction and total internal reflection.



Dispersion of Light

- Splitting of light into its component colours
- Red colour deviates the least and violet deviates the most.

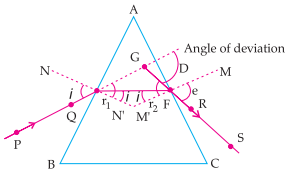
Shows Tyndall Effect

Scattering of Light

- Reddishness of the sun at sunrise and sunset
- Blue colour of the sky
- Blue colour has shorter wavelength as compared to red so m scatters more.

Refraction of Light through Prism

- Different colours travel through a glass prism at different speeds.
- The angle between the extended incident ray and the emergent ray is called the angle of deviation.
- The cause of atmospheric refraction is the variation in the density of air in the difference layers.
- The refraction of light in case of prism is different than that that of a slab.



Atmospheric Refraction

Refraction of light by the earth's atmosphere
- Twinkling of stars
- Planet do not twinkle
- Advanced Sunrise and delayed sunset

Trace the Mind Map
First Level · Second Level · Third Level

@PROCBSE

CHAPTER

11

HUMAN EYE AND THE COLOURFUL WORLD

Syllabus

- Functioning of a lens in human eye, defects of vision and their corrections, applications of spherical mirrors and lenses.
- Refraction of light through a prism, dispersion of light, scattering of light, applications in daily life.

Trend Analysis

List of Concepts	2018	2019		2020	
	OD/D	OD	D	OD	D
Human eye: Structure and Functions	1 Q (5 M)	1 Q (2 M)	1 Q (3 M)		
Eye defects and their correction	1 Q (5 M)	1 Q (5 M)			
Refraction of Light through glass prism, Dispersion of white light, Atmospheric refraction, Scattering of light		1 Q (3 M)		1 Q (3 M) OR 1 Q (3 M)	1 Q (3 M)

@PROCBSE JOIN NOW !

TOPIC - 1

Human eye, Defects of vision and corrections

Revision Notes

Human Eye

- Eye is a natural optical device using which human could see objects around him. It forms an inverted, real image on a light sensitive surface called retina.
- Rods and cones are the cells in retina, which are light sensitive. Rods respond to the intensity of light. Cones respond to the illumination of colours. There are around 125 million rods and cones cells. The cells generate signals which are transmitted to the brain through optic nerve.

Parts of Human Eye

- **Cornea:** It is the outermost, transparent part. It is responsible for most of the refraction of light.

TOPIC - 1

Human eye, Defects of vision and corrections
Page No. 281

TOPIC - 2

Refraction of light through prism, Dispersion of Light and Scattering of Light
Page No. 292

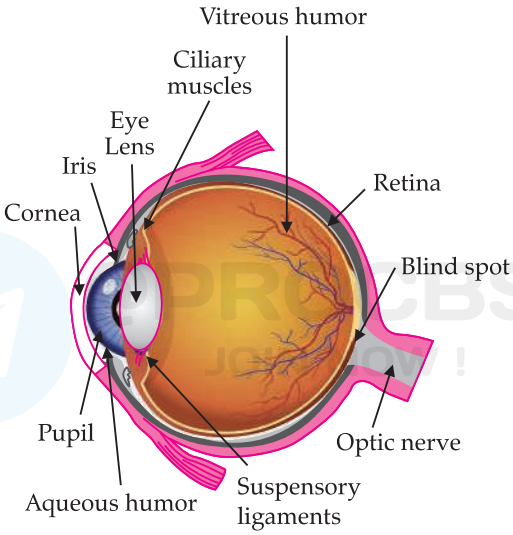
@PROCBSE

- **Lens:** It is composed of a fibrous, jelly like material. It provides the focused, real and inverted image of the object on the retina. This convex lens converges light at retina.
- **Iris:** It is a dark muscular diaphragm that controls the size of the pupil.
- **Pupil:** It is the window of the eye. It is the central aperture in iris. It regulates and controls the amount of light entering the eye.
- **Retina:** It is a delicate membrane having enormous number of light sensitive cells.
- **Ciliary muscles:** These muscles change the shape and size of the eye lens for focussing.
- **Far point:** The maximum distance at which object can be seen clearly is far point of the eye. For a normal adult eye, its value is infinity.
- **Optic Nerve:** The optic nerve sends the electrical impulses from the retina, at the back of the eyes to the brain.
- **Near point or Least distance of distinct vision**
  The minimum distance at which objects can be seen most distinctively without strain.
  - For a normal adult eye, its value is 25 cm.
  - Range of human vision is 25 cm to infinity.
- **Accommodation:** The ability of the eye lens to adjust its focal length is called accommodation. Focal length can be changed with the help of ciliary muscles.

Scan to know more about this topic

Structure of eye

Structure of an Human Eye:

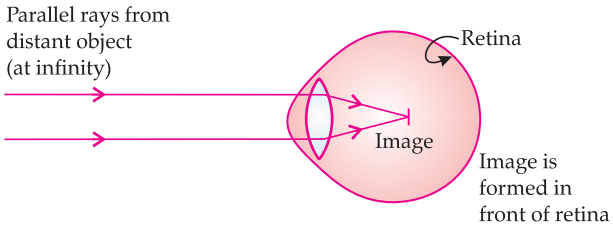


Scan to know more about this topic

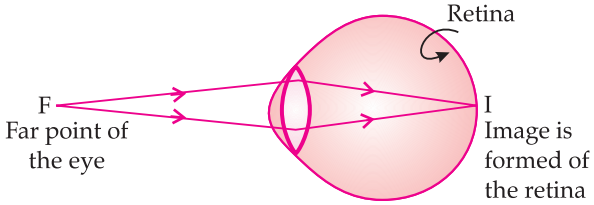
Defects in eye

Myopia (Near-sightedness):

- Distant objects are not clearly visible.

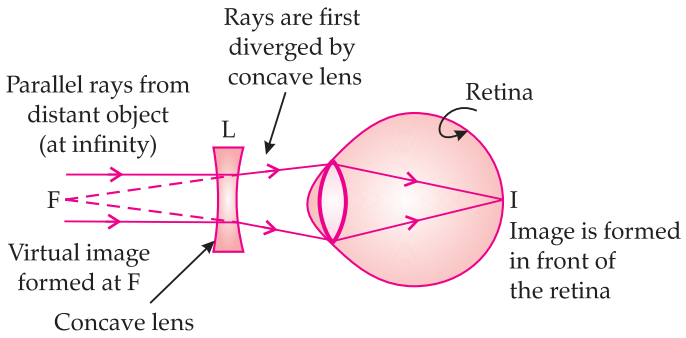


- In a myopic eye, image of distant object is formed in front of the retina (and not on the retina)



- The far point (F) of a myopic eye is less than infinity.

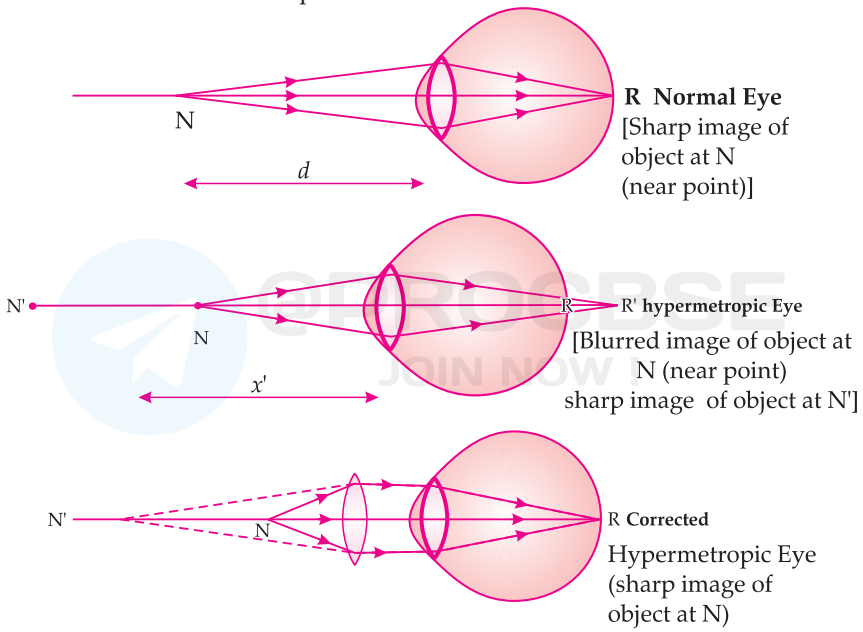
@PROCBSE



- **Correction:** The concave lens placed in front of the eye forms a virtual image of distant object at far point (F) of myopic eye.

Hypermetropia (Far-sightedness):

- Affected person can see far objects clearly but cannot see nearby objects clearly.
- The near point of the eye moves away from 25 cm.
- Image is formed behind the retina.
- **Correction:** Use of convex lens of suitable power can correct this defect.



Presbyopia (Old age Hypermetropia):

- It is the defect of vision due to which an old person cannot see the nearby objects clearly due to less power of accommodation of the eye.
- The near-point of old person having presbyopia gradually recedes and becomes much more than 25 cm.

Objective Type Questions — 1 mark each

A Multiple Choice Questions

Q. 1. When we enter a dark room coming from outside, immediately the things inside the room do not appear clear to our eyes. This is because

(a) pupils do not open at all in the dark.
(b) pupils take time to adjust.
(c) light travels slower in a dark room.
(d) pupils open very quickly in the dark.

[CBSE SQP, 2019]

Ans. Correct option: (b)

Explanation: When we enter a dark room coming from outside, immediately the things inside the room do not appear clear to our eyes. This is because pupils take time to adjust. **1**

Q. 2. The phenomena of light responsible for the working of the human eye is

(a) reflection
(b) refraction
(c) power of accommodation
(d) persistence of vision **[CBSE SQP, 2019]**

Ans. Correct Option: (b)

Explanation: Refraction is responsible for image formation at retina.

@PROCBSE

Q. 3. When light rays enter the eye, most of the refraction occurs at the
(a) crystalline lens.
(b) outer surface of the cornea.
(c) iris.
(d) pupil. [NCERT Exemp.]

Ans. Correct option : (b)
Explanation: Light rays reflecting from distant objects are focussed on the retina after they passed through the cornea, aqueous humour, the lens, and finally the vitreous humour. Most of the refraction of light occurs when the difference in the refractive indices of abutting media is the greatest.
A list of Refractive Indices of various components of the human eye:

S. No.	Medium	Refractive Index
(i)	Air	1.000
(ii)	Cornea	1.376
(iii)	Aqueous humour	1.336
(iv)	Lens	1.42
(v)	Vitreous humour	1.336

B Assertions and Reasons Type Questions

Directions: In the following questions, a statement of assertion (A) is followed by a statement of reason (R). Mark the correct choice as:
(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).
(b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).
(c) Assertion (A) is true but reason (R) is false.
(d) Assertion (A) is false but reason (R) is true.

Q. 1. Assertion (A): Eye lens has the ability to focus clearly on the retina by adjusting its focal length.
Reason (R): This phenomenon is known as power of accommodation.

Ans. Correct option : (b)
Explanation: The ability of the eye lens to focus clearly on the retina by adjusting its focal length is known as the power of accommodation. **1**

Q. 2. Assertion (A): A hypermetropic person prefers to remove his spectacles, while driving.
Reason (R): When a hypermetropic person wearing the spectacles looks at a distant object, the parallel rays from the distant object get converged in front of the retina. The image thus appears blurred.

Ans. Correct option : (a)
Explanation: When a hypermetropic person wearing the spectacles looks at a distant object, the parallel rays from the distant object get converged in front of the retina. The image appears blurred, in order to avoid this, the person prefers to remove his spectacles. **1**

Q. 3. Assertion (A): Concave lens is used to correct myopia or short- sightedness.
Reason (R): A concave lens of suitable focal length diverges the parallel rays from the distant objects as if they are coming from the far point of the myopic eye. This helps the eye lens to form a clear image at the retina.

Ans. Correct option : (a)
Explanation: A concave lens of suitable focal length diverges the parallel rays from the distant objects as if they are coming from the far point of the myopic eye. This helps the eye lens to form a clear image at the retina. So, a concave lens used to correct myopia or short- sightedness. **1**

Q. 4. Assertion (A): Light from a distant object arriving at the eye lens may get converged at a point in front of the retina.
Reason (R): The eye is producing too much divergence in the incident beam.

Ans. Correct option : (c)
Explanation: The light from a distant object arriving at the eye lens may get converged at a point in front of the retina. This type of defect is called near-sightedness or myopia. This means that the eye is producing too much convergence in the incident beam. **1**

C Very Short Answer Type Questions

Q. 1. State one function of iris in human eye. R [CBSE Set AI, 2012]

Ans. Function of Iris: It controls the size of the pupil. **1**

Q. 2. Name the part of the human eye that helps in changing the focal length of the eye lens. R [CBSE Set A1, 2011]

Ans. Ciliary muscles. **1**

AI **Q. 3. What is the range of vision of a normal human eye ?** R [CBSE Set A1, 2011]

Ans. 25 cm to infinity. **1**

Q. 4. What is the function of pupil in human eye ? R [CBSE Set AI, 2011]

Ans. The pupil helps to control the amount of light entering the eye. **1**

Q. 5. Name the part of the eye:
(i) Controls the amount of light entering into the eye.
(ii) Forms real, inverted image of the object formed on it. R [CBSE Set A1, 2011]

Ans. (i) Pupil, (ii) Retina. ½+½

AI **Q. 6. What is the nature of the image formed on the retina ?** R

Ans. Real, inverted and diminished in size. **1**

Q. 7. A person is advised to wear spectacles with convex lenses. State the defect of vision he is suffering from. U [CBSE Set B1, 2011]

Ans. The person is suffering from hypermetropia. **1**

COMMONLY MADE ERROR

- Students usually get confused between myopia and hypermetropia. They write incorrect answer.

ANSWERING TIP

- Understand the concept of myopia and hypermetropia with proper ray diagram.

@PROCBSE

Short Answer Type Questions-I — 2 marks each

Q. 1. Define the term power of accommodation. Write the modification in the curvature of the eye lens which enables us to see the nearby objects clearly ?
R [CBSE Delhi SET I, 2019]

Ans. • Power of accommodation – Ability of eye lens to adjust its focal length. **1**
• Curvature increases/lens becomes thick. **1**
[CBSE Marking Scheme, 2019]

Q. 2. Write the structure of eye lens and state the role of ciliary muscles in the human eye.
R [CBSE Delhi SET II, 2019]

Ans. Structure: Fibrous, jelly like structure **1**
Role: To change the curvature of eye lens / to change the focal length of eye lens.
[CBSE Marking Scheme, 2019] **1**

Q. 3. The power of a lens is +5 diopters. What is the nature and focal length of this lens? At what distance from this lens should an object be placed so as to get its inverted image of the same size ?
R [Outside Delhi SET II, 2019]

Ans. $P = +5$ D
$f = \frac{1}{P} = \frac{100}{5} = 20$ cm **1**
Nature of lens = convex (converging) ½
Distance is 40 cm (at C)
[CBSE Marking Scheme, 2019] ½

Q. 4. What is meant by power of a lens ? What does its sign (+ve or –ve) indicate ? State its S.I. unit. How is this unit related to focal length of a lens ? [CBSE Delhi Set III, 2016]

Ans. • Ability of lens to converge or diverge the light rays. ½
• +ve sign ⟶ converging lens/ convex lens
−ve sign ⟶ diverging lens/ concave lens ½
• S.I. unit – dioptre ½
1 dioptre = 1/ focal length (m) ½

Short Answer Type Questions-II — 3 marks each

Q. 1. The near point of the eye of a person is 50 cm. Find the nature and power of the corrective lens required by the person to enable him to see clearly the objects placed at 25 cm. from the eye.
A [CBSE Delhi Set – III, 2020]

Ans. Given,
Object distance, $u = -25$ cm
Image distance, $v = -50$ cm
Focal length, f =?
Using lens formula,

$$\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$$

$$= \frac{1}{-50} - \frac{1}{-25}$$

$$= -\frac{1}{50} + \frac{1}{25}$$

$$= \frac{-1+2}{50} = \frac{1}{50}$$

$\therefore$ $f = 50$ cm.

Power of the lens, $P = \frac{1}{f(\text{in m})} = \frac{100}{f(\text{in cm})}$

$\Rightarrow$ $P = \frac{100}{50} = +2\text{D}$

Hence, the corrective lens is convex, because power of lens is positive. **3**

Q. 2. (a) A person is suffering from both myopia and hypermetropia
(i) What kind of lenses can correct this defect ?
(ii) How are these lenses prepared ?
(b) A person needs a lens of power + 3D for correcting his near vision and –3D for correcting his distant vision. Calculate the focal lengths of the lenses required to correct these defects.
A [CBSE Outside Delhi Set –I, 2020]

Ans. **(a) (i)** The type of lens required by such person to improve the vision is bifocal lens.
(ii) A bifocal lens consists of both convex lens and concave lenses. The convex lens used in bifocal lens is used to correct hypermetropia (far-sightedness) and concave lens is used to correct myopia (short sightedness).

(b) $P = \frac{1}{f}$

$P_1 = +3\text{D} = \frac{1}{f_1}$

$F_1 = \frac{1}{3}\text{m} = +0.33$ m (Convex lens)

$P_2 = -3\text{D} = \frac{1}{f_2}$

$F_2 = -\frac{1}{3} = -0.33$ m (Concave lens)

[1+2=3]

Q. 3. A student needs spectacles of power – 0.5 D for the correction of his vision.
(i) Name the defect in vision the student is suffering from.

@PROCBSE

(ii) Find the nature and focal length of the corrective lens.

(iii) List two causes of this defect.

A [CBSE Outside Delhi, Set- III, 2019]

Ans. (i) Myopia **1**

(ii) Concave / diverging lens and focal ½

Length = 200 cm ½

(iii) (a) Excessive curvature of the eye lens ½

(b) Elongation of eye ball

[CBSE Marking Scheme, 2019] ½

Detailed Answer:

(i) Negative power shows that lens is concave, so the student is suffering from myopia/near- sightedness.

(ii) The nature of lens used to correct this defect is concave lens.

$$\text{Focal length, } f = \frac{1}{p} = \frac{1}{(-0.5)} = -2 \text{ m}$$

(iii) Causes of defect are:

(a) Excessive curvature of the eye lens.

(b) Elongation of the eyeball.

Q. 4. What is meant by power of a lens ? Write the SI unit. A student uses a lens of focal length 40 cm and another of – 20 cm. Write the nature and power of each lens. A [CBSE Delhi Set I, 2018]

Ans. Power of lens = Ability to converge / diverge light rays passing through it/ reciprocal of the focal length in metres $/\frac{1}{f}$ (in metres).

SI unit of power is Dioptre.

Power of 1st lens $P_1 = \frac{100}{f_1} = \frac{100}{40\,\text{cm}} = +2.5D$ **1**

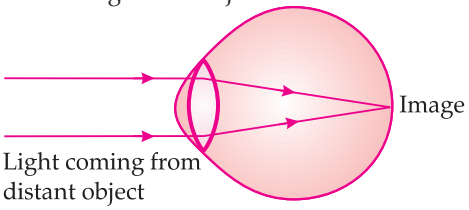
Nature: Converging lens / Convex lens

Power of 2nd lens $P_2 = \frac{100}{f_2} = \frac{100}{-20\,\text{cm}} = -5\text{D}$ **1**

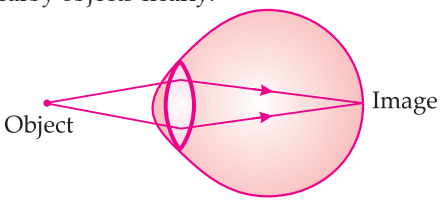
Nature: Diverging lens / Concave lens **1**

Q. 5. With the help of ciliary muscles, the human eye can change its curvature and thus alter the focal length of its lens. State the changes that occur in the curvature and focal length of the eye lens while viewing: (a) a distant object, (b) nearby objects. Explain, why a normal eye is not able to see distinctly the object placed closer than 25 cm, without putting any strain on the eye. U [Delhi 31/1/2 2017]

Ans. (a) When we see distant objects, the ciliary muscles relax/expand to decrease the curvature and thereby increase the focal length of the lens. Hence, the lens becomes thin. This enables us to see the distant object clearly. Thus, the focal length of the eye lens increases while seeing distant objects.



(b) To see the nearby objects clearly, the focal length of the lens should be shorter. For this, the ciliary muscles contract to increase the curvature and thereby decrease the focal length of the lens. Hence, the lens becomes thick. This enables you to see the nearby objects clearly.



A normal eye is not able to see distinctly the objects placed closer than 25 cm, without putting any strain on the eye. This is because the ciliary muscles of eyes are unable to contract beyond a certain limit. If the objects are placed at a distance less than 25 cm from the eye, then the objects appear blurred because light rays coming from the object meet beyond the retina. **1+1+1**

Q. 6. Due to gradual weakening of ciliary muscles and diminishing flexibility of the eye lens a certain defect of vision arises. Write the name of this defect. Name the type of lens required by such persons to improve the vision. Explain the structure and function of such lens. R, U [Delhi 31/1/1 2017]

Ans. Presbyopia

Bifocal lens

Upper portion/part — Concave/ Diverging lens

— To view far off objects

Lower part — Convex/converging lens

— To facilitate/ view nearby objects

[CBSE Marking Scheme, 2017] **3**

Detailed Answer:

The defect caused due to gradual weakening of ciliary muscles and diminishing flexibility of the eye lens is presbyopia.

The type of lens required by such person to improve the vision is bifocal lens.

A bifocal lens consists of both convex lens and concave lenses. The convex lens used in bifocal lens is used to correct hypermetropia (far-sightedness) and concave lens is used to correct myopia (short-sightedness).

Q. 7. Write about power of accommodation of human eye. Explain why the image distance in the eye does not change when we change the distance of an object from the eye ? U [Delhi 31/1/3 2017]

Ans. The ability of the eye lens to adjust its focal length is called power of accommodation.

The focal length of the eye lens is adjusted so that the image distance can not change. Thus, the image distance is equal to distance from the centre of the eye lens to the retina. **1+2**

@PROCBSE JOIN NOW !

@PROCBSE

Long Answer Type Questions — 5 marks each

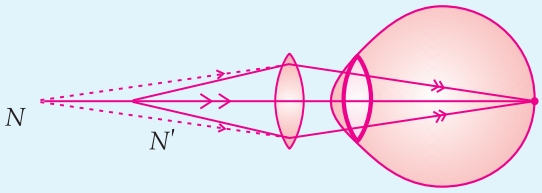
Q. 1. When do we consider a person to be myopic or hypermetropic ? List two causes of hypermetropia. Explain using ray diagrams how the defect associated with hypermetropic eye can be corrected.

R [CBSE Outside Delhi, Set-I, 2019]

Ans. Myopia: Difficult to see the objects placed far away.

Hypermetropia: Difficult to see very close or nearby objects. **1**

Causes of hypermetropia: (i) The focal length of the eye lens is too long (ii) eyeball has become too small. **[½ + ½]**



Note: Diagram with brief description –03 ; only correct diagram with labelling –2 or only explanation 01. [CBSE Marking Scheme, 2019] **3**

Q. 2. (a) Write the function of each of the following parts of human eye: Cornea, iris, crystalline lens, ciliary muscles. R

(b) Millions of people of the developing countries of world are suffering from corneal blindness. These persons can be cured by replacing the defective cornea with the cornea of a donated eye. A charitable society of your city has organized a campaign in your neighbourhood in order to create awareness about this fact. If you are asked to participate in this mission how would you contribute in this noble cause ?

(i) State the objective of organizing such campaigns.

(ii) List two arguments which you would give to motivate people to donate their eyes after death.

(iii) List two values which are developed in the persons who actively participate and contribute in such programmes. U [Delhi Set-I, 2016]

Ans. (a) (i) Cornea – Refracts the rays of light falling on the eye. ½

(ii) Iris – Controls the size of the pupil. ½

(iii) Crystalline lens – Focuses the image of the object on the retina. ½

(b) (i) Objectives – To make people aware and realize their duties towards society. **1**

(ii) One person can give sight to two people. ½

Our eyes can live even after our death. ½

(iii) Concern for others/ Responsible behaviour/ Group work/ or any other. **(Any two) 2×½**

[CBSE Marking Scheme, 2016]

Q. 3. (a) A student is unable to see clearly the words written on the black board placed at a distance of approximately 3 m from him. Name the defect of vision the boy is suffering from. State the possible causes of this defect and explain the method of correcting it. R

(b) Why do stars twinkle ? Explain.

AE [CBSE Delhi/O.D., 2018]

Ans. (a) Defect of vision – Myopia or short sightedness or near sightedness

Causes of myopia: (i) Excessive curvature of eye lens becomes more converging

(ii) Elongation of eyeball

Methods of correction: By the use of concave lens of suitable power or focal length the defect is corrected. It can be represented by a suitable diagrammatic representation.

(b) Due to Atmospheric refraction

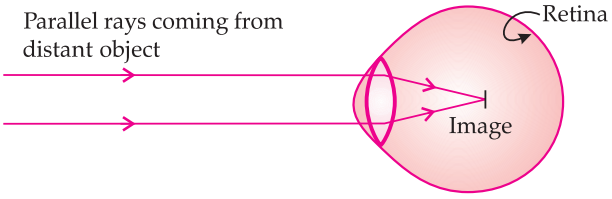
The density of different layers of air keep on changing due to which the apparent images of the stars keep on changing. This changing positions of stars appear as twinkling of stars.

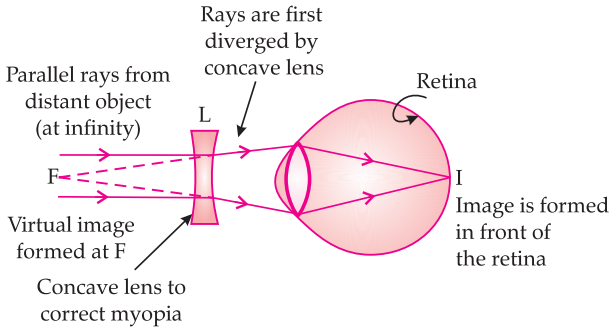
[CBSE Marking Scheme, 2018]

Detailed Answer:

(a) The defect is Myopia or short-sightedness *i.e.*, inability of an eye in viewing long distance objects. This defect is caused by elongation of eyeball and excessive curvature of the lens.

The short-sightedness is corrected by using a concave lens which diverges and shifts the image to the retina.





(b) Stars are very distant and approximately point-sized sources. Path of star light changes continuously due to gradual change in refractive index of the layers of earth's atmosphere. Thus, the apparent positions

@PROCBSE

of the stars fluctuate and the amount of star light entering the eye flicker giving the twinkling effect.

3 + 2

COMMONLY MADE ERROR

- Candidates generally get confused while drawing the ray diagram in the defects whether the image has to be drawn before or after retina.

ANSWERING TIP

- Candidates should remember that concave lens is used for correcting Myopia and also draw image before retina when Myopia is the eye defect.

AI **Q. 4. (a) Write the function of each of the following parts of human eye:**
(i) Cornea (ii) Iris
(iii) Crystalline lens (iv) Ciliary muscles

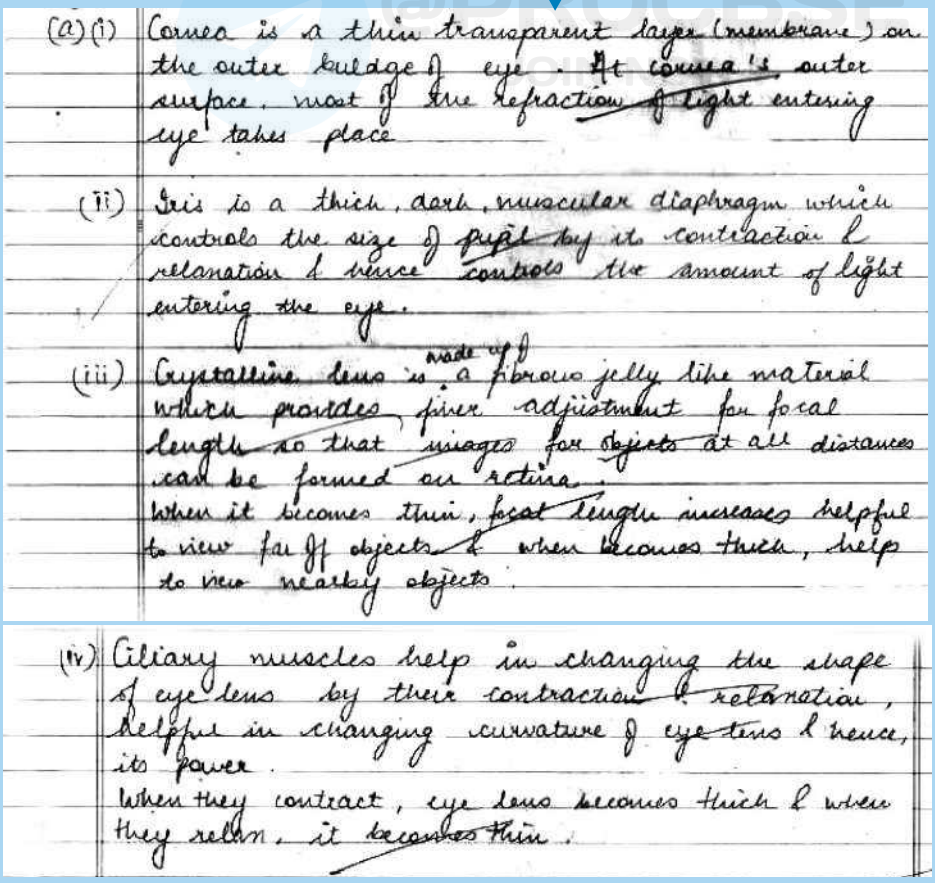
(b) Why does the sun appear reddish early in the morning ? Will this phenomenon be observed by an astronaut on the Moon ? Give reason to justify your answer. U **[CBSE Delhi/O.D., 2018]**

Ans. (a) Function of:
(i) Cornea: focuses light rays / permits the light to enter the eye.
(ii) Iris: Controls amount of light entering the eye and the size of pupil.
(ii) Crystalline Lens: Converges light rays at retina.
(iv) Ciliary Muscles: Adjusts focal length of eye lens by contraction and relaxation so that sharp image can be obtained on the retina. / helps in accommodation

(b) In early morning, sun light has to cover larger distance in the atmosphere. So, the shorter wavelengths scatter out. Only the longer wavelengths like red reach our eye.
On moon – No Cause: Moon has no atmosphere
[CBSE Marking Scheme, 2018] [5]

Detailed Answer:

Topper Answer, 2018

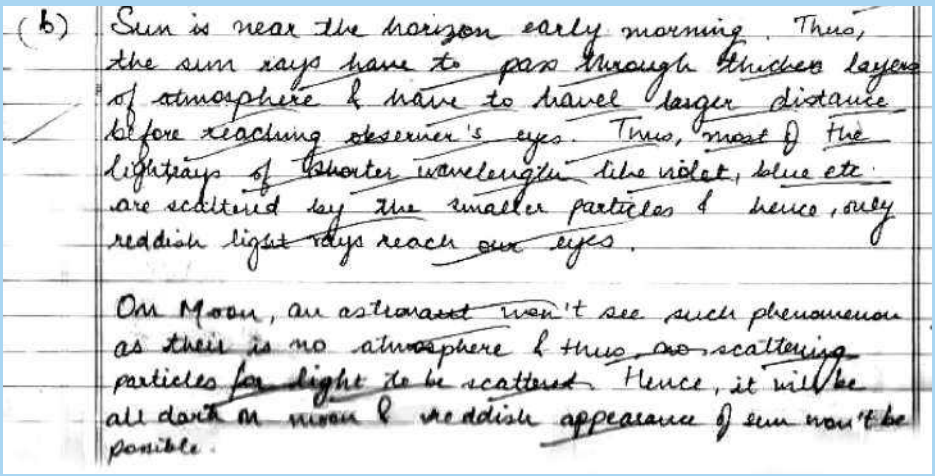

(a)(i) Cornea is a thin transparent layer (membrane) on the outer bulge of eye. At cornea's outer surface, most of the refraction of light entering eye takes place

(ii) Iris is a thick, dark, muscular diaphragm which controls the size of pupil by its contraction & relaxation & hence controls the amount of light entering the eye.

(iii) Crystalline lens is made of a fibrous jelly like material which provides finer adjustment for focal length so that images for objects at all distances can be formed on retina.
When it becomes thin, focal length increases helpful to view far off objects & when becomes thick, help to view nearby objects.

(iv) Ciliary muscles help in changing the shape of eye lens by their contraction & relaxation, helpful in changing curvature of eye lens & hence, its power.
When they contract, eye lens becomes thick & when they relax, it becomes thin.

@PROCBSE


(b) Sun is near the horizon early morning. Thus, the sun rays have to pass through thicker layers of atmosphere & have to travel larger distance before reaching observer's eyes. Thus, most of the light rays of shorter wavelength like violet, blue etc. are scattered by the smaller particles & hence, only reddish light rays reach our eyes.

On Moon, an astronaut won't see such phenomenon as there is no atmosphere & thus, no scattering particles for light to be scattered. Hence, it will be all dark on moon & reddish appearance of sun won't be possible.

Q. 5. (a) What is meant by the term 'power of accommodation' ? Name the component of eye that is responsible for the power of accommodation.

(b) A student sitting at the back bench in a class has difficulty in reading. What could be his defect of vision ? Draw ray diagrams to illustrate the image formation of the blackboard when he sit at the (i) back seat (ii) front seat. State two possible causes of this defect. Explain the method of correcting this defect with the help of a ray diagram. U **[SQP- 2018]**

Ans. (a) Power of accommodation: It is the ability of the eye lens to adjust its focal length.
Ciliary muscles of eye are responsible for change in its focal length.

(b) Myopia

Causes: (i) Excessive curvature of the eye lens
(ii) Elongation of eyeball

This defect can be corrected by using a concave lens of suitable power.
For ray diagram refer NCERT Page 189 figure 11.2 (a), (b) and (c) **[CBSE Marking Scheme, 2018] [5]**

@PROCBSE JOIN NOW !

Detailed Answer:

(a) The ability or the property of the eye lens to adjust its focal length in order to focus both near and distant objects is known as the power of accommodation.

The component of eye that is responsible for the power of accommodation is ciliary muscles because they are responsible for change in its focal length.

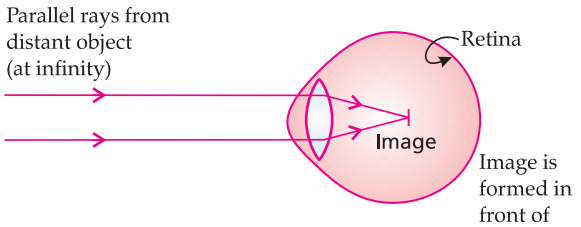
(b) The defect of vision is Myopia:

Causes of Myopia:

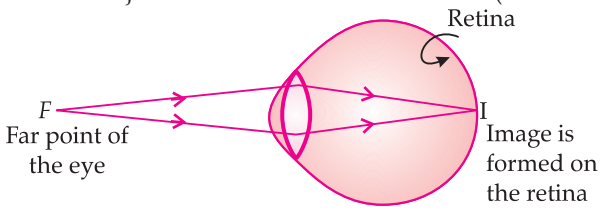
(i) Excessive curvature of the eye lens.

(ii) Elongation of eyeball.

To correct myopia the concave lens placed in front of the eye forms a virtual image of distant object at far point.

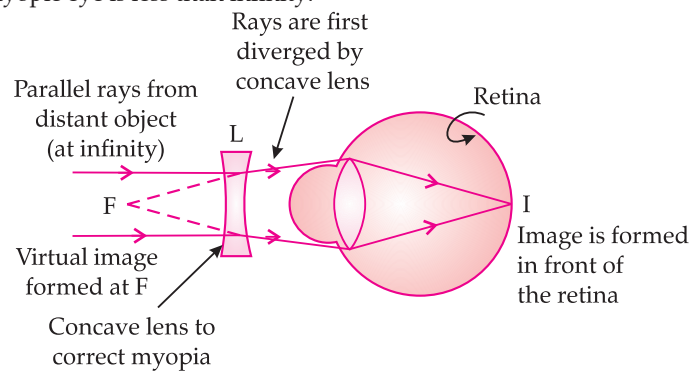


- In a myopic eye, image of distant object is formed in front of the retina (and not on the retina).



@PROCBSE

• The far point of a myopic eye is less than infinity.



Q. 6. (a) A student suffering from myopia is not able to see distinctly the objects placed beyond 5 m. List two possible reasons due to which this defect of vision may have arisen. With the help of ray diagrams, explain;

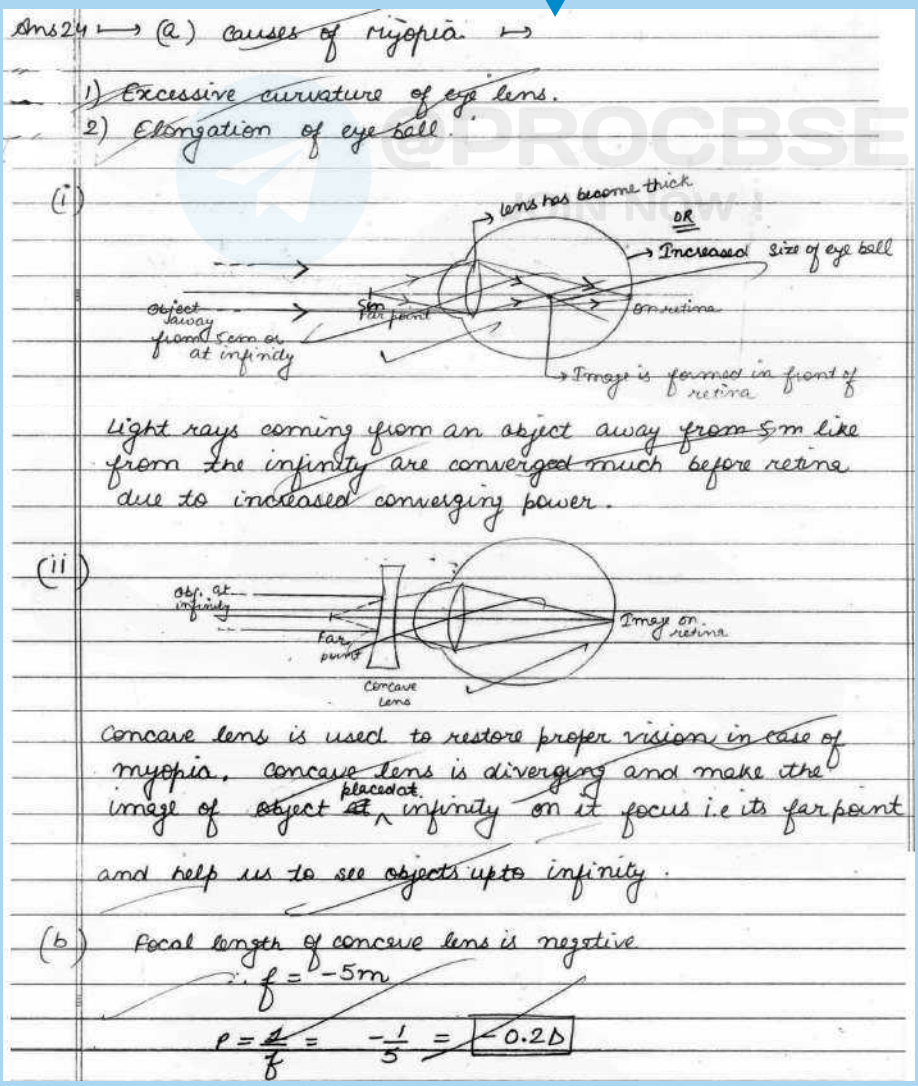
(i) Why the student is unable to see distinctly the objects placed beyond 5 m from his eyes.

(ii) The type of the corrective lens used to restore proper vision and how this defect is corrected by the use of this lens. U

(b) If, in this case, the numerical value of the focal length of the corrective lens is 5 m, find the power of the lens as per the new Cartesian sign convention. AE [OD 31/1 2017]

Topper Answer, 2017

Ans.



@PROCBSE

Detailed Answer:

(a) (i) The student is unable to see distinctly the objects placed beyond 5 m from his eyes as he is suffering from myopia *i.e.*, near-sightedness where is a person can see nearby objects clearly but cannot see distant objects distinctly.

(ii) Concave lens can be used as the corrective lens to restore proper vision. A concave lens of suitable power will bring the image back on to the retina and thus the defect is corrected.

(b) $u = -\infty, v = -5$ m

$$\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$$

$$= \frac{1}{-5} - \frac{1}{-\infty}$$

$$= \frac{1}{-5} - 0$$

$$f = -5 \text{ m}$$

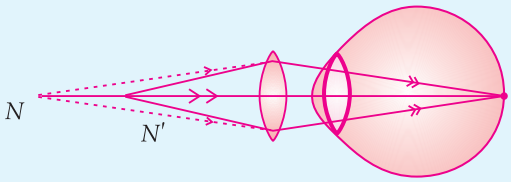
Then, $P = \frac{1}{f} = \frac{1}{-5} = -0.2$ D **5**

Q. 7. A person is unable to see distinctly the words printed on a newspaper. Name the defect of vision he is suffering from. Draw ray diagram to illustrate this defect. List its two possible causes. Draw a ray diagram to show how this defect may be corrected using a lens of appropriate focal length.

U [Delhi Comptt. 31/1/3 2017]

Sol. • Hypermetropia/ Long-sightedness **1**

• Defective eye

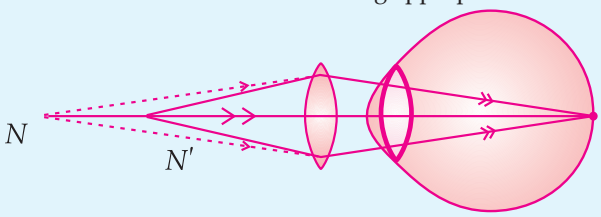


Two causes:

(i) The focal length of the eye lens is too long. **1**

(ii) The eyeball has become too small. **1**

• Correction of the defect using appropriate lens



[CBSE Marking Scheme, 2017]

Q. 8. (a) What is presbyopia ? State its cause. How is it corrected ?

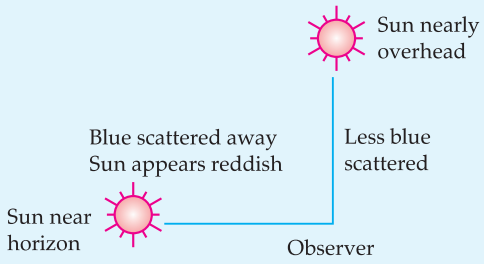
(b) Why does the Sun appear reddish early in the morning ? Explain with the help of a labelled diagram. A [CBSE Delhi Comptt. 31/1, 2018]

Ans. (a) Presbyopia: When a person is unable to see nearby as well as far off objects clearly.

Causes: Gradual weakening of the ciliary muscles/ diminishing flexibility of the eye lens.

Correction: By the use of bi-focal lenses. **1 × 3**

(b) Due to scattering of blue light/light of shorter wavelengths, light of longer wavelengths/ red component of light reaches our eyes. This gives reddish appearance of the sun. **1**



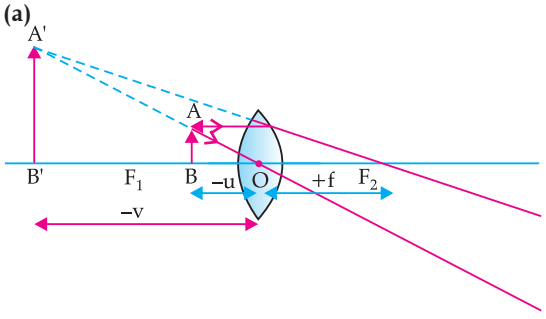
[CBSE Marking Scheme, 2018] **1**

Q. 9. (a) Draw a ray diagram to show the formation of image by a convex lens when an object is placed in front of the lens between its optical centre and principal focus.

(b) In the above ray diagram mark the object-distance (u) and the image-distance (v) with their proper signs (+ve or – ve as per the new Cartesian sign convention) and state how these distances are related to the focal length (f) of the convex lens in this case.

(c) Find the power of a convex lens which forms a real, and inverted image of magnification –1 of an object placed at a distance of 20 cm from its optical centre.

Ans. (a)



1

(b) Relation: $\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$

(c) $m = -1; u = -20$ cm; $v = ?, f = ?$

Marking of u & v ½ + ½

$$m = \frac{v}{u} \quad \text{½}$$

$\therefore$ $v = +20$ cm ½

Thus object is at 2F

i.e., $2f = 20$ cm

$\therefore$ $f = 10$ cm $= 0.1$m **1**

$$P = \frac{1}{f}$$

$$= \frac{1}{0.1} = +10 \text{ D} \quad \textbf{1}$$

@PROCBSE

TOPIC - 2
Refraction of Light through prism, Dispersion of Light and Scattering of Light

Revision Notes

Scan to know more about this topic
Dispersion by prism

- The phenomenon of splitting of white light into its constituent colours on passing through a glass prism is called **dispersion of light**.

  Concept Name: Spectrum
- Different colours undergo different deviations on passing through prism.
- If a second identical prism is placed in an inverted position with respect to the first prism, all the colours recombine to form white light.

Scan to know more about this topic
Rainbow formation

- **Atmospheric refraction** is the phenomenon of bending of light on passing through earth's atmosphere.
- As we move above the surface of earth, density of air goes on decreasing.
- Light travelling from rarer to denser layers always bends towards the normal.
- Stars twinkle on account of atmospheric refraction.
- Sun appears to rise 2 minutes earlier and set 2 minutes later due to atmospheric refraction.

Scan to know more about this topic
Scattering of Light

- The phenomenon in which a part of the light incident on a particle is redirected in different directions is called **scattering of light.**
- Very small particles scatter light of shorter wavelengths better than longer wavelengths.
- The scattering of longer wavelengths of light increases as the size of the particle increases.
- Larger particles scatter light of all wavelengths equally well.

@PROCBSE JOIN NOW !

Mnemonics

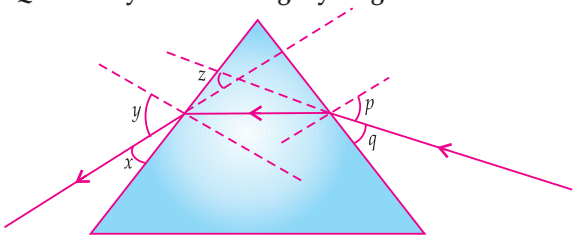
Concept: Complete Phenomenon of light	
Mnemonics: **VIBGYOR**	
Interpretation: **V - V**iolet **I - I**ndigo **B - B**lue **G - G**reen **Y - Y**ellow **O - O**range **R - R**ed	A prism causes dispersion, Stars twinkle due to refraction, Scattering causes redirection, All have their own attraction.

@PROCBSE

Objective Type Questions — 1 mark each

A Multiple Choice Questions

Q. 1. Study the following ray diagram :



In this diagram, the angle of incidence, the angle of emergence and the angle of deviation respectively have been represented by

(A) y, p **and** z **(B)** x, q **and** z
(C) p, y **and** z **(D)** p, z **and** y

[CBSE Board, All India Region, 2017]

Ans. Correct option : (c)

Explanation: The angle between the incident ray and the normal is known as the angle of incidence, and the angle between the emergent ray and the normal is known as the angle of emergence. The emergent ray is bent at an angle with the direction of the incident ray. This angle is called the angle of deviation.

Q. 2. Which of the following phenomena of light are involved in the formation of a rainbow?

(a) Reflection, refraction and dispersion
(b) Refraction, dispersion and total internal reflection
(c) Refraction, dispersion and internal reflection
(d) Dispersion, scattering and total internal reflection

[NCERT Exemp.]

Ans. Correct option : (c)

Explanation: Dispersion means white light getting segregated into its component colours. Refraction bends the incident light to an angle that causes internal reflection and finally rainbow is formed.

Q. 3. Twinkling of stars is due to atmospheric

(a) dispersion of light by water droplets
(b) refraction of light by different layers of varying refractive indices
(c) scattering of light by dust particles
(d) internal reflection of light by clouds

[NCERT Exemp.]

Ans. Correct option : (b)

Explanation: Due to refraction of light by different layers of varying refractive indices, the apparent position of source of light keeps on changing. So stars appear to twinkle.

Q. 4. At noon the sun appears white as

(a) light is least scattered.
(b) all the colours of the white light are scattered away.
(c) blue colour is scattered the most.
(d) red colour is scattered the most.

[NCERT Exemp.]

Ans. Correct option : (a)

Explanation: Sun is directly over the head and sunlight travel relatively shorter distance causing only little of the blue and violet colours to be scattered.

Q. 5. The clear sky appears blue because

(a) blue light gets absorbed in the atmosphere
(b) ultraviolet radiations are absorbed in the atmosphere
(c) violet and blue lights get scattered more than light of all other colours by the atmosphere
(d) light of all other colours is scattered more than the violet and blue colour light by the atmosphere

[NCERT Exemp.]

Ans. Correct option : (c)

Explanation: A clear cloudless day-time sky is blue because molecules in the air scatter blue light from the sun more than they scatter red light. Rayleigh scattering is inversely proportional to the fourth power of wavelength, so that shorter wavelength violet and blue light will scatter more than the longer wavelengths (yellow and especially red light).

B Assertions and Reasons Type Questions

Directions: In the following questions, a statement of assertion (A) is followed by a statement of reason (R). Mark the correct choice as:

(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).
(b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).
(c) Assertion (A) is true but reason (R) is false.
(d) Assertion (A) is false but reason (R) is true.

Q. 1. Assertion (A): A white light on passing through prism splits into its component colours as such that the red light emerges nearest to the base of the prism.

Reason (R): Wavelength of red light is more than other component colours and hence, red light deviates least.

Ans. Correct option : (d)

Explanation: Dispersion takes place because the refractive index of medium for different wavelengths (colours) is different. The refractive index is inversely proportional to λ

Since λ_{red} is more than other colours wavelength. So, deviation is least for red and it appears farthest from the base of the prism.

Q. 2. Assertion (A): Sunlight reaches us without dispersion in the form of white light and not as its components.

@PROCBSE JOIN NOW

Reason (R): Dispersion takes place due to variation of refractive index for different wavelength but in vacuum the speed of light is independent of wavelength and hence vacuum is a non-dispersive medium.

Ans. Correct option : (a)

Explanation: In vacuum speed of light is independent of wavelength. Hence, no dispersion takes places in vacuum. Thus, vacuum is a non-dispersive medium in which all colours travel with the same speed.

Q. 3. Assertion (A): In case of rainbow, light at the inner surface of the water drop gets internally reflected.

Reason (R): The angle between the refracted ray and normal to the drop surface is greater than the critical angle.

Ans. Correct option : (a)

Explanation: The rainbow is formed when light at the inner surface of the water drop gets internally reflected. If the angle between the refracted ray and normal to the drop surface is greater than the critical angle.

C Very Short Answer Type Questions

Q. 1. Why does the Sun appear white at noon? U
[CBSE Sample Question Paper 2021]

Ans. The light is least scattered at noon. Due to this reason, the Sun appears white at noon. **1**

Q. 2. Why does the sun appear reddish early in the morning? Will this phenomenon be observed by an astronaut on the Moon? Give reason to justify your answer. U

Ans. In early morning, sun light has to cover larger distance in the atmosphere. So, the shorter wavelengths scatter out. Only the longer wavelengths like red reach our eye. No, this phenomenon will not be observed as Moon has no atmosphere. **1**

Q. 3. What is meant by dispersion of light ?
R [Board Term II, Foreign Set-I, 2014]

Ans. The splitting of light into its component colours is called dispersion of light. **1**

AI **Q. 4. Name the component of white light that deviates the least and the most while passing through a prism.** R [Board Term II, 2012]

Ans. (i) Least deviation – Red. ½
(ii) Maximum deviation – Violet. ½
[CBSE Marking Scheme, 2012]

COMMONLY MADE ERROR

- Candidates get confused with the colours of VIBGYOR and the deviation of beam of light.

ANSWERING TIP

- Understand the concept of dispersion and deviation of light carefully.

AI **Q. 5. Name the type of particles which acts as a prism in the formation of rainbow in the sky.** R

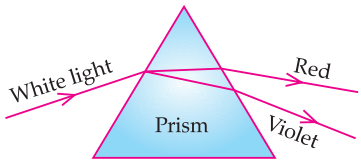
Ans. Water droplets present in the atmosphere. **1**

Q. 6. The sky appears dark to passengers flying at a very high altitude. Why ? C [Board Term II, 2012]

Ans. Due to lack of atmosphere, scattering is not prominent. **1**

Short Answer Type Questions-I — 2 marks each

Q. 1.

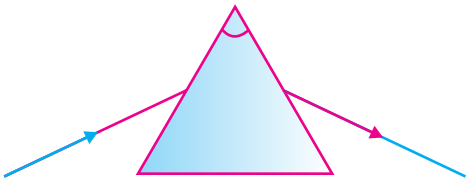


A student observes the above phenomenon in the lab as a white light passes through a prism. Among many other colours, he observed the position of the two colours Red and Violet.

What is the phenomenon called ? What is the reason for the violet light to bend more than the red light ?
R [CBSE Sample Question Paper 2020-21]

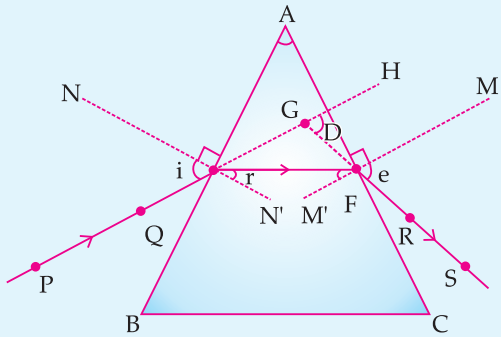
Ans. The phenomenon is called dispersion. **1**
Speed of violet light inside the prism is slowest and that of red is highest. Hence, deviation of violet light is maximum and that of red is minimum. **1**

Q. 2. A student traces the path of a ray of light through a glass prism as shown in the diagram, but leaves it incomplete and unlabelled. Redraw and complete the diagram. Also label on it $\angle i$, $\angle e$, $\angle r$ and $\angle D$.



AE [CBSE Outside Delhi Set-I, 2019]

Ans.



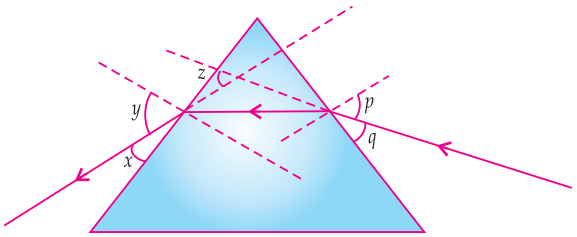
Labelling of $\angle i + \angle e + \angle r$ & $\angle D$
[CBSE Marking Scheme, 2019] ½ × 4

@PROCBSE

Detailed Answer:

The angle of incident is the angle made by the incident ray with the normal NN′. The angle of emergence is the angle made by the ray coming out of the prism with the normal. The emergent ray shifts from its original path of the incident ray. The angle by which the emergent ray is shifted is known as angle of deviation.

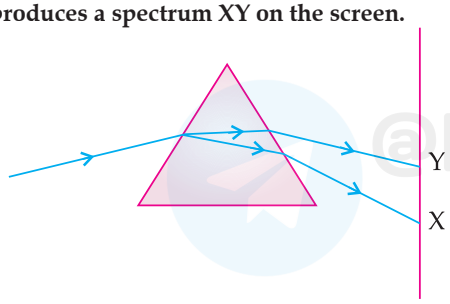
Q. 3. What is the value of angle of incidence, angle of emergence and angle of deviation from the following diagram? U



Ans. The angle between the incident ray and the normal is known as the angle of incidence,and the angle between the emergent ray and the normal is known as the angle of emergence. The emergent ray is bent at an angle with the direction of the incident ray. This angle is called the angle of deviation. Thus, the angle of incidence, angle of emergence and angle of deviation is p, y and z respectively. **1**

Short Answer Type Questions-II — 3 marks each

AI **Q. 1. In the figure given below, a narrow beam of white light is shown to pass through a triangular glass prism. After passing through the prism, it produces a spectrum XY on the screen.**



(i) Name the phenomenon.
(ii) State the colours seen at X and Y.
(iii) Why do different colours of white light bend at different angles through a prism?

R **[CBSE SQP, 2020]**

Ans. (i) The phenomenon is called dispersion.
(ii) X: Violet, Y: Red
(iii) Different colours of white light bend through different angles with respect to the incident beam of light due to difference in speed of light of different wavelengths. **[1+1+1]**

[CBSE Marking Scheme, 2020]

AI **Q. 2. (i) What is visible spectrum?**
(ii) Why is red used as the stopping light at traffic signals?
(iii) Two triangular glass prisms are kept together connected through their rectangular side. A light beam is passed through one side of the combination. Will there be any dispersion? Justify your answer. A, R **[Board SQP, 2020]**

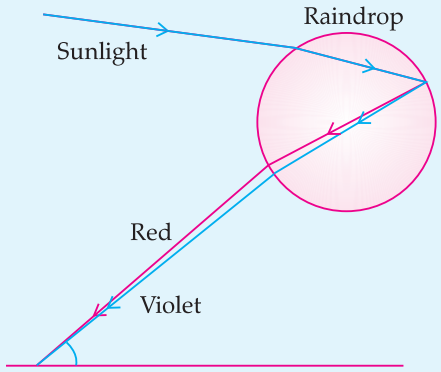
Ans. (i) Visible spectrum is the band of coloured components of a white light beam.
(ii) Red light is scattered the least by air molecules and has longer wavelength. It travels the longest distance.
(iii) The given setup will behave like a glass slab, resulting in recombination of the seven colours to produce white light. **1+1+1**

[CBSE Marking Scheme, 2020]

Q. 3. What is a rainbow ? Draw a labelled diagram to show the formation of a rainbow.

R **[CBSE Delhi, Set- I, 2019]**

Ans. Rainbow – A natural spectrum of sunlight appearing in the sky after a rain shower.



[1 + 2]

[CBSE Marking Scheme, 2019]

Q. 4. What happens to a beam of white light when it gets refracted through a glass prism ? Which colour deviates the most and the least after refraction through a prism ? What is likely to happen if a second identical prism is placed in an inverted position with respect to the first prism? Justify your answer.

U, R **[CBSE Outside Delhi, Set- III, 2019]**

Ans. The white light splits into seven colours when it gets refracted through the glass prism (VIBGYOR) **1**

The colour deviates most – Violet **[½]**

@PROCBSE JOIN NOW !

@PROCBSE

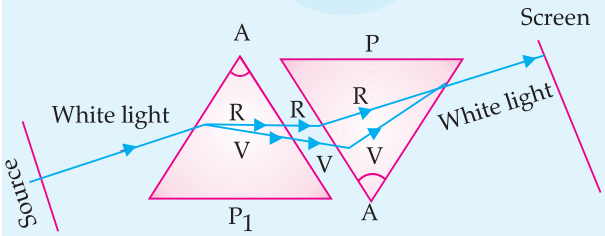
The colour deviates least – Red [½]
Colours disappear and again white light obtained.
[CBSE Marking Scheme, 2019] **1**

Detailed Answer:

When a beam of white light gets refracted through a glass prism, it refracts through different angles causing a splitting of white light into its seven constituent colours (VIBGYOR). This gives rise to the formation of the colour spectrum.
Violet colour deviates the most and red colour deviates the least after refraction through a prism. When a second identical prism is placed in an inverted position with respect to first prism, a beam of white light emerges from the other side of the second prism. The second prism recombines all the seven colours to give a beam of white light.

Q. 5. State the cause of dispersion of white light passing through a glass prism. How did Newton show that white light of sun contains seven colours using two identical glass prisms ? Draw a ray diagram to show the path of light when two identical glass prisms are arranged together in inverted position with respect to each other and a narrow beam of white light is allowed to fall obliquely on one of the focus of the first prism. U [Board Term II Delhi Set-III, 2016]

Ans. Cause of dispersion of white light: Different colours of light bend through different angles with respect to the incident ray as they pass through a prism.
Violet light bends the most and red the least. Thus, the each colour emerges along different paths. **1**



[CBSE Marking Scheme, 2016] **[2]**

COMMONLY MADE ERRORS

- (i) Correct diagram are not drawn by students.
(ii) The arrows are not marked.
(iii) Colours R and V are not marked properly.
(iv) Both prism are not drawn equally.

ANSWERING TIP

- Practice diagram with proper labels. Carefully read the question and answer all parts of the questions.

AI **Q. 6. What is meant by scattering of light ? The sky appears blue and the sun appears reddish at sunrise and sunset. Explain these phenomena with reason.** U [CBSE Term II Delhi Set-II, 2016]

Ans. (i) Scattering of light – Phenomenon of spreading of light (diffused reflection) by minute particles in a medium. **1**

(ii) The sky appears blue because the blue colour of sunlight scatters much more than the red colour by particles in atmosphere/ air due to its shorter wavelength. **1**

(iii) At sun-rise and sun-set most of the blue light and shorter wavelengths are scattered away by the particles in the atmosphere as the light from the sun near the horizon passes through thick layers of air and larger distance. The light that reaches us is of longer wavelength (red colour) giving a reddish appearance. **1**

[CBSE Marking Scheme, 2016]

Q. 7. How does refraction of light take place in the atmosphere ? Explain the reason why stars appear to twinkle and the planets do not twinkle.
U, C [Delhi Comptt. 31/1/2 2017]

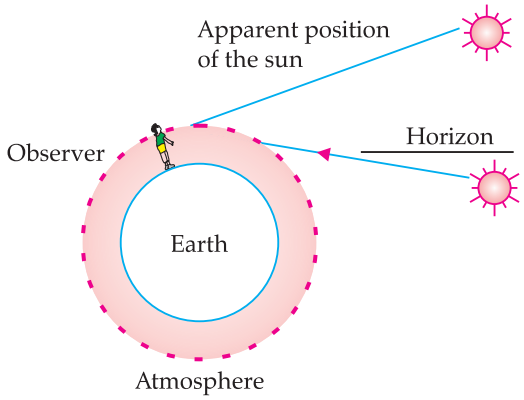
Ans. • Since the atmosphere consists of varying densities the apparent position of the object, as seen through the hot air fluctuates. This wavering of light is an effect on atmospheric refraction. **1**

• The twinkling of a star is due to atmosphere refraction of star light. The atmospheric refraction of light occurs in a medium of gradually changing refractive index.
The planets are much closer to the earth and thus seen as extended sources. A planet is considered as a collection of large number of point sized sources of light, the total variation in the amount of light entering our eye from all individual point sized sources will average out to zero, thereby nullifying the twinkling effect. **2**

[CBSE Marking Scheme, 2017]

Q. 8. Name the phenomenon responsible for the early sunrise and delayed sunset. Explain with the help of a diagram the reason why the sun is visible to us about 2 minutes before the actual sun-rise and about 2 minutes after the actual sunset.
U [OD Comptt. 31/2 2017]

Ans. Atmospheric refraction. [½]



[1½]

@PROCBSE

The sun is visible to us about 2 minutes before the actual sunrise, and about 2 minutes after the actual sunset because of atmospheric refraction. **1**

AI **Q. 9. Explain in brief the reason for each of the following:**

(i) The sun appears reddish during sun-rise.

(ii) At noon the sun appears white.

(iii) To an astronaut the sky appears dark instead of blue. U **[CBSE Term II, Foreign Set-III, 2016]**

Ans. (i) During morning, sun rays travel large distances in the earth's atmosphere, and in this process the shorter wavelengths scatter away and only large wavelength (red light) reaches us. **1**

(ii) At noon, sun is overhead and light rays travel comparatively smaller distance and only little of blue / violet light scatter, so sun appears white. **1**

(iii) There is no atmosphere in outer space for scattering, so sky appears dark. **1**

[CBSE Marking Scheme, 2016]

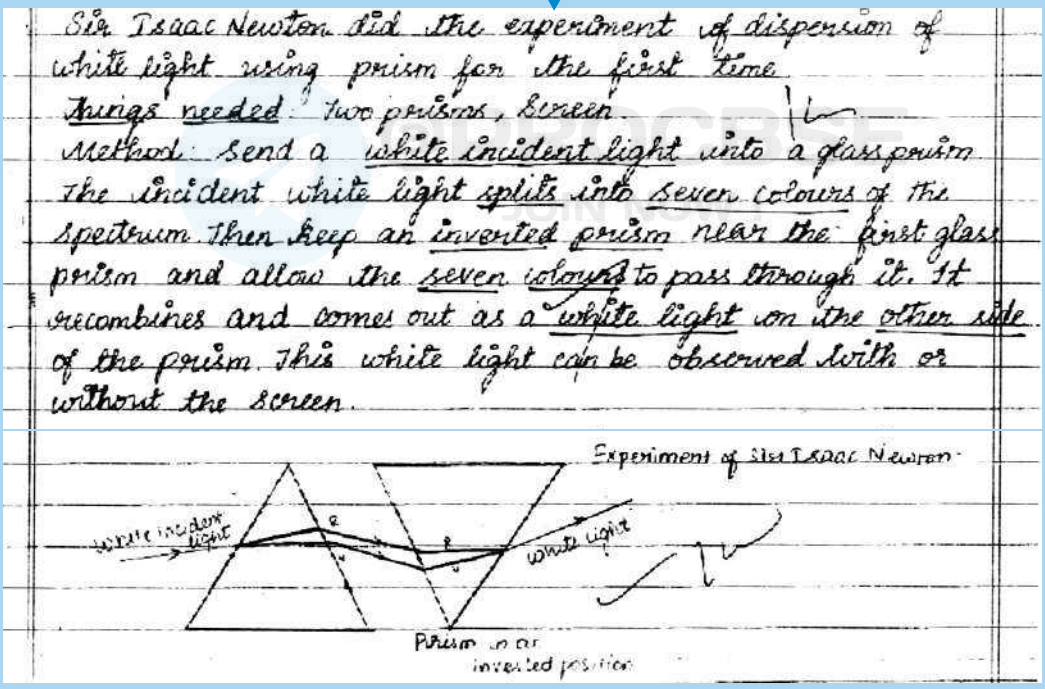
AI **Q. 10. Describe an activity to show that the colours of white light splitted by a glass prism can be recombined to get white light by another identical glass prism. Also, draw ray diagram to show the recombination of the spectrum of white light.** AE **[CBSE Term II O.D. Set-I, 2016]**

Ans. Description of activity: When a glass prism is used to obtain a spectrum of sunlight, a second identical prism in an inverted position with respect to the first position will allow all the colours of spectrum to recombine. Thus a beam of white light will emerge from the other side of the second prism. **1½**

For Diagram See Topic 2, S.A.T. Q./ Q. 5. **[CBSE Marking Scheme, 2016]** **1½**

OR

Topper Answer, 2016


Sir Isaac Newton did the experiment of dispersion of white light using prism for the first time.
Things needed: Two prisms, Screen.
Method: Send a white incident light into a glass prism. The incident white light splits into seven colours of the spectrum. Then keep an inverted prism near the first glass prism and allow the seven colours to pass through it. It recombines and comes out as a white light on the other side of the prism. This white light can be observed with or without the screen.

Long Answer Type Questions — 5 marks each

Q. 1. Why is Tyndall effect shown by colloidal particles? State four instances of observing the Tyndall effect. U **[CBSE Delhi, Set- I, 2020]**

Ans. Tyndall effect is shown by colloidal particles because the colloidal particles size are roughly equal to the wavelength of the light.

Four instances of observing tyndall effect are:

(i) In fog.

(ii) When light passes through canopy in forest.

(iii) Blue colour of the sky.

(iv) When light passes through the milk. **1+2**

Q. 2. Differentiate between a glass slab and a glass prism. What happens when a narrow beam of (i) a monochromatic light, and (ii) white light passes through (a) glass slab and (b) glass prism? R **[CBSE Delhi, Set- I, 2020]**

@PROCBSE

Ans. Difference between glass slab and glass prism:

Glass slab	Glass prism
It is rectangular in shape.	It has two triangular sides, two inclined rectangular sides and one rectangular base.
In this, the direction of incident ray and emergent ray of light are parallel to each other .	In this, the direction of incident ray and emergent ray of light are not parallel to each other.

When a narrow beam of monochromatic light passes through:

(a) Glass slab: It has deviated from the actual path but the direction of the incident ray and the emergent ray are parallel to each other.

(b) Glass of prism: It has deviated from the actual path but the direction of the incident ray and the emergent ray are not parallel to each other.

When a narrow beam of white light passes through:

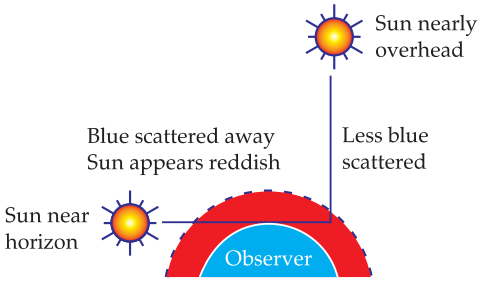
(a) Glass slab, it does not split into its constituent colour. The direction of incident ray and emergent ray of light are parallel to each other.

(b) Glass prism, it splits into its constituent seven colour. The direction of incident ray and emergent ray of light are not parallel to each other. **1+2=3**

Q. 3. Draw a labelled diagram to show (i) reddish appearance of the sun at the sunrise or the sunset and (ii) white appearance of the sun at noon when it is overhead. U **[CBSE Delhi, Set- I, 2020]**

Ans. (i) Reddish appearance of the sun at the sunrise and sunset:

At sun-rise and sun-set most of the blue light and shorter wavelengths are scattered away by the particles in the atmosphere as the light from the sun near the horizon passes through thick layers of air and larger distance. The light that reaches us is of longer wavelength (red colour) giving a reddish appearance.



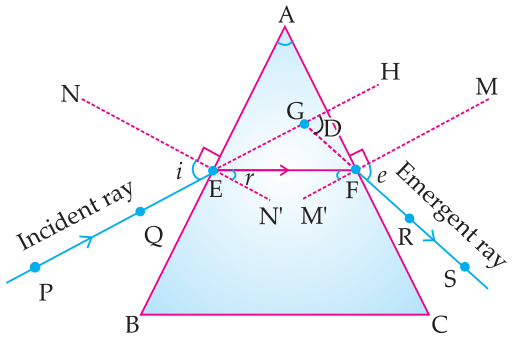
(ii) White appearance of the sun at noon when it is overhead: At noon, the sun is nearly overhead. The sunlight has to pass through much smaller portion of Earth's atmosphere. The scattering is much less and the Sun looks white. **1+1+1=3**

Q. 4. (a) With the help of labelled ray diagram show the path followed by a narrow beam of monochromatic light when it passes through a glass prism.

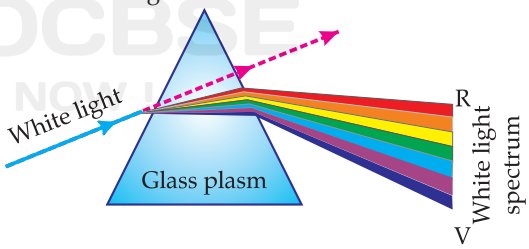
(b) What would happen if this beam is replaced by a narrow beam of white light ?

AE **[CBSE Outside Delhi Set I, 2020]**

Ans. (a) In case of monochromatic light, the ray will bend due to refraction but it will not show dispersion of light.



(b) If narrow beam of monochromatic light is replaced with beam of white light, a combination of narrow beam of seven colour will come out. The phenomenon of splitting of white light into its seven constituent colours when it passes through a glass prism is called dispersion of white light. The various colours seen are Violet, Indigo, Blue, Green, Yellow, Orange and Red. The different component colour of light bends at a different angle w.r.t the incident angle.



[2+1=3]

COMMONLY MADE ERROR

- Candidates get confused with the colours of VIBGYOR and the deviation of beam of light.

ANSWERING TIP

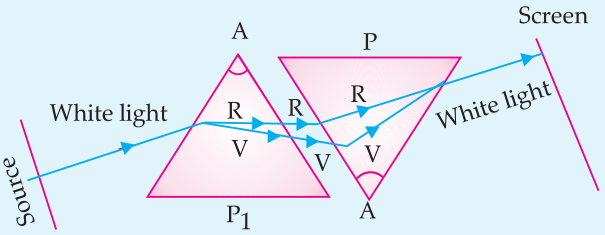
- Understand the concept of dispersion and deviation of light carefully.

Q. 5. State the cause of dispersion of white light by a glass prism. How did Newton, using two identical glass prisms, show that white light is made of seven colours ? Draw a ray diagram to show the path of a narrow beam of white light, through a combination of two identical prisms arranged together in inverted position with respect to each other, when it is allowed to fall obliquely on one of the faces of the first prism of the combination.

AE **[CBSE Outside Delhi Set I, 2017]**

@PROCBSE

Ans. Different colours of light bend through different angles with respect to the incident ray / different speed of different colours of light in glass / different values of refractive index of glass for different colours of light.



Direction of ray & labelling.

[CBSE Marking Scheme, 2017] **3**

COMMONLY MADE ERROR

- (i) Correct diagram are not drawn by students.
  (ii) The arrows are not marked.
  (iii) Colours R and V are not marked properly.
  (iv) Both prism are not drawn equally.

ANSWERING TIP

- Practice diagram with proper labels. Carefully read the question and answer all parts of the questions.

Q. 6. (a) What is scattering of light ? Explain how the colour of the scattered light depends on the size of the scattering particles.

(b) Explain the reddish appearance of the Sun at sunrise or sunset. Why does it not appear red at noon ? R [CBSE Outside Delhi, Set- II, 2019]

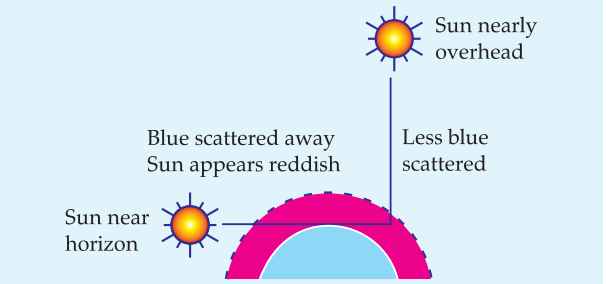
Ans. (a) Scattering: Direction of ray of light changes when it collides with particles of comparable size. **1**

- Fine particle scatter shorter wavelengths like blue light.
- Particles of larger size scatter longer wavelengths like red light.
- If particle size is large enough scattered light may appear white. **[½ × 3]**

(b)

- During sunrise and sunset, sun is near horizon. Sunlight travels longer distance. Most of blue light scatters away by particles. Light of longer wavelength reaches our eye so sun appears reddish.
- At noon, sun is directly overhead so sunlight travels lesser distance. Less amount of blue light is scattered giving white appearance to sun. **[½ × 3]**

Or can be explained with the help of a diagram given below:



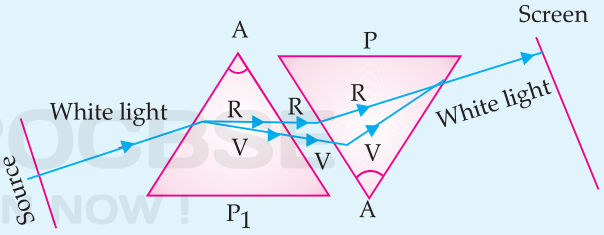
(One Mark with correct labelling) 1

[CBSE Marking Scheme, 2019]

Q. 7. What is "dispersion of white light" ? Draw a labelled diagram to illustrate the recombination of the spectrum of white light. Why is it essential that the two prisms used for the purpose should be identical and placed in an inverted position with respect to each other ? [CBSE Outside Delhi Set III, 2017]

Ans.

- Splitting of white light into seven colours. **1**
- Because the refraction / bending produced by second prism is equal to the refraction / bending produced by the first prism. **1**

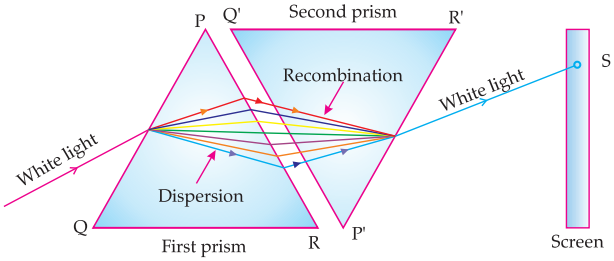


1

[CBSE Marking Scheme, 2017]

Detailed Answer:-

The phenomenon of splitting of white light into its constituent seven colours on passing through a glass prism is called dispersion of light.



It is essential that the two prisms used should be identical and placed in an inverted position with respect to each other because the extent of refraction produced by second prism is equal to the refraction produced by the first prism. The second prism acts in the opposite sense than that of the first one. **[3]**

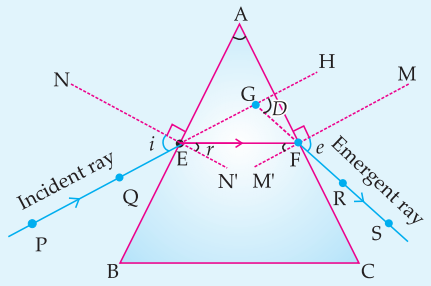
AI **Q. 8. (a) Draw a ray diagram to explain the term angle of deviation.**

(b) Why do the component colour of incident white light split into a spectrum while passing through a glass prism, explain.

@PROCBSE

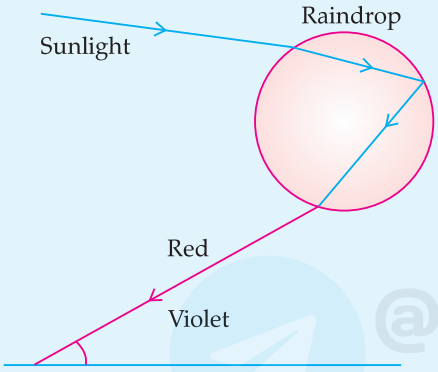
(c) Draw a labelled ray diagram to show the formation of a rainbow. A, AE **[Delhi 31/1/1 2017]**

Ans. (a)



(b) Different colour of white light bend through different angles with respect to the incident light, as they pass through the glass prism. Thus, each colour emerges along a different path, forming a spectrum. **1**

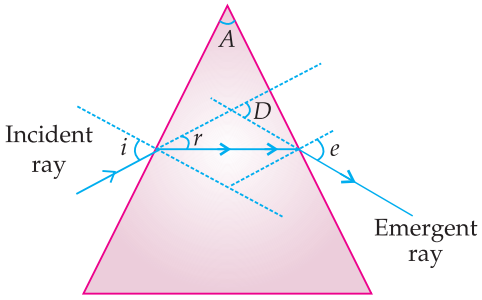
(c)



[CBSE Marking Scheme, 2017]

Detailed Answer:

(a) Emergent ray bends at an angle to the direction of the incident ray and the angle between them is known as angle of deviation.



(b) When a beam of light enters a prism, it gets refracted and splits into its constituent colours. This splitting of the light ray occurs because of the different angles of bending of each colour. Hence, each colour passing through the prism bends at different angles with the respect to the incident beam. This gives rise to the formation of the colour spectrum.

(c) Same as in Marking Scheme Answer.

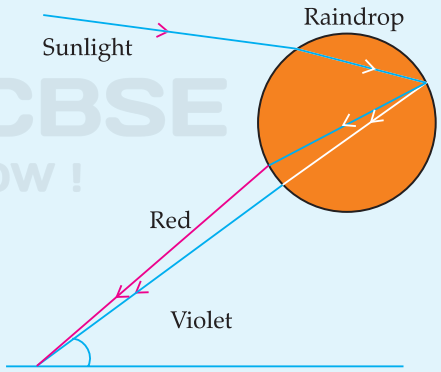
Q. 9. (i) What is dispersion of white light ? State its cause.

(ii) "Rainbow is an example of dispersion of sunlight." Justify this statement by explaining, with the help of a labelled diagram, the formation of a rainbow in the sky. List two essential conditions for observing a rainbow. R, AE **[CBSE Term II Foreign-I, 2016]**

Ans. (i) Definition of Dispersion: Splitting of white light into seven constituent colours by a prism. **1**

Cause of dispersion: When white light passes through a glass prism, different constituent colours bend through different angles with respect to the incident ray and hence are separated. **1**

(ii)



2

Conditions for observing a rainbow:

(a) after the rainfall/ at a water fountain.

(b) sun is at the back of the observer. ½ + ½

[CBSE Marking Scheme, 2016]

Q. 10. What is atmospheric refraction ? Use this phenomenon to explain the following natural events. U, A **[CBSE Term II O.D. Set-I, 2016]**

(i) Twinkling of stars.

(ii) Advanced sun-rise and delayed sun-set.

Draw diagrams to illustrate your answers.

@PROCBSE JOIN NOW !

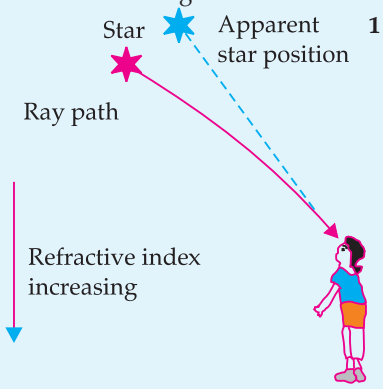
@PROCBSE

Ans. **Atmospheric refraction:** Refraction of light caused by the earth's atmosphere due to change in the refractive indices of different layers.

(i) Twinkling of stars: Stars are distant point sized source of light. The path of the rays of light coming from the star goes on varying due to atmospheric refraction slightly. Thus apparent position of the stars fluctuates and the amount of star light entering the eye flickers giving the twinkling effect. **1**

(ii) Advanced sun-rise: When the sun is slightly below the horizon, light rays coming from the sun travel from the rarer to denser layers of air. Because of atmospheric refraction of light, light appears to come from a higher position above the horizon. Thus sun appears earlier than actual sunrise. **1**

Delayed sunset: Same reason as similar refraction occurs at the sunset.



1

[CBSE Marking Scheme, 2016] **1**

OR

Topper Answer, 2016

The refraction of light rays when it passes through the atmosphere bend towards the normal and reaches us. This atmosphere is phenomena of refraction in the atmosphere is called atmospheric refraction.

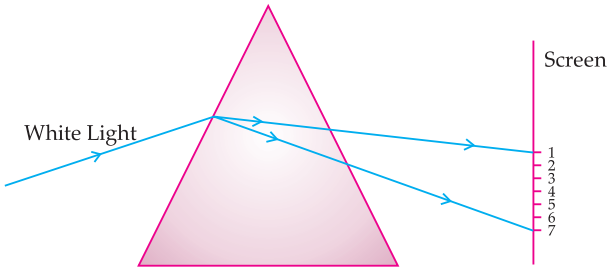
(a) Twinkling of Stars

The starlight on entering the atmosphere undergoes refraction completely and continuously. It bend towards the normal. Since, the atmosphere is not stationary, the apparent position of Star changes. It appears slightly higher up. The amount of starlight that enters the

@PROCBSE

Visual Case-based Questions — 4 marks each

1. A narrow beam of white light is passing through a glass prism as shown in the diagram. Study the diagram and answer any four questions from (a) to (e).



(a) The phenomenon observed in above set-up is

(i) scattering of light **(ii) dispersion of light**

(iii) reflection of light **(iv) refraction of light**

(b) In nature, this phenomenon is observed in

(i) Formation of rainbow **(ii) Twinkling of stars**

(iii) Blue colour of sky **(iv) Advance sunrise**

(c) Which of the following statement is correct about constituents of white light based on above observations?

(i) White light consists of seven colours.

(ii) Violet colour suffers minimum deviation.

(iii) Red light suffers maximum deviation.

(iv) All the colours of the white light move with different speed in vacuum.

@PROCBSE

(d) The cause of dispersion of light is

(i) All the colors of light travel with the speed more than the speed of light.

(ii) All the colors have different angles of deviation.

(iii) All the colors do not travel with the same speed of light.

(iv) All the colors have the same wavelength .

(e) Read the following statements carefully

(I) The prism behaves same as that of rectangular glass slab.

(II) All the colours have different angles of deviation in case of dispersion through prism.

(III) All the colours travel with the same speed of light in glass.

(IV) Dispersion of light is observed in case of rectangular glass slab.

Which of the above statement/s is true?

(i) Only II **(ii) I and II only**

(iii) I, II and IV only **(iv) All of the above**

Ans. (a) (ii) Dispersion of light.

Explanation: The phenomenon of splitting of white light into its constituent colours after passing through a prism is called as dispersion of light. When the light enters the prism, all the colours have different speeds due to which its gets split into bands.

(b) (i) Formation of rainbow

Explanation: Rainbow is caused by dispersion of sunlight by tiny water droplets present in the atmosphere which is one of the application of dispersion of light.

(c) (i) White light consists of seven colours.

Explanation: When the light disperses, various bands of light are clearly visible. It is clear from the figure that the violet light suffers maximum deviation and red light suffers minimum deviation. All the colours of the white light move with the same speed in air or vacuum but with different wavelengths and frequencies.

(d) (iii) All the colours do not travel with the same speed of light

Explanation: The various colours of white light have different extent of refraction in a medium. All of colours of light do not travel with same speed in the medium which is the cause of dispersion of light.

(e) (i) Only II

Explanation: A prism is made up of glass in which the faces are joined at a certain angle but in case of rectangular glass slab, the opposite faces are parallel to each other. As the light enters in the prism, all the colours travel with the different speed of light because glass is a denser medium as compared to air and dispersion of light is not observed in case of a rectangular glass slab. So, both prism and rectangular glass slab behave differently.

Q. 2. Read the passage on human eye and answer any four questions from (a) to (e).

Eye is a natural optical device by which human could see objects around him. It forms an inverted, real image on a light sensitive surface. It works on the phenomenon of refraction of light through a natural convex lens. However, Meena was unable to see clearly the words written on the black board placed at a distance of approximately 3 m from her. Her mother discussed the same with the doctor. Doctor explained her about this defect of vision and its correction.

(a) The human eye forms the image of the object at its

(i) Cornea **(ii) Iris**

(iii) Pupil **(iv) Retina**

(b) What kind of defect Meena is suffering from?

(i) Myopia **(ii) Hypermetropia**

(iii) Astigmatism **(iv) Malnutrition**

(c) The possible cause this defect is

(i) eye ball is of same size

(ii) eye ball becomes long

(iii) eye ball becomes small

(iv) None of the above

(d) The closest distance up to which a person can see without any strain in the eyes

(i) 35 cm **(ii) 15 cm**

(iii) 5 cm **(iv) 25 cm**

(e) The defective eye of a person has near point 0.5 m and far point as 3 m. The power of both lens required for reading purpose and seeing far off objects is

(i) 0.75 D and +4 D **(ii) +2D and – 1/3 D**

(iii) – 2.5D and + 1/8D **(iv) 0.85 D and – 2 D**

@PROCBSE JOIN NOW!

@PROCBSE

Ans. (a) (iv) Retina

Explanation: The retina in the human eye consists of contains a large number of light-sensitive cells which help in the organization of visual information. Thus, the retina helps in sending information to the brain due to which a person is able to see.

(b) (i) Myopia

Explanation: Meena was unable to read the words written on the blackboard i.e. she could see the nearby objects clearly but was unable to see the far off objects. Thus, she was suffering from Myopia

(c) (ii) eye ball becomes long

Explanation: The excessive curvature of eye lens becomes more converging and it results in the elongation of eye ball due to which a person suffers from Myopia.

(d) (iv) 25 cm

Explanation: A normal eye is not able to see distinctly the objects placed closer than 25 cm, without putting any strain on the eye. This is because the ciliary muscles of eyes are unable to contract beyond a certain limit. If the objects are placed at a distance less than 25 cm from the eye, then the objects appear blurred because light rays coming from the object meet beyond the retina.

(e) (ii) +2D and – 1/3 D

Explanation: Let the object distance = u

image distrance = v

$u = -25$ cm, $v = 0.5$ cm, $m = -50$ cm

Using Lens formula

$$\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$$

$$= \frac{1}{-50} - \frac{1}{-25}$$

$$= \frac{1}{50}$$

$$\therefore P = \frac{100}{f(\text{cm})} = 100 \times \frac{1}{50} = +2\text{D}$$

If the distance objects are taken into consideration

$$u = \infty, v = -3 \text{ m}$$

Using Lens formula

$$\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$$

$$= \frac{1}{-3} - \frac{1}{\infty}$$

$$= -\frac{1}{3}$$

$$\therefore \quad P = \frac{1}{f(\text{m})} = -\frac{1}{3}\text{D}$$

@PROCBSE JOIN NOW !

Know the Terms

- **Range of Vision:** The distance between far point and near point of the eye is called the range of vision.
- **Accommodation:** The ability of an eye lens to adjust its focal length by the action of ciliary muscles to get a clear and sharp image of the distant object as well as nearby object is called accommodation. For a person having normal vision, it is about 4 diopter.
- **Power of Accommodation:** The maximum variation in the converging power (focal length) of eye lens so that the far–off and nearby objects are viewed clearly is called power of accommodation.
- **Persistence of vision:** The time for which the impression or sensation of an object continues in the eye is called the persistence of vision. It is about $1/16^{th}$ of a second.
- **Prism:** Prism is a homogenous, transparent, refracting material, such as glass, enclosed by two inclined plane refracting surfaces, at some fixed angle, called refracting angle or angle of prism. It has two triangular bases and three rectangular lateral surfaces which are inclined to each other.
- **Angle of Refraction:** The angle between the refracted ray and the normal is called angle of refraction ($\angle r$).

@PROCBSE

- **Angle of Emergence:** The angle between the emergent ray and normal at the second refracting face of the prism is called angle of emergence ($\angle e$).
- **Angle of Deviation:** The angle formed between the incident ray produced in the forward direction and emergent ray produced in the backward direction in the refraction through the prism is called angle of deviation ($\angle \delta$).
- **Tyndall effect:** The phenomenon of scattering of light by the colloidal particles is known as tyndall effect.

OSWAAL LEARNING TOOL
To learn from Oswaal Concept Video
Visit: http:qrgo.page.link OR Scan this code

❑❑❑

@PROCBSE
JOIN NOW !

@PROCBSE

SELF ASSESSMENT TEST - 3

Maximum Time: 1 hour **MM: 25**

Q. 1. What is the reason due to which the planets do not twinkle? **1**

Q. 2. What is tyndall effect? **1**

Q. 3. What is the relationship between wavelength of a particular colour and extent of bending through a prism? **1**

Q. 4. Directions : In the following questions, a statement of assertion (A) is followed by a statement of reason (R). Mark the correct choice as :

(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

(b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).

(c) Assertion (A) is true but reason (R) is false.

(d) Assertion (A) is false but reason (R) is true. 1

Q. 5. (i) Define dispersion of light

(ii) List the colours into which it splits in the decreasing order of their bending on emergence from the prism. **2**

Q. 6. What is the reason for scattering of light? Explain this phenomenon with an example. **2**

Q. 7. Define angle of deviation. Why do different components of white light split up into spectrum when it passes through a triangular glass prism Show the angle of deviation for red colour when white light passes through a prism. **3**

Q. 8. (a) Name the type of particles which acts as a prism in the formation of rainbow in the sky.

(b) Name the component of white light that deviates the least and the most while passing through a prism.

(c) On which factor does the colour of the scattered white light depend? **1+1+1**

Q. 9. (a) Describe an activity along with a labelled diagram the phenomenon of dispersion through a prism.

(b) Explain in brief the formation of rainbow with the help of figure. **5**

Q. 10. (a) (i) What should be the range of distance of object if we desire to obtain an erect image of an object using focal length of 20 cm. **1**

(ii) State the size of the image. ½

(iii) Draw a ray diagram to show the image formation in the above case. **1**

(b) Now, if the one half of the convex lens of focal length 20 cm is covered with black paper?

(i) Will a complete image will be formed by lens? ½

(ii) Draw a ray diagram to show the formation of image when object is placed at $2F_1$ using the covered lens as discussed above. **1**

(iii) How will the intensity of image changes on using covered lens? **1**



@PROCBSE

Electricity

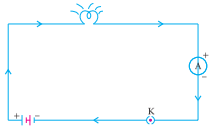
Electric Current

Electric current $= \frac{\text{Charge}}{\text{Time}}$ or $I = \frac{Q}{t}$

It's SI unit is ampere, denoted by 'A'

Electric Circuit

The closed path along which an electric current flows.



Ohm's Law

$V = IR$

Where R is a constant called as resistance

Resistance

$R = V/I$

Resistance in Parallel Combination

$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$

Resistance in Series Combination

$R = R_1 + R_2 + R_3$

Power

$P = VI = V^2/R = I^2R$

Rate at which electrical energy denoted is dissipated

Unit (Watt)

Commercial unit of electrical energy

kWh (kilo watt hour)

Commercial 1 kWh = 3.6×10^6 J = 1 unit

Electric Potential or Potential difference

Work done to move a unit charge from one point to another

Factors on which the Resistance of a Conductor depends

Length $R \propto l$

Area of cross section $R \propto \frac{1}{A}$

Temperature $R \propto T$

Nature of the material

Danger of mishandling electrical appliances

- Electrocution
- Electrical Shock
- Explosion
- Fire

Resistivity

$\rho = R \frac{A}{l}$

SI unit = Ohm-meter(Ω.m)

It depends upon the nature of the material

Joule's Law Heating effect

$H = I^2Rt = VIt$

1 cal = 4.18J

Symbols of components of circuit diagram

Variable Resistance

Resistor

Wire crossing

Wire joint

Cell

Dry cell

Bulb

Switch

Wire

Fuse-wire

Trace the Mind Map

First Level · Second Level · Third Level

@PROCBSE

UNIT IV: EFFECTS OF CURRENT

CHAPTER 12

ELECTRICITY

Syllabus

Electric current, potential difference and electric current, Ohm's law; Resistance, Resistivity, Factors on which the resistance of a conductor depends. Series combination of resistors, parallel combination of resistors and its application in daily life, Heating effect of electric current and its applications in daily life, Electric power, Interrelation between P, V, I and R.

Trend Analysis

@PROCBSE JOIN NOW !

List of Concepts	2018	2019		2020	
	OD/D	OD	D	OD	D
Electric Current, Potential difference, Galvanometer, ammeter, voltmeter			1 Q (1 M)	2 Q (1 M)	2 Q (3 M)
Ohm's Law, Resistance, Resistivity, Factors on which the resistance of a conductor depends, alloys	1 Q (3 M)				
Series combination of resistors, parallel combination of resistors	1 Q (3 M)	1 Q (5 M) Or 1 Q (5 M)	1 Q (5 M)	1 Q (5 M)	1 Q (1 M)
Heating Effect of Electric Current, Electric Power.	Or 1 Q (3 M)	1 Q (1 M)	Or 1 Q (5 M)	1 Q (5 M)	

TOPIC - 1
Electric Current, Ohm's Law

Revision Notes

- **Static and Current Electricity:** Static electricity deals with the electric charges at rest while the current electricity deals with the electric charges in motion.
- **Electric Current:** The electric current is defined as the rate of flow of electric charge through any cross section of a conductor.

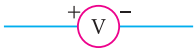
$$\text{Electric current} = \frac{\text{Charge}}{\text{Time}} \quad \text{or} \quad I = \frac{Q}{t}$$

TOPIC - 1
Electric Current, Ohm's Law
Page No. 307

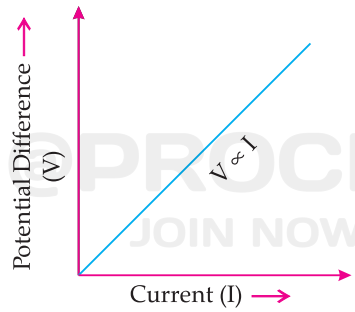
TOPIC - 2
Resistance in Series and Parallel Combination, Electric Power and Heating Effect
Page No. 317

@PROCBSE

- Electric current is a scalar quantity.
- **Ampere:** It is the SI unit of current. If one coulomb of charge flows through any cross-section of a conductor in one second, then current through it is said to be one ampere.
- **Electric circuit:** The closed path along which an electric current flows is called an 'electric circuit'.
- **Conventional direction of current:** Conventionally, the direction of motion of positive charges through the conductor is taken as the direction of current. The direction of conventional current is opposite to that of the negatively charged electrons.
- **Electrochemical or voltaic cell:** It is a device which converts chemical energy into electrical energy.
- **Galvanometer:** It is a device to detect current in an electric circuit.
- **Ammeter:** It is a device to measure current in a circuit. It is a low resistance galvanometer and is always connected in series in a circuit.
- **Voltmeter:** It is a device to measure the potential difference. It is a high resistance galvanometer and is always connected in parallel to the component across which the potential difference is to be measured. Symbol is,



- **Ohm's Law:** The current through a conductor between two points is directly proportional to the voltage across the two points provided external conditions remain constant.
  - **(i) Mathematical expression for Ohm's law:**
    $I \propto V$
    $V = IR$ (Where R = Resistance)
  - **(ii) *V-I* graph for Ohm's law:**



Scan to know more about this topic
Electric current

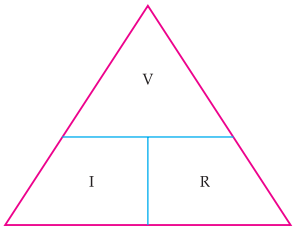
@PROCBSE JOIN NOW !

- **Resistance (*R*):** It is the property of a conductor to resist the flow of charges through it.
  - **(i)** S.I. unit of resistance is Ohm (Ω).
  - **(ii)** 1 ohm = $\frac{1 \text{ volt}}{1 \text{ ampere}}$
- When potential difference is 1 V and current through the circuit is 1 A, then resistance is 1 ohm.
- **Rheostat:** Rheostat is a variable resistor used to regulate current without changing the source of voltage.
- **Factors on which the Resistance of a Conductor depends:** Resistance of a uniform metallic conductor is,
  - **(i)** Directly proportional to the length of conductor
  - **(ii)** Inversely proportional to the area of cross-section
  - **(iii)** Directly proportional to the temperature
  - **(iv)** Depends on nature of the material.
- **Resistivity (ρ):** It is defined as the resistance offered by a cube of a material of side 1 m when current flows perpendicular to its opposite faces.
  - **(i)** Its S.I. unit is ohm-metre (Ωm).
  - **(ii)** Resistivity does not change with change in length or area of cross-section but it changes with change in temperature.
  - **(iii)** Range of resistivity of metals and alloys is 10^{-8} to 10^{-6} Ωm.
  - **(iv)** Range of resistivity of insulators is 10^{12} to 10^{17} Ωm.
  - **(v)** Resistivity of alloy is generally higher than that of its constituent metals.
  - **(vi)** Alloys do not oxidize (burn) readily at high temperature, so they are commonly used in electrical heating devices.
  - **(vii)** Copper and aluminium are used for electrical transmission lines as they have low resistivity.

@PROCBSE

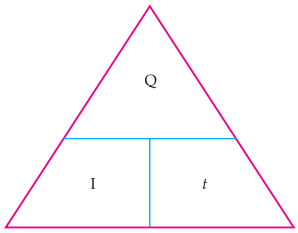
Mnemonics

Concept: Ohm's Law



Interpretation:
To find V=Multiply I and R
To find I=Divide V and R
To find R=Divide V and I

Concept: Current Formula



Interpretation:
I=Q/t
Q=I x t
t=Q /I

Concept: Connection of ammeter and voltmeter

Mnemonics: **m Sleeping Very Patiently**

Interpretation:
Ammeter is connected in **S**eries
Voltmeter is connected in **P**arallel

How is it done on the GREENBOARD?

Q. Calculate the resistance of a 1 km long copper wire of area of corss section 2×10^{-2} cm^2. The restivity of copper is 1.623×10^{-8} ohm-meter.

Solution:

Step I: $R = \rho \frac{L}{A}$

where R = Resistance of the wire
L = Length of the were
A = Area of cm section of the wire

Step II: $\rho = 1.623 \times 10^{-8}$ ohm-meter
$L = 1$ km $= 1000$ m
$A = 2 \times 10^{-2}$ cm^2 $= 2 \times 10^{-2} \times 10^{-4}$ m^2

Step III: $R = \rho \frac{L}{A}$

or $R = 1.623 \times 10^{-8} \times \frac{1000}{2 \times 10^{-2} \times 10^{-4}}$

$\therefore$ $R = 8.1\ \Omega$

Objective Type Questions — 1 mark each

A Multiple Choice Questions

Q. 1. A cylindrical conductor of length 'l' and uniform area of cross section 'A' has resistance 'R'. The area of cross section of another conductor of same material and same resistance but of length '2l' is

(a) $\frac{A}{2}$ **(b)** $\frac{3A}{2}$ **(c)** 2 A **(d)** 3 A [OD CBSE, 2020]

Ans. Correct option: (c)

Explanation : Resistivity of the conductor in the first case, $\rho = \frac{RA}{l}$ ...(i)

Resistivity of the conductor in second case,

$\rho = \frac{RA'}{2l}$ ...(ii)

@PROCBSE

Since, both conductors are of same material and are at same temperature, so the resistivity of both the conductors will be same.

Therefore, from equations, (i) and (ii), we have :

$$\Rightarrow \frac{RA}{l} = \frac{RA'}{2l}$$

$$\Rightarrow A' = 2A$$

Q. 2. The maximum resistance which can be made using four resistor each of resistance ½Ω is

(a) 2 Ω **(b)** 1 Ω

(c) 2.5 Ω **(d)** 8 Ω [OD CBSE, 2020]

Ans. Correct option: (a)

Explanation : Maximum resistance in series = 4 x ½ = 2ohm

Q. 3. When a 4V battery is connected across an unknown resistor there is a current of 100 mA in the circuit. The value of the resistance of the resistor is:

(a) 4 Ω **(b) 40 Ω**

(c) 400 Ω **(d) 0.4 Ω**

[Board SQP, 2020]

Ans. Correct option: (b)

Explanation : $V=IR$, $V = 4$ V, $I = 100$ mA $= 0.1$ A

Hence, $R=\frac{V}{I}=\frac{4}{0.1} = 40\ \Omega$.

Q. 4. Unit of electric power may also be expressed as:

(a) Volt-ampere **(b) Kilowatt-hour**

(c) Watt-second **(d) Joule-second**

[Board SQP, 2020]

Ans. Correct Option: (a)

Explanation : Unit of electric power is volt-ampere.

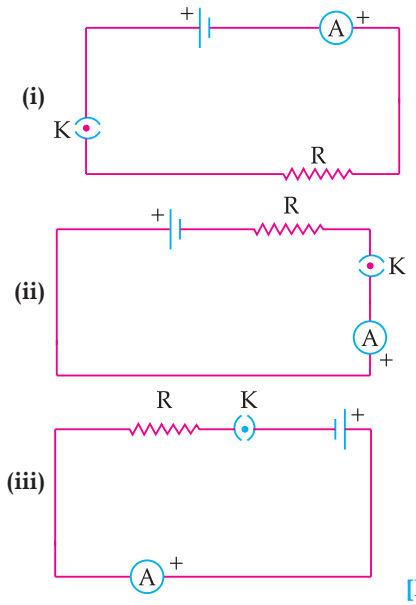
Q. 5. A cell, a resistor, a key, and ammeter are arranged as shown in the circuit diagrams of Figure. The current recorded in the ammeter will be:

(a) maximum in (i).

(b) maximum in (ii).

(c) maximum in (iii).

(d) the same in all the cases.



[NCERT Exemp.]

Ans. Correct option : (d)

Explanation : In series connections, the order of elements in the circuit will not affect the amount of current flowing in the circuit.

Q. 6. Electrical resistivity of a given metallic wire depends upon

(a) its length. **(b) its thickness.**

(c) its shape. **(d) nature of the material.**

[NCERT Exemp.]

Ans. Correct option : (d)

Explanation : The resistivity of a material is constant for a particular material at a constant temperature. It only depends on the temperature. Resistivity of material does not depend on length, thickness, and shape of the material.

Q. 7. A current of 1 A is drawn by a filament of an electric bulb. Number of electrons passing through a cross section of the filament in 16 seconds would be where, $e = 1.6 \times 10^{-19}$ C

(a) 10^{20} **(b)** 10^{16}

(c) 10^{18} **(d)** 10^{23}

[NCERT Exemp.]

Ans. Correct option : (a)

Explanation :

Given, $I = 1$ Amp.

$t = 16$ s

$$\text{As } I = \frac{Q}{t} = \frac{ne}{t}$$

$$n = \frac{(1\times T)}{e} = \frac{1\times 16}{1.6\times 10^{-19}}$$

$$n = 10^{20}$$

B Assertions and Reasons Type Questions

Directions: In the following questions, a statement of assertion (A) is followed by a statement of reason (R). Mark the correct choice as:

(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

(b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).

(c) Assertion (A) is true but reason (R) is false.

(d) Assertion (A) is false but reason (R) is true.

Q. 1. Assertion (A): A conductor has + 3.2 × 10^{-19} C charge.

Reason (R): Conductor has gained 2 electrons.

Ans. Correct option : (c)

Explanation : Conductor has positive charge, so it has lost two electrons.

Q. 2. Assertion (A): The resistivity of conductor increases with the increasing of temperature.

Reason (R): The resistivity is the reciprocal of the conductivity.

Ans. Correct option : (b)

Explanation : The resistivity of the conductors is directly proportional to temperature.

Q. 3. Assertion (A): Bending a wire does not affect electrical resistance.

Reason (R): Resistance of wire is proportional to resistivity of material.

@PROCBSE

Ans. Correct option : (a)

Explanation : Resistance of wire $R = \rho\left(\frac{l}{A}\right)$

Where ρ is resistivity of material which does not depend on the geometry of wire. Since when wire is bent its, resistivity, length and area of cross-section do not change, therefore resistance of wire also remains same.

Q. 4. Assertion (A): Two resistance having value R each. Their equivalent resistance is $\frac{R}{2}$.

Reason (R): Given Resistances are connected in parallel.

Ans. Correct option : (a)

Explanation : When two resistances R_1 and R_2 connected in parallel than their equivalent resistance will be $R = \frac{R_1R_2}{R_1 + R_2}$.

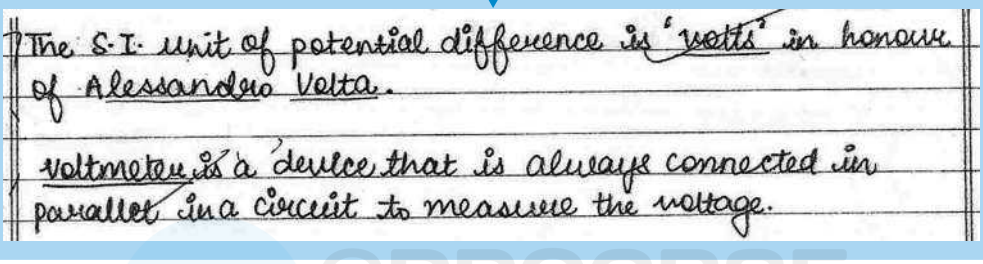
C Very Short Answer Type Questions

Q. 1. Some work is done to move a charge Q from infinity to a point A in space. The potential of the point A is given as V. What is the work done to move this charge from infinity in terms of Q and V? R [SQP-2020]

Ans. W = QV. **1**

Q. 2. State the SI unit of potential difference and name the device used to measure it. A [CBSE Board Delhi, 2019]

Topper Answer, 2019


The S.I. unit of potential difference is 'volts' in honour of Alessandro Volta.

voltmeter is a device that is always connected in parallel in a circuit to measure the voltage.

Q. 3. What is the function of a galvanometer in a circuit ? R [CBSE Board Delhi- Set- I, 2019]

Ans. Detect the presence or direction of current. **1**
[CBSE Marking Scheme, 2019]

Q. 4. Name and define the SI unit of current. R [CBSE Board Delhi, Set- II, 2019]

Ans. Ampere. ½
Flow of 1 coulomb of charge per second.
1 ampere = $\frac{1\text{ coulomb}}{1\text{ second}}$ ½
[CBSE Marking Scheme, 2019]

Q. 5. Write the function of voltmeter in an electric circuit. R [CBSE Board Delhi, Set-II, 2019]

Ans. To measure potential difference across two points.
[CBSE Marking Scheme, 2019] **1**

Q. 6. Why are the heating elements of electric toasters and electric irons made of an alloy rather than a pure metal ? A [CBSE Board Outside Delhi, 2019]

Ans. Due to high resistivity of alloys rather than its constituting metals. **1**
[CBSE Marking Scheme, 2019]

AI **Q. 7. Should the resistance of a voltmeter be low or high? Give reason.**
A [Board Outside Delhi, Set- II, 2019]

Ans. High. In parallel connection, less current passes through high resistance. ½ + ½
[CBSE Marking Scheme, 2019]

Q. 8. Name the device that helps to maintain a potential difference across a conductor.
R [Board Term I, 2016]

Ans. A battery is used to maintain potential difference across a conductor. **1**

Q. 9. Write SI unit of resistivity.
R [Board Term I, Set-2, 2015] [DDE 2017]

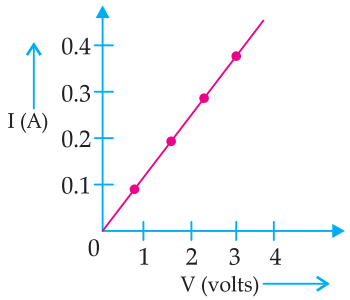
Ans. Ohm metre (ohm m).

Short Answer Type Questions-I — 2 marks each

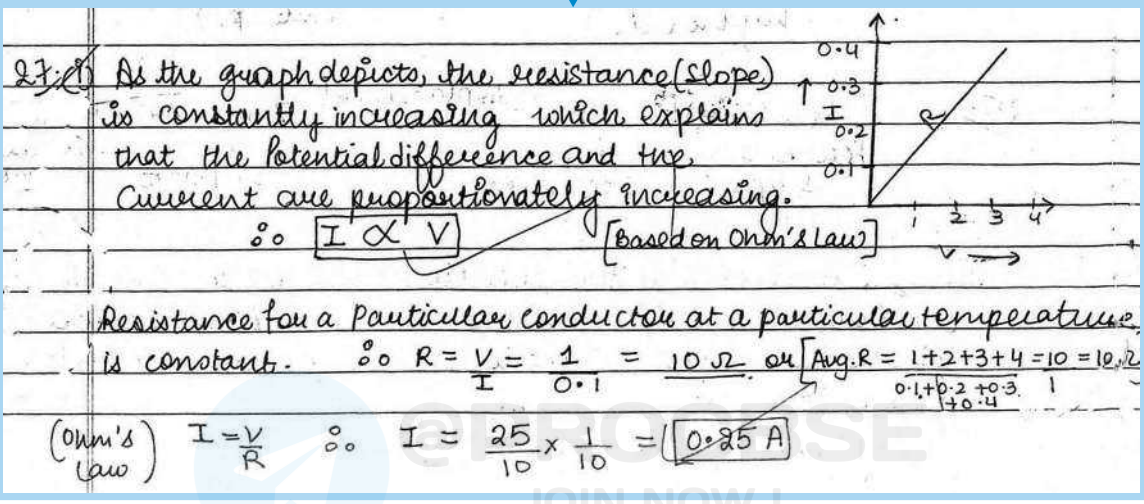
Q. 1. In the experiment to study the dependence of current (I) on the potential difference (V) across a resistor, a student obtained a graph as shown,
What does the graph depict about the dependence of current on the potential difference?
Find the current that flows through the resistor when the potential difference across it is 2.5V.

A [CBSE Board Delhi, 2019]

@PROCBSE



Topper Answer, 2019



Q. 2. While studying the dependence of potential difference (V) across a resistor on the current (I) passing through it, in order to determine the resistance of the resistor, a student took 5 readings for different values of current and plotted a graph between V and I. He got a straight line graph passing through the origin. What does the straight line signify? Write the method of determining resistance of the resistor using this graph.

[CBSE, Delhi 2019]

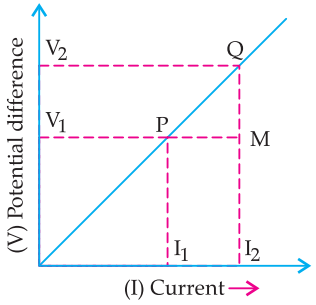
Ans. Potential difference (V) is directly proportional to current (I) or V ∝ I. **1**

- Method : Finding slope of the graph. **1**

[CBSE Marking Scheme 2019]

Detailed Answer:

The graph between V and I is a straight line and passes the origin, this verifies the Ohm's law. **1**



The slope gives the resistance of the resistor used in the circuit. **1**

$$\text{Slope} = \frac{QM}{MP} = \frac{V_2 - V_2}{I_2 - I_2}$$

$$\text{Or } R = \frac{\text{Value of potential differnce at a point}}{\text{Value of current at the same point}}$$

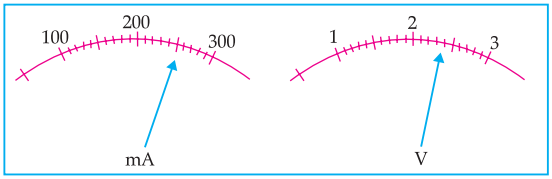
1+1=2

Q. 3. The current flowing through a resistor connected in a circuit and the potential difference developed across its ends are as shown in the diagram by milliammeter and voltmeter readings respectively.

(a) What are the least counts of these meters ?

(b) What is the resistance of the resistor ?

[CBSE 2019, OD SET-2]



Ans. (a) least count of ammeter = 10 mA ½+½

least count of voltmeter = 0.1 V ½+½

(b) $\frac{2.4}{0.25}$ = 9.6 ohm (250 mA = 0.25 A)

[CBSE Marking Scheme 2019]

@PROCBSE

Detailed Answer:

(a) Least count of millianmeter = 10 mA

Least count of voltmeter = $\frac{1}{10}$ = 0.1 V ½+½

(b) Current, I = 250 mA = 250 × 10^{-3} A

Potential difference, V = 2.4 V

Resistance, R= $\frac{V}{I}$ = $\frac{24}{250\times10^{-3}}$ = 9.6 Ω ½+½

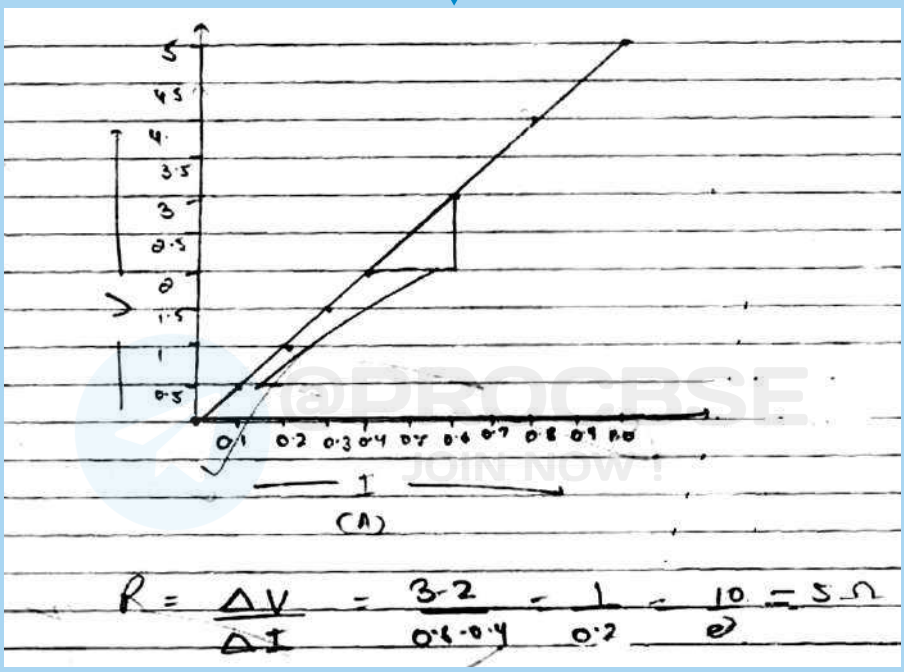
Q. 4. The values of current (I) flowing through a given resistor of resistance (R), for the corresponding values of potential difference (V) across the resistor are as given below:

V (volts)	0.5	1.0	1.5	2.0	2.5	3.0	4.0	5.0
I (amepere)	0.1	0.2	0.3	0.4	0.5	0.6	0.8	1.0

Plot a graph between current (I) and potential difference (V) and determine the resistance (R) of the resistor.

[CBSE 2018 Delhi Set-1]

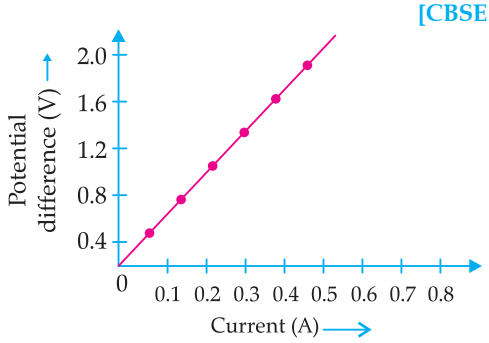
Topper Answer, 2018



Short Answer Type Questions-II — 3 marks each

Q. 1. A V-I graph for a nichrome wire is given below. What do you infer from this graph? Draw a labelled circuit diagram to obtain such a graph.

[CBSE 2020]



Ans. Graph between V and I is a straight line.

So, this infers that the flow of current (I) in the conductor is directly proportional to the potential diffidence (V) established across it. This is ohm's law.

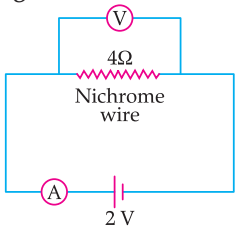
Resistance of the wire can be calculated as :

$$R = \frac{V}{I}$$

$$\frac{0.8}{0.2} = 4 \text{ ohm}$$

This means nichrome wire has a constant value of the resistance 4 ohm. **2**

Circuit diagram:



1

@PROCBSE

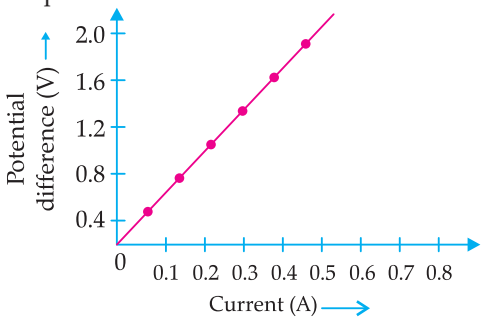
Q. 2. (a) State the relation correlating the electric current flowing in a conductor and the voltage applied across it. Also draw a graph to show this relationship.

(b) Find the resistance of a conductor if the electric current flowing through it is 0.35 A when the potential difference across it is 1.4 V. [CBSE 2020]

Ans. (a) The flow of current (I) in the conductor is directly proportional to the potential difference (V) established across it provided the physical conditions remain same.

Or V = IR

Graph:



2

(a) Given :

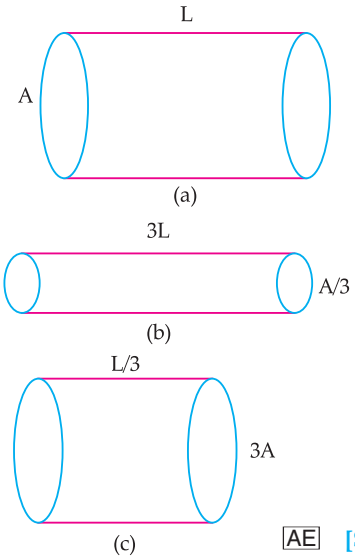
Potential Difference (V)= 1.4 V

Current (I) = 0.35 A

As per formula, V = IR

So, $\frac{V}{I} = \frac{1.4}{0.35} = 4\text{ohm}$ **1**

Q. 3. The figure below shows three cylindrical copper conductors along with their face areas and lengths. Compare the resistance and the resistivity of the three conductors. Justify your answer.



AE [SQP - 2018]

Ans. $R_a = \frac{L}{A}$ ½

$R_b = \rho\left(\frac{3L}{A/3}\right) = 9\,\frac{\rho L}{A} = 9\,R_a$ ½

$R_c = \rho\,\frac{L/3}{3A} = \frac{1}{9}\frac{\rho L}{A} = \frac{1}{9}\,R_a$ ½

Hence $R_b > R_a > R_c$ ½

$\rho_a = \rho_b = \rho_c$ because all the three conductors are of same material. [CBSE Marking Scheme, 2018] **1**

Q. 4. What is electrical resistivity ? Derive its SI unit. In a series electrical circuit comprising a resistor made up of a metallic wire, the ammeter reads 100 mA. If the length of the wire is doubled, how will the current in the circuit change ? Justify your answer. U [Delhi Comptt. 31/1, 31/2, 31/3, 2018]

Ans. Electrical resistivity of the material of a conductor is the resistance offered by the conductor of length 1 m and area of cross-section 1 m^2. **1**

$$\rho = \frac{RA}{l}$$

$$\text{Unit of } \rho = \frac{\text{ohm meter}^2}{\text{metre}} = \text{ohm meter} \quad \textbf{1}$$

Resistance of wire is doubled if its length is doubled.

Hence current is reduced to half.

$\therefore$ Ammeter reading $= \frac{100\text{ mA}}{2} = 50\text{ mA}.$ **1**

[CBSE Marking Scheme, 2018]

COMMONLY MADE ERROR

- Students often write vague answer. They get confused between the terms resistance and resistivity.

ANSWERING TIP

- Always write the unit in SI system only. Resistance of wire is directly proportional to length of the wire. So, Resistance of wire get doubled if the length is doubled.

Q. 5. (a) List the factors on which the resistance of a conductor in the shape of a wire depends.

(b) Why are metals good conductors of electricity whereas glass is a bad conductor of electricity ? Give reason.

(c) Why are alloys commonly used in electrical heating devices ? Give reason. U [Delhi /Outside Delhi 2018]

@PROCBSE JOIN NOW !

@PROCBSE

Ans. (a) Factors on which resistance of a conductor depends :

(i) Length of conductor [or $R \propto l$]

(ii) Area of cross-section of the conductor

[or $R \propto \frac{1}{A}$] **1**

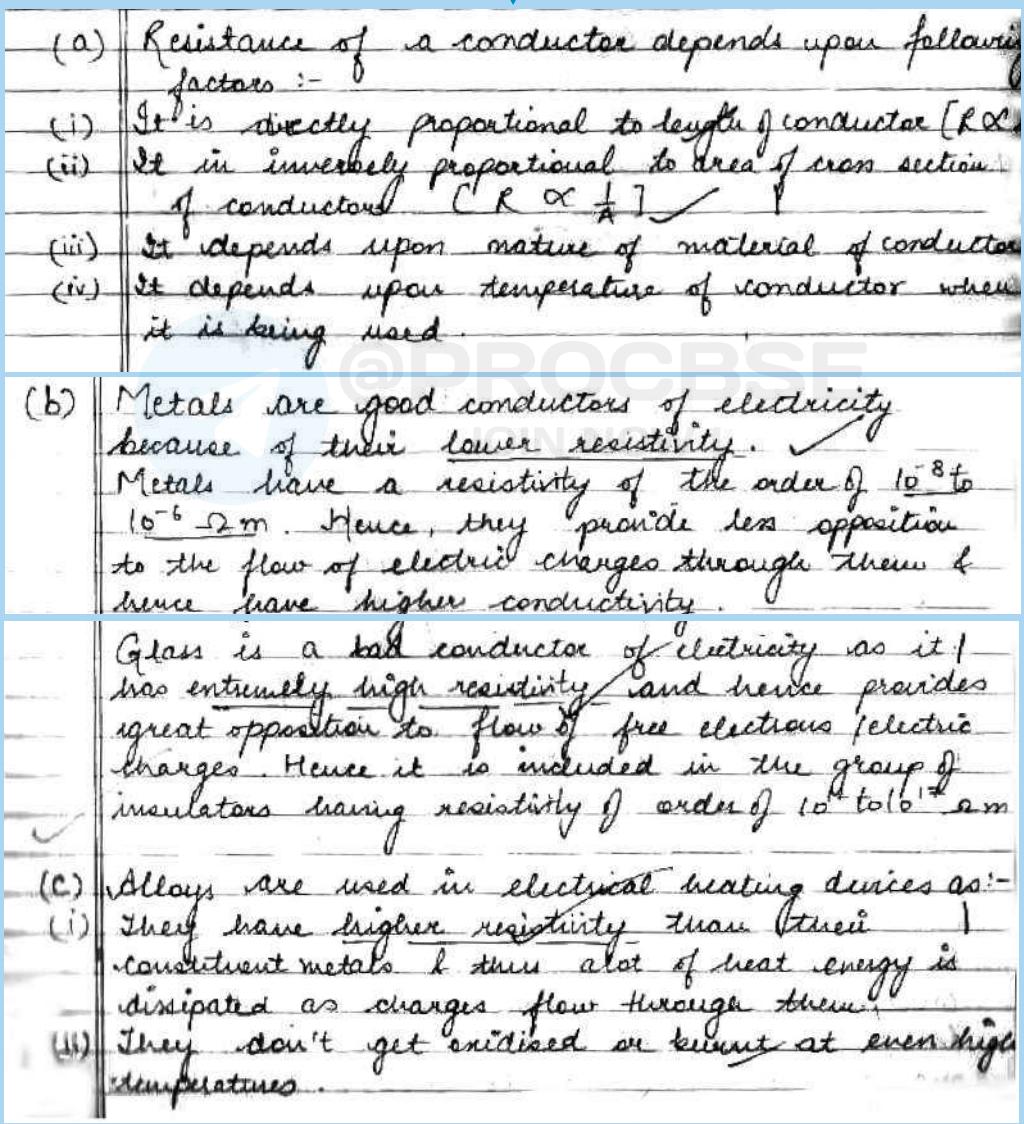
(b) Metals are good conductor of electricity – as they have low resistivity/have free electrons. Glass is a bad conductor of electricity – as it has high resistivity/have no free electrons. **1**

(c) Reason: Alloys have high resistivity/high melting point/alloys do not oxidize (or burn) readily at high temperatures. **(Any one) 1**

[CBSE Marking Scheme, 2018]

Detailed Answer:

Topper Answer, 2018


(a) Resistance of a conductor depends upon following factors :-
(i) It is directly proportional to length of conductor [$R \propto$
(ii) It is inversely proportional to area of cross section of conductor [$R \propto \frac{1}{A}$]
(iii) It depends upon nature of material of conductor
(iv) It depends upon temperature of conductor when it is being used.

(b) Metals are good conductors of electricity because of their lower resistivity.
Metals have a resistivity of the order of 10^{-8} to 10^{-6} Ωm. Hence, they provide less opposition to the flow of electric charges through them & hence have higher conductivity.

Glass is a bad conductor of electricity as it has extremely high resistivity and hence provides great opposition to flow of free electrons (electric charges). Hence it is included in the group of insulators having resistivity of order of 10^{11} to 10^{17} Ωm

(c) Alloys are used in electrical heating devices as:-
(i) They have higher resistivity than their constituent metals & thus alot of heat energy is dissipated as charges flow through them.
(ii) They don't get oxidised or burnt at even high temperatures.

AI Q. 6. State Ohm's Law. Draw a circuit diagram to verify this law indicating the positive and negative terminals of the battery and the meters. Also show the direction of current in the circuit.

R [Board Term I, 2016]

Ans. Statement of Ohm's Law,
Circuit diagram with polarity of battery, ammeter and voltmeter
Direction of current by arrow.

[CBSE Marking Scheme, 2016] 3

@PROCBSE

Detailed Answer:

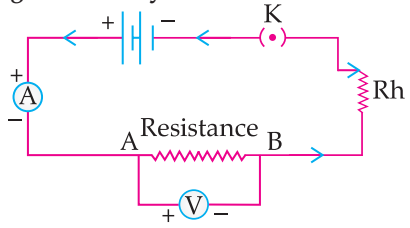
Ohm's Law: It states that "Physical conditions remaining same, the current flowing through a conductor is directly proportional to the potential difference across its two ends".

i.e., $I \propto V$

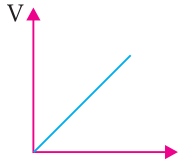
$V = IR$

where the constant of proportionality R is called the electrical resistance.

Diagram to verify Ohm's Law:



Graph :



2 + 1

COMMONLY MADE ERROR

- Students often write incorrect ohm's law. While drawing circuit diagram, many of them fail to mark the direction of current by arrow.

ANSWERING TIP

- Candidates should write Ohm's law correctly and should draw the correct diagram to verify Ohm's law.

Q. 7. Calculate the resistance of a 1 km long copper wire of area of cross section 2×10^{-2} cm^2. The resistivity of copper is 1.623×10^{-8} ohm-meter.

A [Board Term I, 2016]

Ans. $R = \rho \frac{l}{A}$

$= \frac{1.623 \times 10^{-8} \times 1000}{2 \times 10^{-2} \times 10^{-4}\ m^2}$

$= 0.81 \times 10\ \Omega = 8.1\ \Omega.$ **3**

[CBSE Marking Scheme, 2016]

COMMONLY MADE ERROR

- Sometimes, students fail to write the correct formula of resistance.

ANSWERING TIP

- Practice writing formula in the beginning. Make sure you write all essential steps. Final answer need to be expressed along with a proper unit.

Long Answer Type Questions — 5 marks each

Q. 1. What does an electric circuit mean ? Name a device that helps to maintain a potential difference across a conductor in a circuit. When do we say that the potential difference across a conductor is 1 volt ?

R [Board Term I, 2016]

Ans. Electric circuit: The closed path along which an electric current flows is called an 'electric circuit'. The device that helps to maintain a potential difference across a conductor in a circuit are—

Electric cell, electric battery, electric generator **2+1**

1 Volt: The potential difference between two points in an electric field is said to be one volt if one joule of work has to be done in bringing a positive charge of one coulomb from one point to another.

$$1 \text{ volt} = \frac{1 \text{ Joule}}{1 \text{ Coulomb}} \text{ or } 1\ V = \frac{1\ J}{1\ C} \quad \textbf{2}$$

AI **Q. 2. (i) Name an instrument that measures electric current in a circuit. Define unit of electric current.**

(ii) What are the following symbols mean in an electric circuit.

(a) 

(b) 

(iii) Draw a closed circuit diagram consisting of 0.5 m long nichrome wire XY, an ammeter, a voltmeter, four cells of 1.5 V and a plug key.

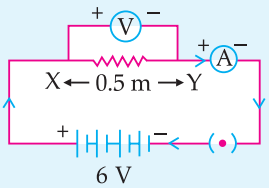
R [Board Term I, 2016]

Ans. (i) Ammeter

The current is said to be one ampere if 1 coulomb of charge flows through a cross section of conductor per second.

(ii) (a) Rheostat **(b)** Plug key (closed)

(iii)



[CBSE Marking Scheme, 2016] **2 + 3**

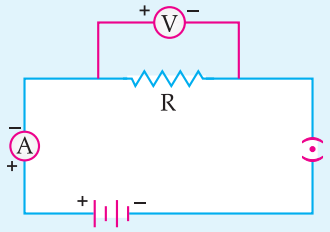
@PROCBSE

Q. 3. (i) Draw a labelled circuit diagram to study a relationship between potential difference (V) across the two ends of a conductor and the current (I) flowing through it. State the formula to show how I in a conductor varies when V across it is increased step wise. Show this relationship also on a schematic graph.

(ii) Calculate the resistance of a conductor if the current flowing through it is 0.25 A when the applied potential difference is 1.0 V.

U [Board Term I, 2016]

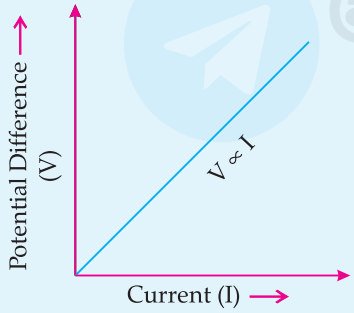
Ans. (i)



The formula states that the current passing through a conductor is directly proportional to the potential difference across its ends, provided the physical conditions like temperature, density, etc. remain unchanged. This is Ohm's law.

$$I \propto V \text{ or } I = \frac{V}{R}$$

$$V = IR.$$



(ii)

$V = 1.0\ V$

$I = 0.25\ A$

$V = IR$

$$R = \frac{V}{I}$$

$$= \frac{1}{0.25} = 4\ \Omega \quad 1 + 2 + 2$$

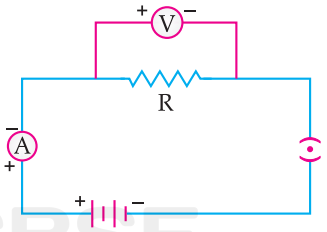
[CBSE Marking Scheme, 2016]

Q. 4. Draw a labelled circuit diagram to study the relationship between the current (*I*) flowing through a conductor and the potential difference (*V*) applied across its two ends. State the formula co-relating the I in a conductor and the *V* across it. Also show their relationship by drawing a diagram.

What would be the resistance of a resistor if the current flowing through it is 0.15 A when the potential difference across it is 1.05 V ?

A [Board Term I, 2015]

Ans.



Try Yourself. See Question No. 3(i) of Long Answer Type Question.

$$I \propto V \text{ or } I = \frac{V}{R}$$

$$V = IR.$$

$V = 1.05\ V$

$I = 0.15\ A$

Putting in equation

$$V = IR$$

or, $1.05 = 0.15 \times R$

$$\therefore \quad R = \frac{1.05}{0.15} = 7\ \Omega \qquad 1 + 2 + 2$$

@PROCBSE JOIN NOW !

TOPIC - 2

Resistance in Series and Parallel Combination, Electric Power and Heating Effect

Revision Notes

- **Resistances in series:** When two or more resistances are connected end to end so that same current flows through each one of them in turn, they are said to be connected in series. Here, the total resistance is equal to the sum of the individual resistances.

$$R_s = R_1 + R_2 + R_3 + ...$$

- **Resistances in parallel:** When two or more resistances are connected across two points so that each one of them provides a separate path for current, they are said to be connected in parallel. Here, the reciprocal of their combined resistance is equal to the sum of the reciprocals of the individual resistances.

@PROCBSE

$$\frac{1}{R_P} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + ...$$

- **Heating effect of current** : When an electric current is passed through a conductor, heat is produced in it. This is known as heating effect of current.
- **Joule's law of heating:** It states that the heat produced in a conductor is directly proportional to **(i)** the square of the current I through it, **(ii)** its resistance R and **(iii)** the time t, for which current is passed. Mathematically, it can be expressed as :

$$H = I^2 Rt \text{ joule} = \frac{I^2 Rt}{4.18} \text{cal}$$

Or $$H = VIt \text{ joule} = \frac{VIt}{4.18} \text{cal}$$

Scan to know more about this topic

Resistor: Parallel and Series

- **Practical application of the heating effect of electric current:** It is utilised in the electrical heating appliances such as electric iron, room heaters, water heaters etc. The electric heating is also used to produce light as in an electric-bulb.
- **Electric energy:** It is the total work done in maintaining an electric current in an electric circuit for a given time.

Electric energy, $W = VIt = I^2Rt$ joule

- **Electric Fuse:** It is a safety device that protects our electrical appliances in case of short circuit or overloading.
  (i) Fuse is made up of pure tin or alloy of copper and tin.
  (ii) Fuse is always connected in series with live wire.
  (iii) Fuse has low melting point.
  (iv) Current capacity of fuse is slightly higher than that of the appliance.
- **Electric Power:** The rate at which electric energy is consumed or dissipated in an electric circuit :

$$P = VI$$

$$P = I^2R = \frac{V^2}{R}$$

@PROCBSE JOIN NOW !

Scan to know more about this topic

Heating effect of current

- S.I. unit of power = Watt (W)
  1 Watt = 1 Volt × 1 ampere
- Commercial unit of electric energy = Kilo Watt hour (KWh)
  1 kWh = 3.6×10^6 J
  1 kWh = 1 unit of electric energy
- **Electrical power:** Electrical power is the rate at which electric energy is consumed by an appliance.
- **Watt:** It is the SI unit of power. The power of an appliance is 1 watt if one ampere of current flows through it on applying a potential difference of 1 volt across its ends.

$$1 \text{ watt} = \frac{1 \text{ joule}}{1 \text{ second}} = 1 \text{ volt} \times 1 \text{ ampere}$$

or $$1 \text{ W} = 1\text{Js}^{-1} = 1\text{VA}$$

$$1 \text{ kilowatt} = 1000 \text{ W.}$$

Scan to know more about this topic

Electric power

- **Kilowatt hour:** It is the commercial unit of electrical energy. One kilowatt hour is the electrical energy consumed by an appliance of 1000 watts when used for one hour.

$$1 \text{ kilowatt hour (kWh)} = 3{\cdot}6 \times 10^6 \text{ J}$$

- **Power rating:** The power rating of an appliance is the electric energy consumed per second by the appliance when connected across the marked voltage of the mains.
- **Efficiency of an electrical device:** It is the ratio of the output power to the input power.

$$\text{Efficiency, } \eta = \frac{\text{Output power}}{\text{Input power}}$$

@PROCBSE

Mnemonics

Concept: Formula of power	
Mnemonics: Twinkle Twinkle Little Star Power equals I squared R	
Interpretation: $P = I^2 R$	

Objective Type Questions — 1 mark each

A Multiple Choice Questions

Q. 1. At the time of short circuit, the electric current in the circuit:

(a) vary continuously **(b) does not change**
(c) reduces substantially **(d) increases heavily**

[CBSE 2020, Delhi]

Ans. Correct option : (d)

Q. 2. Two bulbs of 100 W and 40 W are connected in series. The current through the 100 W bulb is 1 A. The current through the 40 W bulb will be:

(a) 0.4 A **(b) 0.6 A**
(c) 0.8 A **(d) 1 A** [CBSE 2020]

Ans. Correct option : (d)

Q. 3. What is the maximum resistance which can be made using five resistors each of $\frac{1}{5}$ Ω?

(a) $\frac{1}{5}$ Ω **(b) 10 Ω**
(c) 5 Ω **(d) 1 Ω**

[NCERT Exemp.]

Ans. Correct option : (d)

Explanation : The highest resistance is always given by connecting the resistors in series. Here, the highest resistance would be $5 \times \frac{1}{5} = 1$ ohm.

Therefore, the maximum resistance is 1 ohm.

Q. 4. What is the minimum resistance which can be made using five resistors each of $\frac{1}{5}$ Ω?

(a) $\frac{1}{5}$ Ω. **(b) $\frac{1}{25}$ Ω.**
(c) $\frac{1}{10}$ Ω. **(d) 25 Ω.**

[NCERT Exemp.]

Ans. Correct option : (b)

Explanation : Minimum resistance is obtained when resistors are connected in parallel combination. Thus, equivalent resistance obtained by connecting five resistors of resistance $\frac{1}{5}$ Ω each, parallel to each other :

$$\frac{1}{R} = \frac{1}{1/5} + \frac{1}{1/5} + \frac{1}{1/5} + \frac{1}{1/5} + \frac{1}{1/5} \Rightarrow \frac{1}{R} = \frac{5}{1/5}$$

$$\Rightarrow \frac{1}{R} = \frac{25}{1}$$

$$\Rightarrow R = \frac{1}{25}\ \Omega$$

Q. 5. Which of the following represents voltage?

(a) $\frac{\text{Work done}}{\text{Current} \times \text{Time}}$

(b) Work done × Charge

(c) $\frac{\text{Work done} \times \text{Time}}{\text{Current}}$

(d) $\frac{\text{Work done} \times \text{Charge}}{\text{Time}}$ [NCERT Exemp.]

Ans. Correct option : (a)

Explanation : As we know that,

Work done = Charge × Potential difference

⇒Work done = (Current × Time) × Potential Difference

[∵ Charge = Current × time]

$$\Rightarrow \text{Potential difference} = \frac{\text{Workdone}}{\text{Current} \times \text{Time}}$$

Q. 6. If the current *I* through a resistor is increased by 100% (assume that temperature remains unchanged), the increase in power dissipated will be

(a) 100% **(b) 200%**
(c) 300% **(d) 400%**

[NCERT Exemp.]

Ans. Correct option : (c)

Explanation : If I is current and R is resistance then,

Power, $P = I^2R$

Power in first case, $P_1 = I^2R$

100% increase in current means that current becomes 2I

Power in second case, $P_2 = (2I)^2R = 4I^2R$

Now, increase in dissipated power $= P_2 - P_1$

$= 4I^2R - I^2R$

$= 3I^2R$

Percentage increase in dissipated power $= \frac{3P_1}{P_1} \times 100$

$= 300\%$

Q. 7. In an electrical circuit three incandescent bulbs A, B, and C of rating 40 W, 60 W, and 100 W, respectively are connected in parallel to an electric source. Which of the following is likely to happen regarding their brightness?

(a) Brightness of all the bulbs will be the same.
(b) Brightness of bulb A will be the maximum.

@PROCBSE JOIN NOW!

@PROCBSE

(c) Brightness of bulb B will be more than that of A.
(d) Brightness of bulb C will be less than that of B.
[NCERT Exemp.]

Ans. Correct option : (c)
Explanation : We know that power is defined as rate of doing work. A bulb consumes electric energy and produces heat and light. Now, bulb with more power rating will produce more heat and light or we can say that power rating of bulb is directly proportional to the brightness produced by bulb. Therefore, brightness of bulb B with power rating 60 W will be more than the brightness of bulb A having power rating as 40 W.

Q. 8. An electric kettle consumes 1 kW of electric power when operated at 220 V. A fuse wire of what rating must be used for it?
(a) 1 A **(b) 2 A**
(c) 4 A **(d) 5 A**
[NCERT Exemp.]

Ans. Correct option : (d)
Explanation : Given that,
power = P = 1 kW = 1000 W
Voltage = V = 220
Now, $I = \frac{P}{V} = \frac{1000}{220} = 4.5$ A
Now rating of fuse wire must be slightly greater than 4.5 A, that is, 5 A.

B Assertions and Reasons Type Questions

Directions: In the following questions, a statement of assertion (A) is followed by a statement of reason (R). Mark the correct choice as:

(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).
(b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).
(c) Assertion (A) is true but reason (R) is false.
(d) Assertion (A) is false but reason (R) is true.

Q. 1. Assertion (A): Alloys are commonly used in electrical heating devices like electric iron and heater.
Reason (R): Resistivity of an alloy is generally higher than that of its constituent metals but the alloys have low melting points then their constituent metals.

Ans. Correct option : (c)
Explanation : Alloy are hold for electrical heating devices due to their light restivity and high melting point compared to constituent metals.

Q. 2. Assertion (A): In a simple battery circuit the point of lowest potential is positive terminal of the battery.
Reason (R): The current flows towards the point of the lower potential as it flows in such a circuit from the positive to the negative terminal.

Ans. Correct option : (d)
Explanation : It is quite clear that in a battery circuit, the point of lowest potential is the negative terminal of the battery and the current flows from higher potential to lower potential.

Q. 3. Assertion (A): Electric appliances with metallic body have three connections, whereas an electric bulb has a two pin connection.
Reason (R): Three pin connections reduce heating of connecting wires.

Ans. Correct option : (c)
Explanation : The metallic body of an electrical appliances is connected to the third pin which is connected to the earth. This is a safety precaution and avoids eventual electric shock. By doing this the extra charge flowing through the metallic body is passed to earth and avoid shocks. There is nothing such as reducing of the heating of connecting wires by three pin connections.

Q. 4. Assertion (A): The electric bulbs glow immediately when switch is ON.
Reason (R): The drift velocity of electrons in a metallic wire is very high.

Ans. Correct option : (a)
Explanation : In a conductor there are large numbers of free electrons. When we close the circuit, the electric field is established instantly with the speed of electromagnetic wave which causes electron drift at every portion of the circuit. Due to which the current is set up in the entire circuit instantly. The current which is set up does not wait for the electrons flow from one end of the conductor to another end. It is due to this, the bulb glows immediately when switch is ON.

Q. 5. Assertion (A): Copper is used to make electric wires.
Reason (R): Copper has very low electrical resistance.

Ans. Correct option : (a)
Explanation : A low electrical resistance of copper makes it a good electric conductor. So, it is used to make electric wires.

Q. 6. Assertion (A): Silver is not used to make electric wires.
Reason (R): Silver is a bad conductor.

Ans. Correct option : (c)
Explanation : Silver is a good conductor of electricity but it is not used to make electric wires because it is expensive.

C Very Short Answer Type Questions

Q. 1. Two unequal resistances are connected in parallel. If you are not provided with any other parameters (eg. numerical values of I and R), what can be said about the voltage drop across the two resistors?

Ans. Voltage-drop is same across both.

Q. 2. What is meant by the statement. "The resistance of a conductor is one ohm" ?
U [CBSE 2020,OD,Set-3]

Ans. The resistance of a conductor is said to be 1 ohm if a current of 1 ampere flows through it when the potential difference across it is 1 volt.

@PROCBSE

Q. 3. Write the mathematical expression for Joule's law of heating. R [CBSE 2020]

Ans. Mathematical expression of Joule's law of heating is : $H = I^2Rt$

Where, H = Produced Heat

I = Current flowing through the device

t = Time of current flow

R = Resistance of the appliance

Q. 4. What does the cord of an electric oven not glow while its heating element does ?

A [Board Outside Delhi, Set- III, 2019]

Ans. Cord is made up of copper wire whereas heating element is made up of alloy.

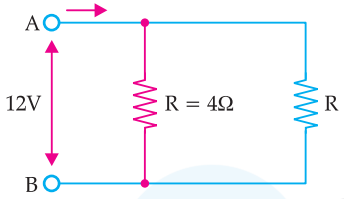
[CBSE Marking Scheme, 2019] **1**

Detailed Answer:

The cord of an electric oven is usually made of copper or aluminium whose resistance is very low so it does not glow. Whereas, its heating element is made up of alloy which has very high resistance. So, when current is passed through the heating element it becomes very hot and glows red.

Short Answer Type Questions-I — 2 marks each

Q. 1. A student has two resistors- 2 Ω and 3 Ω. She has to put one of them in place of R_2 as shown in the circuit. The current that she needs in the entire circuit is exactly 9A. Show by calculation which of the two resistors she should choose



[SQP 2020]

Ans. The overall current needed = 9A.

The voltage is 12V

Hence by Ohm's Law V=IR,

The resistance for the entire circuit = 12/9 = 4/3 Ω. = R

R_1 and R_2 are in parallel. Hence, $R=(R_1 R_2)/(R_1 + R_2)$

or, $\frac{4}{3} = 4R_2/(4+R_2) = 4/3$

$\therefore \quad R_2 = 2\Omega$

Q. 2. Compute the heat generated while transferring 96,000 coulomb of charge in two hours through a potential difference of 40 V.

Ans. (b) Given, Charge (Q)= 96000 C, Time (t) = 2 h, Potential difference (V) = 40 V

Heat generated, H = VIt (where I = Q/t)

H = d

H = V × Q

H = 40 ×96000

H = 384000 J

Q. 3. Define electric power. Write an expression relating electric power, potential difference and resistance.

[CBSE 2020 OD]

Ans. Electric power : It is the amount of electric energy consumed in a circuit per unit time.

Expression : $P = \frac{V^2}{R}$

Q. 4. How many 132 Ω resistors in parallel are required to carry 5 A on a 220 V line ?

[CBSE 2020 OD Set -3]

Ans. Given V = 220 V, I = 5 A

V = IR

Or $R = \frac{V}{I}$

In parallel combination, let the no. of resistors = x

$$\frac{132}{x} = \frac{220}{5}$$

or, $\frac{132}{x} = 44$

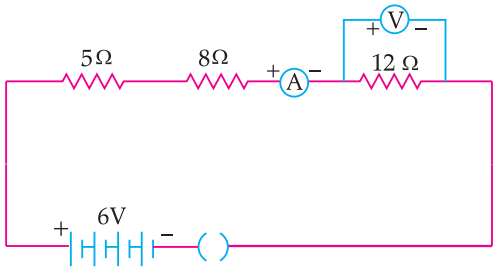
or, $x = \frac{132}{44}$

$\therefore \quad x = 3$

The number of resistors = 3

Short Answer Type Questions-II — 3 marks each

AI **Q. 1. Consider the following circuit:**



What would be the readings of the ammeter and the voltmeter when key is closed ? Give reason to justify your answer.

R [CBSE Delhi Comptt. 31/1, 31/2, 31/3, 2018]

Ans. $R = R_1 + R_2 + R_3$

$R = 5\,\Omega + 8\,\Omega + 12\,\Omega = 25\,\Omega$ **1**

$V = 6$ V

$V = IR$

$\therefore \quad I = \frac{V}{R} = \frac{6\text{ V}}{25\,\Omega} = 0.24$ A **1**

@PROCBSE JOIN NOW !

@PROCBSE

Hence, Current through 12 Ω resistance is $\frac{6}{25}$ A

= 0.24 A

$$V = IR = \frac{6A \times 12\Omega}{25} = 2.88\ V \quad \mathbf{1}$$

AI **Q. 2. Calculate the total cost of running the following electrical devices in the month of September, if the rate of 1 unit of electricity is ₹ 6.00.**

(i) Electric heater of 1000 W for 5 hours daily.

(ii) Electric refrigerator of 400 W for 10 hours daily.

R **[CBSE Comptt. 31/1, 31/2, 31/3, 2018]**

Ans. $P_1 = 1000\ W = \frac{1000}{1000}\ kW, \quad t_1 = 5h$

$P_2 = 400\ W = \frac{400}{1000}\ kW, \quad t_2 = 10h$

No. of days, $n = 30$

$E_1 = P_1 \times t_1 \times n$ ½

$= 1\ kW \times 5h \times 30 = 150\ kWh$ ½

$E_2 = P_2 \times t_2 \times n$

$= \frac{400}{1000}\ kW \times 10\ h \times 30$

$= 120\ kWh$ ½

∴ Total energy = (150 + 120) kWh = 270 kWh ½

∴ Total cost = 270 × 6 = ₹ 1620 **1**

COMMONLY MADE ERROR

- Calculation error should be avoided.

ANSWERING TIP

- While solving numerical, always write formula in the beginning. Keep in mind that the essential steps are properly shown and final answer is expressed along with a proper unit.

Q. 3. (a) Write Joule's law of heating.

(b) Two lamps one rated 100 W 220 V, and the other 60 W 220 V, are connected in parallel to electric mains supply. Find the currents drawn by two bulbs from the line, if the supply voltage is 220 V.

U **[Delhi /Outside Delhi-2018]**

Ans. (a) Joule's law of heating: Heat produced in a resistor is (i) directly proportional to the square of current for a given resistance, (ii) directly proportional to the resistance for a given current and (iii) directly proportional to the time for which the current flows through the resistor. $H = I^2Rt$ where, H = Heat produced, I = current, R = Resistance of the conductor and t = Time for which the current flows through the resistor.

(b) Current in 1st bulb,

$$I_1 = \frac{P_1}{V} = \frac{100}{220} = \frac{5}{11}\ A \text{ or } 0.45\ A$$

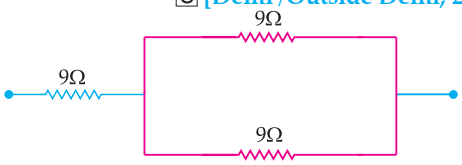
Current in 2nd bulb,

$$I_2 = \frac{P_2}{V} = \frac{60}{220} = \frac{3}{11}\ A \text{ or } 0.27\ A \quad \mathbf{1 + 2}$$

AI **Q. 4. Show how would you join three resistors, each of resistance 9 Ω so that the equivalent resistance of the combination is (i) 13.5 Ω, (ii) 6 Ω ?**

U **[Delhi /Outside Delhi, 2018]**

Ans. (i)



Two 9 ohm resistors in parallel connected to one 9 ohm resistor in series.

$$\frac{1}{R_p} = \frac{1}{9} + \frac{1}{9} = \frac{2}{9}$$

$$\therefore \quad R_p = \frac{9}{2}\ \Omega$$

$$R = 9\ \Omega + \frac{9}{2}\ \Omega = 13.5\ \Omega$$

(ii)



Two 9 ohm resistors in series connected to one 9 ohm resistor is parallel

$$R_s = 9\ \Omega + 9\ \Omega = 18\ \Omega$$

$$\frac{1}{R} = \frac{1}{18} + \frac{1}{9} = \frac{3}{18}$$

$$\therefore \quad R = 6\ \Omega \quad \mathbf{3}$$

COMMONLY MADE ERROR

- Students often forget to write formula in the beginning. Keep in mind that the essential steps are properly shown and final answer is expressed along with a proper unit.

ANSWERING TIP

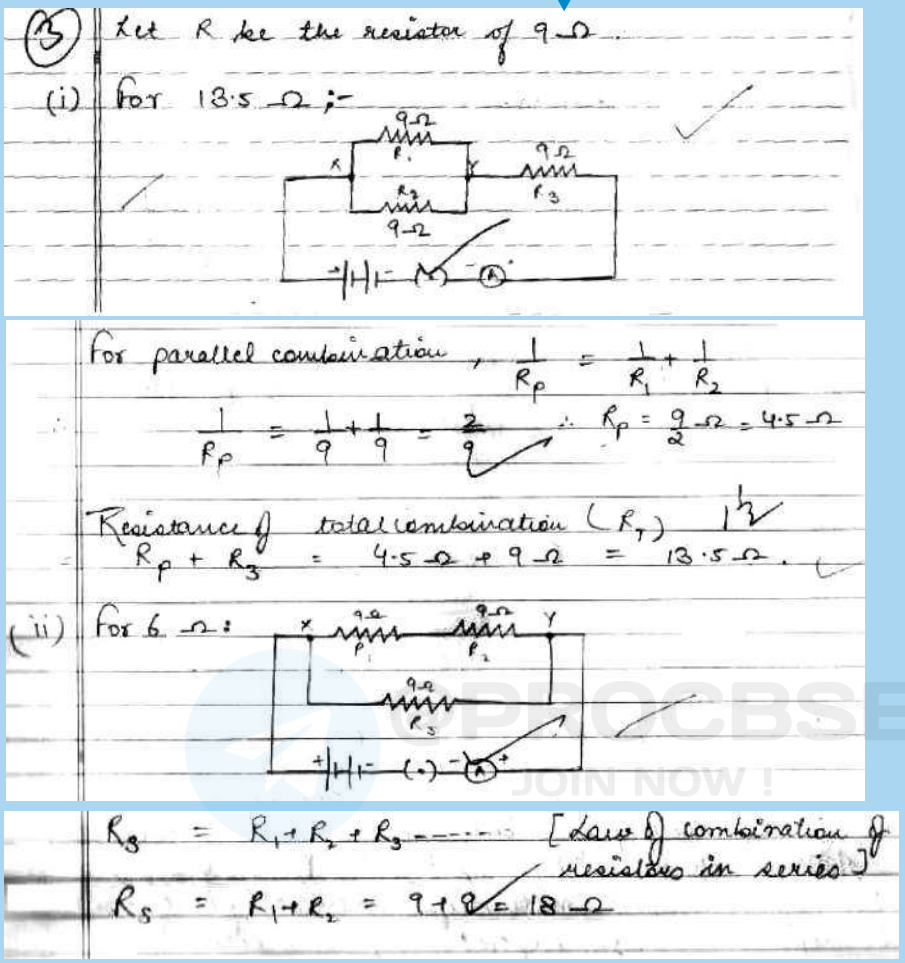
- Candidates should do calculations completely otherwise marks are deducted for incomplete calculations.

@PROCBSE JOIN NOW !

@PROCBSE

Detailed Answer:

Topper Answer, 2018



Q. 5. Three resistors of 10 Ω, 15 Ω and 20 Ω are connected in series in a circuit. If the potential drop across the 15 Ω resistor is 3 V, find the current in the circuit and potential drop across the 10 Ω resistor.

A [Board Term I, 2016]

Ans. In series circuit same current flows through all the resistors. Current through 15 Ω resistor,

$$I = \frac{V}{R} = \frac{3\ V}{15\ \Omega} = \frac{1}{5}$$

$= 0.2$ A

$\therefore$ Current in the circuit $= 0.2$ A

$\therefore$ Potential drop across 10 Ω resistor is.

$V = IR$

$= 0.2\ A \times 10\ \Omega$

$= 2$ V **1½ + 1½**

[CBSE Marking Scheme, 2016]

Q. 6. A circuit has a line of 5 A. How many lamps of rating 40 W, 200 V can simultaneously run on this line safely ? A [Board Term I, 2016]

@PROCBSE JOIN NOW !

@PROCBSE

Ans. Given, V = 200 V, P = 40 W, I = 5A, n = ?

$$nP = VI$$

$$n = \frac{VI}{P} = \frac{200\times5}{40}$$

$$= \frac{100}{4} = 25 \text{ lamps}$$

[CBSE Marking Scheme, 2016] **3**

AI **Q. 7. A bulb is rated at 200V – 40W. What is its resistance ? 5 such bulbs are lighted for 5 hours. Calculate the electrical energy consumed ? Find the cost if the rate is 5.10 per KWh.**

A [Board Term I, 2016]

Ans. V = 200 V, P = 40 W

$$P = VI$$

$$I = \frac{P}{V} = \frac{40}{200} = \frac{1}{5} A$$

$$R = \frac{V}{I} = \frac{200}{\frac{1}{5}}$$

$$= 200 \times 5 = 1000\ \Omega$$

Total Power = 40 W × 5 = 200 W

Time = 5 hrs

Electrical energy = 200 W × 5 hrs.

= 1000 Wh

= 1 KWh.

Cost of 1 KWh = ₹ 5.10 **3**

∴ Total cost = ₹ 1 × 5.10 = ₹ 5.10

[CBSE Marking Scheme, 2016]

Q. 8. Give reason for the following:

(i) Why are copper and aluminium wires used as connecting wires ?

(ii) Why is tungsten used for filament of electric lamps?

(iii) Why is lead-tin alloy used for fuse wires ?

AE [Board Term-I- 2015, 2016]

Ans. (i) These are good conductors of electricity/low resistance, low resistivity.

(ii) Very high melting point and high resistivity.

(iii) Low melting point. **1+1+1**

[CBSE Marking Scheme, 2016]

Q. 9. Show four different ways in which three resistors of 'r ' ohm each may be connected in a circuit. In which case is the equivalent resistance of the combination: C [DDE-2015]

(i) Maximum

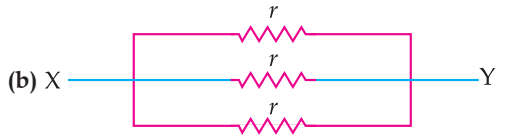
(ii) Minimum [Board Term I, 2014]

Ans. (a)



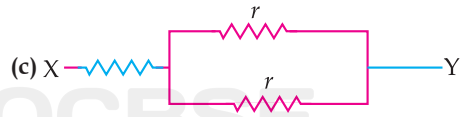
½

(b)



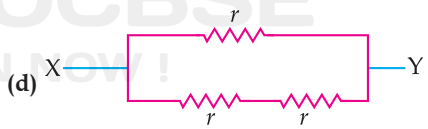
½

(c)



½

(d)



½

(i) Circuit (a) has maximum resistance ½

(ii) Circuit (b) has minimum resistance ½

Long Answer Type Questions — 5 marks each

Q. 1. (a) Define Power and state its S1 unit.

(b) A torch bulb is rated 5 V and 500 mA. Calculate:

(i) Power (ii) Resistances (iii) Energy consumed when it is lighted for 2½ hours. R [CBSE 2020 OD]

Ans. (a) Power: It is the amount of electric energy consumed in a circuit per unit time.

$$P = W/t$$

Its S.I unit is Watt (W).

(b) V = 5V

I = 500 mA = 0.5 A **2**

(i) P = V × I = 5 × 0.5 = 2.5 W

(ii) Resistance $R = \frac{V}{I} = \frac{5}{0.5}$ = 10 ohms

(iii) Energy consumed = P × t

= 2.5 × 2.5

= 6.25 Wh **3**

Q. 2. (a) An electric bulb is rated at 200 V-100 W. What is its resistance ? U

(b) Calculate the energy consumed by 3 such bulbs if they glow continuously for 10 hours for complete month of November. AE

(c) Calculate the total cost if the rate is Rs 6.50 per unit. U [CBSE 2020 OD]

Ans. (a) Given, V = 200 volts and P = 100 watt

$$\text{As } P = \frac{V^2}{R} \text{ or } R = \frac{V^2}{R} = \frac{(200)^2}{100W} = \frac{40000}{100\Omega} = 400 \text{ W}$$

2

(b) Electrical energy consumed, E = number of units × Power of each unit × time × total days

Here, n = 3, P = 100 W, t = 10 hours, Days = 30

So, E = 3 × 100 W × 10 h × 30 = 90,000 Wh

= 90 kWh **2**

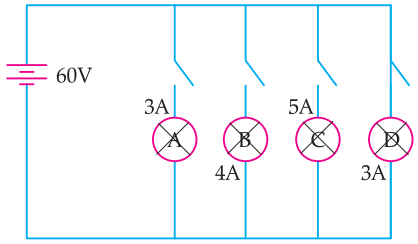
(c) Total cost of electricity = Total unit of energy consumed × Cost per unit

= 90 kWh × 6.50 = ₹ 585 **1**

Q. 3. In the given circuit, A, B, C and D are four lamps connected with a battery of 60 V. [SQP 2020]

@PROCBSE JOIN NOW !

@PROCBSE



Analyse the circuit to answer the following questions.

(i) What kind of combination are the lamps arranged in (series or parallel)? U

(ii) Explain with reference to your above answer, what are the advantages (any two) of this combination of lamps? C

(iii) Explain with proper calculations which lamp glows the brightest? A

(iv) Find out the total resistance of the circuit R

Ans. (i) The lamps are in parallel. **1**

(ii) Advantages: If one lamp is faulty, it will not affect the working of the other lamps. They will also be using the full potential of the battery as they are connected in parallel. **1**

(iii) The lamp with the highest power will glow the brightest.

P=VI In this case, all the bulbs have the same voltage. But lamp C has the highest current. Hence, for Lamp C

P = 5 × 60 Watt = 300 W. (the maximum). **1**

(iv) The total current in the circuit = 3+4+5+3 A = 15A

Voltage = 60V

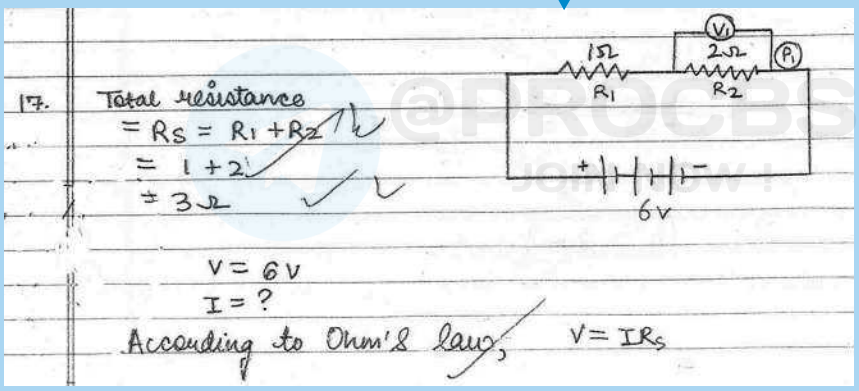
V= IR and hence R = V/I

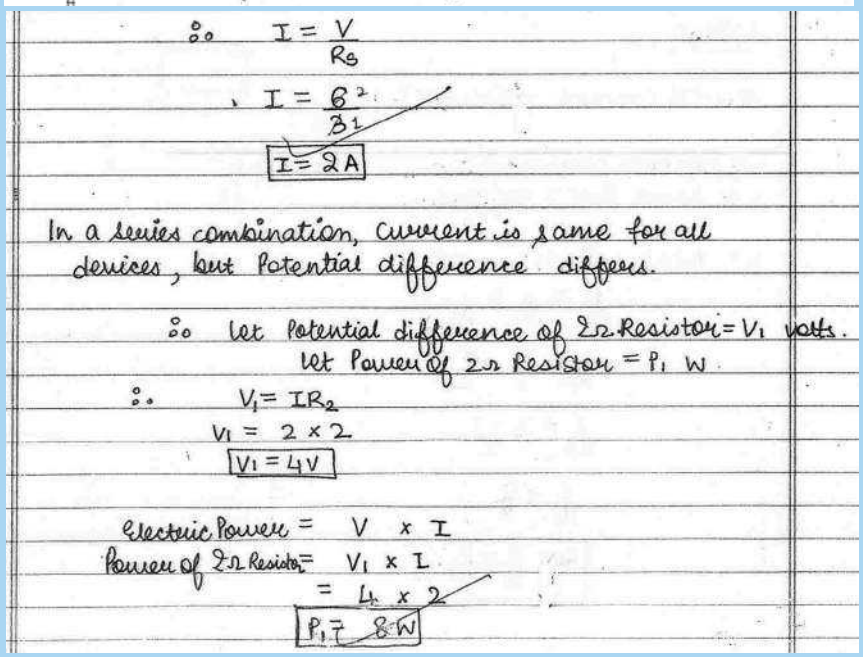
= 60/15 A = 4A **1**

Q. 4. A bulb is rated 40W, 220V. Find the current drawn by it, when it is connected to a 220V supply. Also find its resistance. If the given bulb is replaced by a bulb of rating 25W, 220V,will be there be any change in the value of current and resistance ? Justify your answer and determine the change. U

Ans. [CBSE Delhi, 2019]

Topper Answer, 2019





@PROCBSE

Case II

Let total current in circuit = I.

In a parallel combination, V is same but I differs.

Let total resistance = R_P

$$\frac{1}{R_P} = \frac{1}{R_1} + \frac{1}{R_2}$$

$$\frac{1}{R_P} = \frac{1}{1} + \frac{1}{2}$$

$$\frac{1}{R_P} = \frac{2+1}{2}$$

$$\frac{1}{R_P} = \frac{3}{2}$$

$$R_P = \frac{2}{3}\Omega$$

According to Ohm's law;

$$V = IR_P$$

$$4 = I \times \frac{2}{3}$$

$$I = 6\ A$$

$$I_2 = \frac{V}{R_2} = \frac{4}{2} = 2\ A$$

Let Power of $R_2 = P_2$ W

$$P_2 = V \times I_2$$

$$P_2 = 4 \times 2$$

$$P_2 = 8\ W$$

Both the resistors have same powers in ratio 1 : 1.

Ans. P = 40 W, V = 220V

$$P = VI$$

$$\therefore \quad I = \frac{P}{V} = \frac{40}{220} = \frac{2}{11}\text{A}$$

From Ohm's law,

$$V = IR$$

$$R = \frac{V}{I} = \frac{220}{2} = 1210\Omega$$

when replaced by 25w, 220 v lamp

$$I = \frac{P}{V} = \frac{25}{220} = \frac{5}{44}\text{A}$$

$$\mathbf{R} = \frac{V}{I} = \frac{220}{5} = 1936\Omega$$

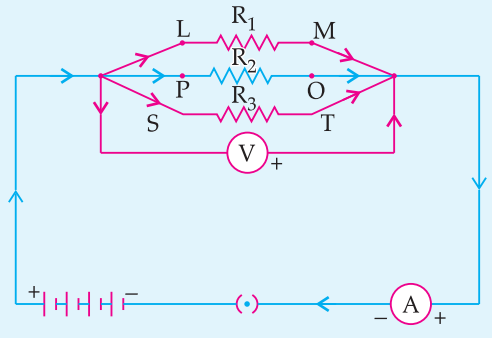
Low power bulb draw less current since its resistance is higher.

Q. 5. (a) With the help of a suitable circuit diagram prove that the reciprocal of the equivalent resistance of a group of resistances joined in parallel is equal to the sum of the reciprocals of the individual resistances.

(b) In an electric circuit two resistors of 12Ω each are joined in parallel to a 6 V battery. Find the current drawn from the battery.

A [CBSE Board Delhi, Set- I, 2019]

Ans.



1

From figure:

$$I = I_1 + I_2 + I_3$$

$$I_1 = \frac{V}{R_1}, I_2 = \frac{V}{R_2}, I_3 = \frac{V}{R_3}$$

@PROCBSE

$$\therefore \quad I = V\left(\frac{1}{R_1}+\frac{1}{R_2}+\frac{1}{R_3}\right)=\frac{V}{R_p} \qquad 1$$

$$\therefore \quad \frac{1}{R_p} = \frac{1}{R_1}+\frac{1}{R_2}+\frac{1}{R_3} \qquad 1$$

(b) $R_1 = R_2 = 12\ \Omega$ and $V = 6$ V

$$\therefore \quad \frac{1}{R_p}=\frac{1}{R_1}+\frac{1}{R_2}=\frac{1}{12}+\frac{1}{12} \qquad ½$$

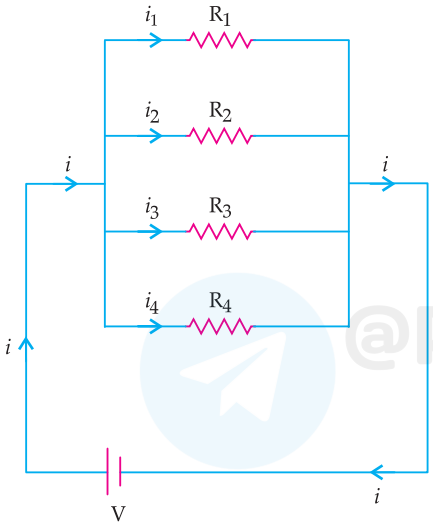
$$\therefore \quad R_p = 6\ \Omega \qquad ½$$

$$I=\frac{V}{R_p}=\frac{6V}{6\Omega}=1\text{A} \qquad 1$$

[CBSE Marking Scheme, 2013]

Detailed Answer:

(a)



1 + 2 + 2

Let there be n resistance, each of value $R_1, R_2 .... R_n$ respectively connected in parallel to a battery of voltage V.
Let current I is sent to the circuit.
If the equivalent resistance is R_{eq}, then current drawn $I = \frac{V}{R_{eq}}$
According to the above circuit,

$$I = I_1 + I_2 + I_3 + ... + I_n$$

$$\frac{V}{R_{eq}} = \frac{V}{R_1}+\frac{V}{R_2}+\frac{V}{R_3}+....+\frac{V}{R_n}$$

So, $$\frac{1}{R_{eq}} = \frac{1}{R_1}+\frac{1}{R_2}+\frac{1}{R_3}+.....+\frac{1}{R_n}$$

Therefore, the reciprocal of the equivalent resistance of a group of resistances joined in parallel is equal to sum of the reciprocals of individual resistances.

(b) In parallel combination, R_{total} is given as

$$\frac{1}{R_{Total}} = \frac{1}{R_1}+\frac{1}{R_2}$$

$$= \frac{1}{12}+\frac{1}{12} = \frac{2}{12} = 1/6 \text{ ohm}$$

$R_{total} = 6$ ohm

Hence, current $I = \frac{V}{R_{Total}} = \frac{6V}{6\Omega} = 1$ A

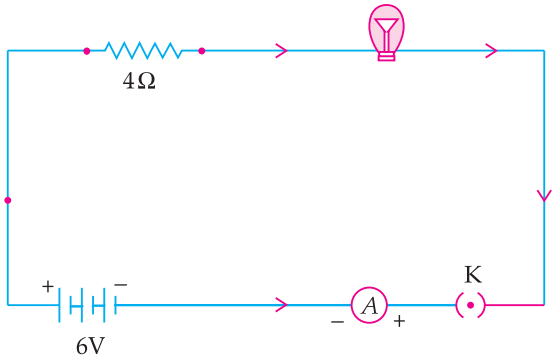
Q. 6. An electric lamp of resistance 20 Ω and a conductor of resistance 4 Ω are connected to a 6 V battery as shown in the circuit. Calculate:

(a) the total resistance of the circuit.

(b) the current through the circuit.

(c) the potential difference across the (i) electric lamp and (ii) conductor, and

(d) power of the lamp.



U [CBSE Board Delhi, Set- 1, 2019]

Ans. (a) $R = R_1 + R_2$ **1**

$= 20\ \Omega + 4\ \Omega = 24\ \Omega$

(b) $I = \frac{V}{R}$

$= \frac{6\ V}{24\ \Omega} = 0.25$ A **1**

(c) (i) For electric lamp:

$V = IR$

$= \frac{6}{24}\times 20 = 5$ V **1**

(ii) For Conductor:

$V = IR$

$= \frac{6}{24}\times 4 = 1$ V **1**

(d) $P = VI$

$= 5\text{V}\times\frac{6}{24}\text{A} = 1.25$ W. **1**

[CBSE Marking Scheme, 2019]

Detailed Answer:

Given, Voltage of battery, $V = 6$ V
Resistance of electric lamp, $R_1 = 20\ \Omega$
Resistance of series conductor, $R_2 = 4\ \Omega$

(a) Total resistance of circuit, $R_{Total} = R_1 + R_2$
$= 20\ \Omega + 4\ \Omega$
$= 24\ \Omega$

(b) Using Ohm's law $I = \frac{V}{R_{Total}}$

@PROCBSE JOIN NOW !

$= \frac{6V}{24\Omega} = 0.25$ A

(c) Potential difference across

(i) Electric lamp, $V_1 = IR_1$
$= 0.25$ A $\times$ 20 Ω
$= 5$V

(ii) Conductor, $V_2 = IR_2$
$= 0.25$ A $\times$ 4 Ω
$= 1$V

(d) Power of the lamp $= I^2R$
$= (0.25)^2 \times 20$ Ω
$= 1.25$ W **1+1+2+1**

COMMONLY MADE ERROR

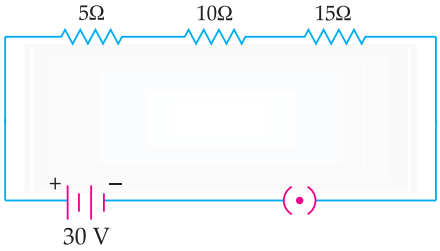
- Many students commit errors in substituting the correct values in formulas.

ANSWERING TIP

- Cross-check the values after substituting them in the formula. Keep in mind, essential steps need to be shown expressed along with a proper unit.

Q. 7. (a) How will you infer with the help of an experiment that the same current flows through every part of a circuit containing three resistors in series connected to a battery ?

(b) Consider the given circuit and find the current flowing in the circuit and potential difference across the 15 Ω resistor when the circuit is closed.



A [Board Outside Delhi, Set-I, 2019]

Ans. (a) **(i)** Join the three resistors of different values in series.

(ii) Connect them with battery, an ammeter and plug key.

(iii) Plug the key and note the ammeter reading.

(iv) Change the position of ammeter to anywhere in between the resistors and note the ammeter reading each time.

(v) The ammeter reading will remain same every time. Therefore when resistors are connected in series same current flows through all resistors, when it is connected to a battery.

Note: If explained with the help of diagram give full credit. **½ × 5**

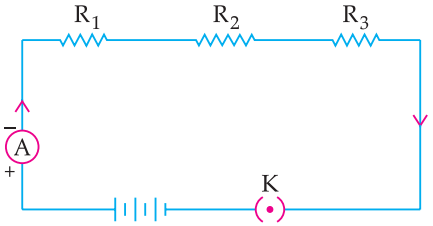
(b) Total resistance of the circuit = **1**
$R = R_1 + R_2 + R_3 = 5 + 10 + 15 = 30$ ohm
Potential difference across the circuit / By ohm's law

$V = IR$ or $I = \frac{V}{R} = \frac{30V}{30\,\Omega} = 1A$ **1**

Potential difference across 15 ohm Resistor = 1A × 15 Ω = 15 V
[CBSE Marking Scheme, 2019] ½

Detailed Answer:

(a) Suppose the experimental set up comprises of three resistors R_1, R_2 and R_3 of three different values which are connected in series with an ammeter, key and a battery of known voltage is given as below :



The key K is closed and the ammeter reading is recorded. Now, the position of ammeter is changed to anywhere in between the resistors. The ammeter reading is recorded each time. It is found that there is an identical reading each time, which shows that same current flows through every part of the circuit containing three resistances in series connected to a battery.

(b) $R_{eq} = R_1 + R_2 + R_3$
$= 5\,\Omega + 10\,\Omega + 15\,\Omega = 30\,\Omega$

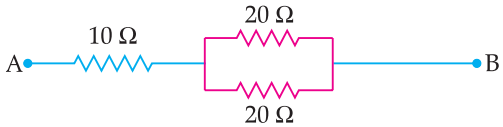
Electric current (I) $= \frac{V}{R_{eq}}$

$= \frac{30}{30} = 1$A

Potential difference across 15Ω resistor $= IR$
$= 1 \times 15 = 15$ V **3+2**

Q. 8. (a) Three resistors R_1, R_2 and R_3 are connected in parallel and the combination is connected to a battery, ammeter, voltmeter and key. Draw suitable circuit diagram and obtain an expression for the equivalent resistance of the combination of the resistors.

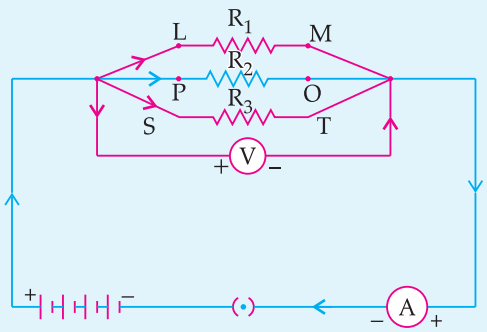
(b) Calculate the equivalent resistance of the following network:



R [Board Outside Delhi, 2019]

Ans. (a) Total current $I = I_1 + I_2 + I_3$
Let R_p be the equivalent resistance of R_1, R_2, R_3. Then the total current $I = \frac{V}{R_p}$ **1**

@PROCBSE



½

$I_1 = \frac{V}{R_1}, I_2 = \frac{V}{R_2}, I_3 = \frac{V}{R_3}$ ½

$\therefore \quad I = V\left(\frac{1}{R_1}+\frac{1}{R_2}+\frac{1}{R_3}\right) = \frac{V}{R_p}$ ½

$\therefore \quad \frac{1}{R_p} = \frac{1}{R_1}+\frac{1}{R_2}+\frac{1}{R_3}$ ½

(b) On applying ohm's law for each R_1, R_2, R_3

$R_p = 10$ ohm

$\frac{1}{R_p} = \frac{1}{20}+\frac{1}{20} = \frac{2}{20} = \frac{1}{10}$ **1**

$R_p = 10$ ohm

Equivalent resistance of the network

$= R_{eq} = R_1 + R_p = 10 + 10 = 20$ ohm. **1**

[CBSE Marking Scheme, 2019]

Q. 9. (i) Consider a conductor of resistance '*R*', length '*L*', thickness '*d*' and resistivity 'ρ'.
Now this conductor is cut into four equal parts. What will be the new resistivity of each of these parts? Why?
(ii) Find the resistance if all of these parts are connected in:
(a) Parallel
(b) Series
(iii) Out of the combinations of resistors mentioned above in the previous part, for a given voltage which combination will consume more power and why? [Board Outside Delhi, 2019]

Ans. (i) Resistivity will not change as it depends on the material of the conductor.

(ii) The length of each part become $\frac{L}{4}$. ρ A constant

$R = \frac{\rho L}{A}$

Resistance of each part $= R_{part} = \frac{\frac{\rho L}{4}}{A} = \frac{R}{4}$.

(a) In parallel the $\frac{1}{R_{eqv}} = \frac{1}{R_{part}}+\frac{1}{R_{part}}+\frac{1}{R_{part}}+\frac{1}{R_{part}}$

$\therefore \quad = \frac{4}{R_{part}} \Rightarrow R_{eqv} = \frac{R}{16}\Omega$

(b) In series the $R_{eqv} = \frac{R}{4}+\frac{R}{4}+\frac{R}{4}+\frac{R}{4} = R\,\Omega$

(iii) $P = \frac{V^2}{R}$.

If R_{eqv} is less, power consumed will be more.
In the given case, R_{eqv} is lesser in the parallel and thus power consumed will be more.

[CBSE Marking Scheme, 2019]

AI **Q. 10. What is meant by electric current ? Name and define S.I. unit. In a conductor electrons are flowing from B to A. What is the direction of conventional current ? Give justification for your answer.**
A steady current of 1 Ampere flows through a conductor. Calculate the number of electrons that flow through any section of conductor in 1 second. (Charge on electron = 1.6×10^{-19} C)
R [DDE-2014] [Board Term-I, 2015]

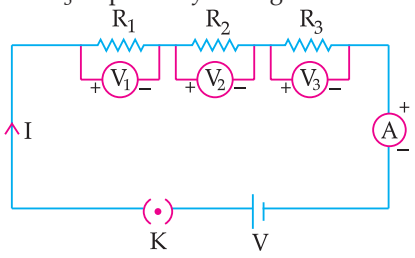
Ans. Definition of Electric current: Refer quick Review
S.I. unit of Current: Ampere
Definition of 1 Ampere: It is the SI unit of current. If one coulomb of charge flows through any cross-section of a conductor in one second, then current through it is said to be one ampere.
Direction of Current from A to B - Justification
Justification: Conventionally, the direction of motion of positive charges through the conductor is taken as the direction of current. The direction of conventional current is opposite to that of the negatively charged electrons.

$I = \frac{ne}{t} \Rightarrow n = \frac{I \times t}{e} = \frac{1A \times 1s}{1.6 \times 10^{-19} C} = 6.25 \times 10^{18}$

[CBSE Marking Scheme, 2015] **5**

Q. 11. Establish a relationship to determine the equivalent resistance R of a combination of three resistors having resistances R_1, R_2 and R_3 connected in series. Calculate the equivalent resistance of the combination of three resistors of 2 Ω, 3 Ω and 6 Ω joined in parallel. U [Board Term I, 2016, 2015]

Ans. An applied potential V produces current *I* in the resistors R_1, R_2 and R_3, causing a potential drop V_1, V_2 and V_3 respectively through each resistor.



Total Potential, $V = V_1 + V_2 + V_3$
By Ohm's Law, $V_1 = IR_1$
$V_2 = IR_2$
$V_3 = IR_3$
Thus, $V = IR_1 + IR_2 + IR_3$
$= I(R_1 + R_2 + R_3)$
If R is the equivalent resistance, V = IR

@PROCBSE

Hence, $IR = I(R_1 + R_2 + R_3)$

$R = R_1 + R_2 + R_3$

This proves that overall resistance increases when resistors are connected in series.

Three resistors 2 Ω, 3 Ω and 6 Ω, are connected in parallel combination.

Equivalent resistance,

$$\frac{1}{R_P} = \frac{1}{2}+\frac{1}{3}+\frac{1}{6}$$

$$= \frac{3+2+1}{6} = \frac{6}{6}$$

$R_P = 1\ \Omega$ **4 + 1**

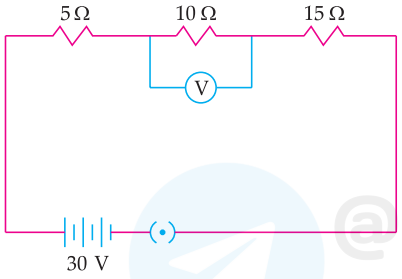
Visual Case-based Questions — 4 marks each

Q. 1. Read the passage and answer any four questions from (a) to (e).

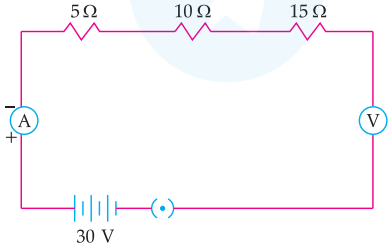
Three resistors of 5 Ω, 10 Ω and 15 Ω are connected in series and the combination is connected to the battery of 30 V. Ammeter and voltmeter are connected in the circuit.

(a) Which of the following is the correct circuit diagram to connect all the devices in proper correct order. A

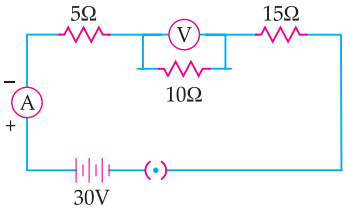
(i)



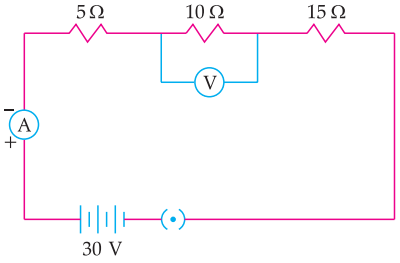
(ii)



(iii)



(iv)



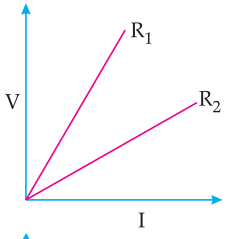
(b) How much is the total resistance? AE

(i) 30Ω **(ii)** 20Ω

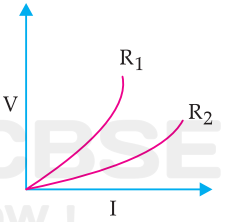
(iii) $\frac{11}{30}\Omega$ **(iv)** $\frac{30}{11}\Omega$

(c) Two students perform experiments on two given resistors R_1 and R_2 and plot the following V-I graphs. If $R_1 > R_2$, which of the diagrams correctly represent the situation on the plotted curves? U

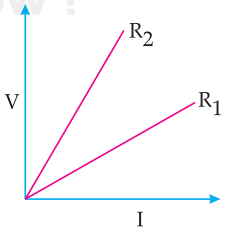
(i)



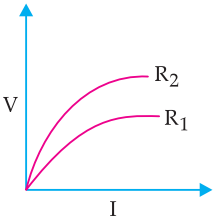
(ii)



(iii)



(iv)



(d) The device used to measure the current:

(i) Ammeter **(ii)** Galvanometer

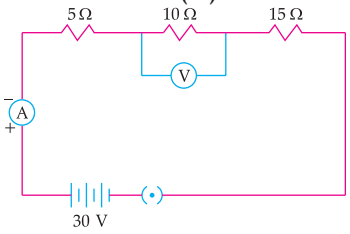
(iii) Voltmeter **(iv)** None of these

(e) Which of the following is connected in series in circuit:

(i) Ammeter **(ii)** Voltmeter

(iii) Both of these **(iv)** None of these

Ans. (a) (iv)

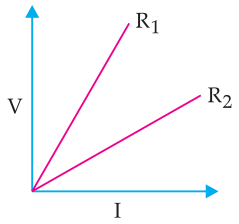


@PROCBSE JOIN NOW !

@PROCBSE

(b) (i) 30Ω

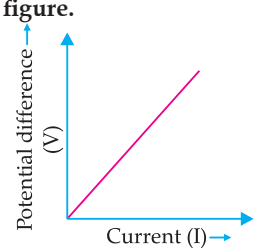
(c) (i)



(d) (i) ammeter

(e) (i) ammeter

Q. 2. Observe the graph and answer any four questions from (a) to (e). V-I graph for a conductor is as shown in figure.



(a) What do you infer from this graph ? AE

(i) $V \propto \frac{1}{I}$ **(ii)** $V \propto I^2$

(iii) $V \propto I$ **(iv)** $V \propto \frac{1}{I^2}$

(b) Name the physical quantity represented by the slope of this graph R

(i) Current
(ii) Resistance
(iii) Potential difference
(iv) None of the above

(c) Ohm is the SI unit of: R

(i) Potential difference
(ii) Resistance
(iii) Current
(iv) Resistivity

(d) Which of the following law justify the above graph: A

(i) Faradays Law **(ii) Ohm's Law**
(iii) Faradays Law **(iv) Joule's Law**

(e) Resistance of a conductor depends on: U

(i) length of conductor
(ii) area of cross-section
(iii) temperature
(iv) all of the above

Ans. (a) (iii) $V \propto I$

(b) (ii) Resistance

(c) (ii) Resistance

(d) (ii) Ohm's Law

(e) (iv) all of the above **1+1+1**

Q. 3. Study the given table and answer any four questions from (a) to (e):

	Material	Resistivity (Ω m)
Conductors	Silver	1.60×10^{-8}
	Copper	1.62×10^{-8}
	Aluminium	2.63×10^{-8}
	Tungsten	5.20×10^{-8}
	Nickel	6.84×10^{-8}
	Iron	10.0×10^{-8}
	Chromium	12.9×10^{-8}
	Mercury	94.0×10^{-8}
	Manganese	1.84×10^{-6}
Alloys	Constantan [alloy of Cu and Ni]	49×10^{-6}
	Manganin [alloy of Cu, Mn and Ni]	44×10^{-6}
	Nichrome [alloy of Ni, Cr, Mn and Fe]	100×10^{-6}

(a) Which is a better conductor: U

(i) Chromium **(ii) Nickel**
(iii) Mercury **(iv) Iron**

(b) Element used to make heating element of electric geyser: AE

(i) Iron **(ii) Silver**
(iii) Nichrome **(iv) tungsten**

(c) Element used to make filament of incandescent bulb: AE

(i) Copper **(ii) Silver**
(iii) Nichrome **(iv) tungsten**

(d) What happens to resistance of a conductor when its area of cross section is increased? A

(i) Resistance increases
(ii) Resistance decreases
(iii) No change
(iii) Resistance doubles

(e) A given length of a wire is doubled and this process is repeated once again. The resistance of wire becomes: U

(i) $1/4^{th}$ **of original resistance**
(ii) 16 times of original resistance
(iii) Double the original resistance
(iv) Half of original resistance

Ans. (a) (ii) Nickel

(b) (i) Nichrome

(c) (iv) tungsten

(d) (ii) Resistance decreases as $R \propto 1/A$

(e) (ii) 16 times of original resistance

Q. 4. Observe the following table and answer any four questions from (a) to (e). Electrical resistivities of some substances, at 20°C are given as follows:

Silver	1.60×10^{-8} Ω.m
Copper	1.62×10^{-8} Ω.m
Tungsten	5.2×10^{-8} Ω.m
Mercury	94×10^{-8} Ω.m
Iron	10×10^{-8} Ω.m
Nichrome	10×10^{-6} Ω.m

@PROCBSE JOIN NOW

@PROCBSE

(a) Which is a better conductor of electric current: U
(i) Silver **(ii) Copper**
(iii) Tungsten **(iv) mercury**

(b) Which element will be used for electrical transmission lines: U
(i) Iron **(ii) Copper**
(iii) Tungsten **(iv) mercury**

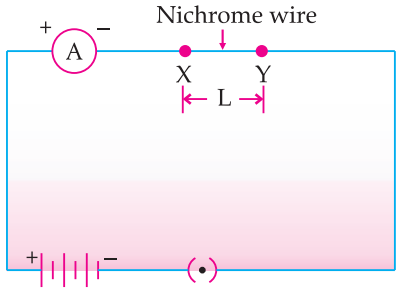
(c) Nichrome is used in the heating elements of electric heating device because: AE
(i) It has high resistivity
(ii) It does not oxidise readily at high temperature
(iii) Both of the above
(iv) None of the above

(d) Series arrangement is not used for domestic circuits because: R
(i) Current drawn is less
(ii) Current drawn is more
(iii) Neither of the above
(iv) Both of the above

(e) If the resistance is to be increased, then the resistors are to be increased in: A
(i) Series
(ii) Parallel
(iii) Mixed arrangement
(iv) None of the above

Ans. (a) (i) silver
(b) (ii) copper
(c) (iii) Both of the above
(d) (i) Current drawn is less
(e) (i) Series

Q. 5. In the given circuit, connect a nichrome wire of length '*L*' between points X and Y and note the ammeter reading Answer any four questions from (a) to (e).



(a) When this experiment is repeated by inserting another nichrome wire of the same thickness but twice the length (2*L*), what changes are observed in the ammeter reading ? A
(i) Ammeter reading will increase
(ii) Ammeter reading will decrease
(iii) Will show double the increase
(iv) No change in ammeter reading

(b) State the changes that are observed in the ammeter reading if we double the area of cross-section without changing the length in the above experiment. AE
(i) Ammeter reading will increase
(ii) Ammeter reading will decrease
(iii) Will decrease half
(iv) No change in ammeter reading

(c) In a circuit two resistors of 5 Ω and 10 Ω are connected in series. Compare the current passing through the two resistors. U
(i) 1 : 2 **(ii) 1: 3**
(iii) 2: 1 **(iv) 1:1**

(d) The instrument used to measure current is _____. R
(i) Ammeter **(ii) Voltmeter**
(iii) Galvanometer **(iv) manometer**

(e) When nichrome and copper wire of same length and same radius are connected in series and current I is passed through them. Which wire gets heated up more? A
(i) Nichrome wire
(ii) Copper wire
(iii) Both will heat up at the same temperature
(iv) None of the wire will get heated up.

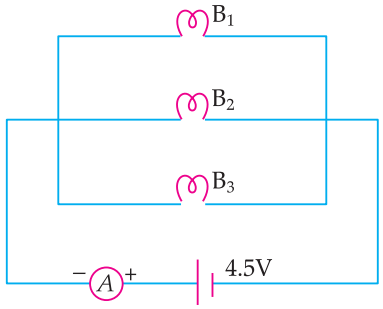
Ans. (a) (i) ammeter reading will decrease (becomes half)
Explanation: The ammeter reading will decrease (becomes half). This is because with the increase in length, resistance of the circuit increases, hence current decreases.

(b) (ii) The ammeter reading will increase (becomes two times).
Explanation: The ammeter reading will increase (becomes two times). This is because as area increases, resistance decreases and hence current increases.

(c) (iv) 1:1
Explanation: In a series connection of resistors, same current passes through all the resistors. Hence, current will be same. Ratio of the currents will be 1 : 1.

(d) (i) Ammeter.
(e) (i) nichrome wire

Q. 6. Study the circuit shown in which three identical bulbs B_1, B_2 and B_3 are connected in parallel with a battery of 4.5 V. Answer any four questions (a) to (e).



(a) What will happen to the other two bulbs if the bulb B_3 gets fused ?
(i) They will also stop glowing
(ii) Other bulbs will glow with same brightness
(iii) They will glow with low brightness
(iv) They glow with more brightness

@PROCBSE JOIN NOW !

(b) If the wattage of each bulb is 1.5 W, how much readings will the ammeter A show when all the three bulbs glow simultaneously.

(i) 1.0A **(ii) 2A**
(iii) 1.5W **(iv) None of the above**

(c) Find the total resistance of the circuit:

(i) 1.0Ω **(ii) 4.5Ω**
(iii) 1.5Ω **(iv) 2.0Ω**

(d) How many resistors of 88 W are connected in parallel to carry 10 A current on a 220 V line:

(i) 2 resistors **(ii) 1 resistors**
(iii) 3 resistors **(iv) 4 resistors**

(e) Find the statement which does not justify parallel connection:

(i) The voltage of each component is same
(ii) Overall resistance is lower than the resistance of single component
(iii) Automobile headlight is connected in parallel
(iv) There is a single path for the flow of electrons/ charge

Ans. (a) (ii)

Explanation: Other bulbs will glow with same brightness

(b) (i) 1.0 A

Explanation: When the bulbs are in parallel, wattage will be added (4.5 W) and the ammeter reading would be,

$$I = P/V = \frac{4.5}{4.5} = 1A$$

(c) (ii) 4.5Ω

Explanation: Ammeter reading = 1.0A

$$V = 4.5V$$
$$R = V/I$$
$$= 4.5 = 4.5\ \Omega$$

(d) (iv) 4 resistors

Explanation: Equivalent resistance,$= \frac{1}{R_p} = \frac{n}{88}$

$$R_p = \frac{88}{n}$$
$$V = IR$$
$$R = \frac{88}{n}$$
$$\frac{88}{n} = \frac{220}{10}$$
$$n = 4 \text{ resistors}$$

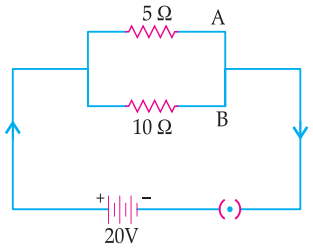
(e) (iv)

Explanation: There is path of flow of electron change through each resistor. So there are several path.

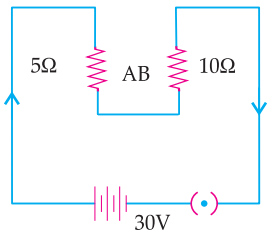
Q. 7. Two conductors A and B of resistances 5 Ω and 10 Ω respectively are first joined in parallel and then in series. In each case the voltage applied is 20 V. Answer any four questions from (a) to (e).

(a) Draw the circuit diagram to show connection when A and B are joined in parallel? U

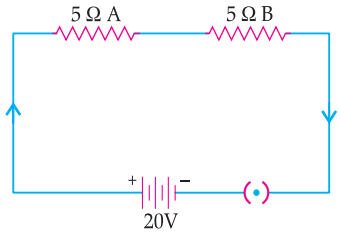
(i)



(ii)



(iii)



(iv) none of these

(b) In which combination will the voltage across the conductors A and B be the same ? C

(i) Series arrangement
(ii) Parallel arrangement
(iii) Both of the above
(iv) None of the above

(c) In which arrangement will the current through A and B be the same ? C

(i) Series arrangement
(ii) Parallel arrangement
(iii) Both of the above
(iv) None of the above

(d) Equivalent resistance in parallel combination is: A

(i) 15 Ω **(ii) 3.33 Ω**
(iii) 0.3 Ω **(iv) None of the above**

(e) Equivalent resistance in series combination is: A

(i) 15 Ω **(ii) 3.33 Ω**
(iii) 0.3 Ω **(iv) None of the above**

Ans. (a) (i) Correct circuit diagram

(b) (ii) Parallel arrangement

(c) (i) Series arrangement

(d) (ii) 3.33 Ω

Explanation :

$$\frac{R_1R_2}{R_1+R_2} = \frac{5\times10}{5+10}$$
$$= 3.33\ \Omega$$

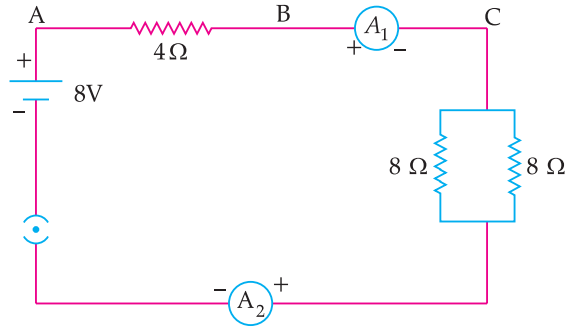
(e) (i) 15 Ω

Explanation: 5 + 10 = 15 Ω

Q. 8. Find out the following in the electric circuit given in the figure. Answer any four questions from (a) to (e).

@PROCBSE JOIN NOW !

@PROCBSE



(a) Effective resistance of two 8 Ω resistors in the combination. U
(i) 4Ω **(ii) 16Ω**
(iii) 8Ω **(iv) 1Ω**

(b) Current flowing through 4 Ω resistor. A
(i) 1A **(ii) 2A**
(iii) 8A **(iv) 4A**

(c) Potential difference across 4 Ω resistor R
(i) 1V **(ii) 2V**
(iii) 4V **(iv) 8V**

(d) Power dissipated in 4 Ω resistor A
(i) 4W **(ii) 2W**
(iii) 1W **(iv) 8W**

(e) Difference in reading of ammeter A_1 and A_2 AE
(i) will become double
(ii) will become half
(iii) remains the same
(iv) 8A

Ans. (a) (i) 4 Ω

Explanation: $\frac{1}{R} = \frac{1}{8} + \frac{1}{8} = \frac{2}{8}$

$R = 4\Omega$

(b) (i) 1A

Explanation: Current flowing through the circuit = Current flowing through 4 Ω
Equivalent resistance of the circuit = 4Ω + 4Ω = 8Ω
Current flowing in the circuit = $\frac{V}{R} = \frac{8V}{8\Omega} = 1A$

(c) (iii) 4 V

Explanation: Potential difference across 4Ω = V_1
$V_1 = IR_1$
$V_1 = 1A \times 4\Omega = 4V$

(d) (i) 4W

Explanation: Power dissipated in 4Ω = P
$P = VI = 4V \times 1A = 4$ watt

(e) (iii) Remains the same

Explanation: Since the resistance are in series combination, hence same current will flow through each resistor. Hence ammeter reading will be same.

1 + 1 + 1 + 1

Know the Terms

- **Frictional Electricity:** It is the electricity produced by rubbing two suitable bodies and flow of electrons from one body to other.
- **Electricity:** A fundamental form of energy observable in positive and negative forms that occurs naturally (as in lightning) or is produced (as in a generator) and that is expressed in terms of the movement and interaction of electrons.
- **Ohm:** It is the SI unit of resistance. A conductor has a resistance of one ohm if a current of one ampere flows through it on applying a potential difference of 1 volt across its ends.

$$1 \text{ ohm} = \frac{1 \text{volt}}{1 \text{ ampere}} \quad \text{or} \quad 1\,\Omega = \frac{1V}{1\,A}$$

- **Resistor:** A conductor which has some appreciable resistance is called a 'resistor'.
- **Semiconductors:** Materials having resistivity between that of an insulator and a conductor are called semiconductors. They are used in making integrated circuits.
- **Superconductors:** These are certain materials that lose their resistivity at low temperature. Such materials are called as superconductors. The phenomenon of complete loss of resistivity by substances below a certain temperature is called superconductivity.
- **Fuse Wire:** The wire which melts, breaks the circuit and prevents the damage of various appliances in the household connections. It is connected in series with live line and its thickness determines the maximum current that can be drawn. It is made of an alloy of aluminium, copper, iron and lead.

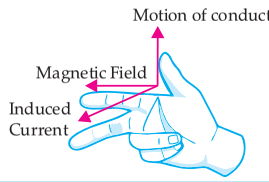
OSWAAL LEARNING TOOL
To learn from Oswaal Concept Video
Visit: http:qrgo.page.link OR Scan this code

@PROCBSE

Magnetic Effects of Electric Current

Electric Generator

- Converts mechanical energy into electrical energy
- Works on the basis of electromagnetic induction (Fleming's right hand rule).
- Fleming's Right hand rule



Electromagnetic Induction

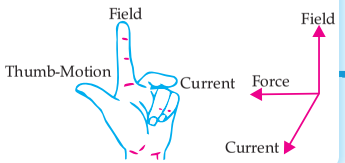
Process by which a change in magnetic field in a conductor induces a current in another conductor.

Electric Motor

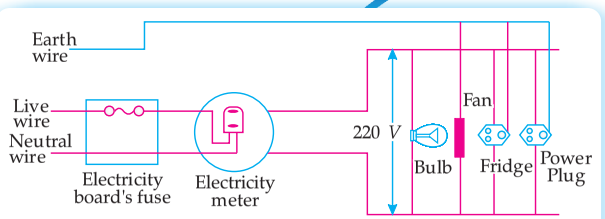
Converts electrical energy into mechanical energy

Fleming's Left hand rule

Works on the principal of Fleming's left hand rule.



Common Domestic Circuits



Domestic Electric Circuit

- Earth Wire (with green insulation cover) Safety measure to take care of leakage
- Neutral Wire (Negative) with black installation cover
- Live Wire (Positive) with red installation cover
- Supply electricity to circuits within home

Fuse

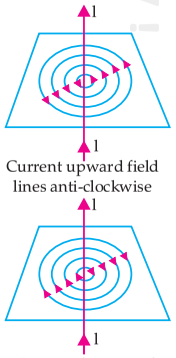
Protects the appliances from short circuiting (overloading)

Magnetic Field Lines

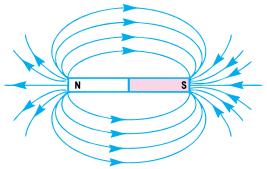
- Representation of the magnetic field path along which an imaginary free north pole would tend to move.
- The tangent at any point on the magnetic field line gives the direction of the magnetic field at that point.
- Field Lines North to South Pole

Magnetic Fields

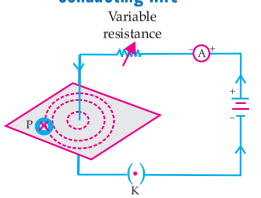
Field lines due to current in a solenoid



Field lines around a bar magnet



Field lines around a straight conducting wire



Trace the Mind Map

First Level · Second Level · Third Level

@PROCBSE

CHAPTER

13 MAGNETIC EFFECTS OF ELECTRIC CURRENT

Syllabus

Magnetic field, field lines, field due to a current carrying conductor, field due to current carrying coil or solenoid; Force on current carrying conductor, Fleming's Left Hand Rule, Electric Generator, Electromagnetic induction, Induced potential difference, Induced current, Fleming's Right Hand Rule, Electric Motor, Direct current, Alternating current: frequency of AC, Advantage of AC over DC. Domestic electric circuits.

Trend Analysis

List of Concepts	2018	2019		2020	
	OD/D	OD	D	OD	D
Magnetic effects of current		1 Q (5 M)	1 Q (5 M)		1 Q (5 M)
Electric motor, Electric Generator	1 Q (5 M)			1 Q (3 M)	1 Q (1 M)

@PROCBSE JOIN NOW !

TOPIC - 1
Magnetic Effects

Revision Notes

Magnet:

- The black ore of iron (Fe_3O_4) called magnetite, capable of attracting similar pieces of iron is called lodestone. They are naturally existing magnets used by human to find the directions.
- There are two poles of a magnet namely North pole and South pole. Like poles repel each other, while unlike poles attract each other.
- H.C. Oersted, a Danish physicist first noticed the magnetic effect of electric current. According to him, a needle kept near the wire carrying current will deflect due to the magnetic field produced. Any change in the direction of current will show variation in the deflection.
- Magnet is any substance that attracts iron or iron-like substances.
- **Properties of magnet**

  (i) Every magnet has two poles i.e., North and South.

TOPIC - 1
Magnetic Effects
Page No. 336
TOPIC - 2
Electric Generator and Electric Motor
Page No. 348

@PROCBSE

(ii) Like poles repel each other.

(iii) Unlike poles attract each other.

(iv) A freely suspended bar magnet aligns itself in nearly north-south direction, with its north pole towards north direction.



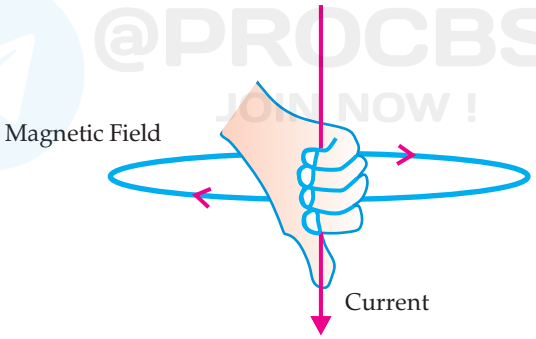
- The substances which are attracted by a magnet are called **magnetic substances**. **Examples:** Iron, nickel, cobalt, steel. The substances which are not attracted by a magnet are called **non-magnetic substances. Examples:** wood, glass, copper, aluminium, brass, paper etc.
- **Magnetic Field:** The area around a magnet in which its magnetic force can be experienced.
  - **(i)** Its SI unit is Tesla (T).
  - **(ii)** Magnetic field has both magnitude and direction.
  - **(ii)** Magnetic field can be described with help of a magnetic compass.
- **Magnetic needle:** The needle of a magnetic compass is a freely suspended bar magnet.
- **Characteristics of Field Lines**
  - **(i)** Field lines arise from North pole and end into South pole of the magnet.
  - **(ii)** Field lines are closed curves.
  - **(iii)** Field lines are closer in stronger magnetic field.
  - **(iv)** Field lines never intersect each other as for two lines to intersect, there must be two directions of magnetic field at a point, which is not possible.
  - **(v)** Direction of field lines inside a magnet is from South to North.
  - **(vi)** The relative strength of magnetic field is shown by degree of closeness of field lines.

Scan to know more about this topic

Magnetic effects of Current

- **Right Hand Thumb Rule:** Imagine you are holding a current carrying straight conductor in your right hand such that the thumb is pointing towards the direction of current. Then the fingers wrapped around the conductor give the direction of magnetic field.

@PROCBSE JOIN NOW !



Scan to know more about this topic

Magnetic effects of current in straight conductor

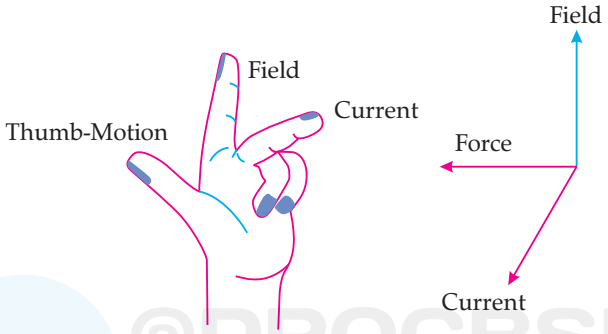
- **Magnetic Field Due to Current through a Straight Conductor**
  - It can be represented by concentric circles at every point on conductor.
  - Direction can be given by right hand thumb rule or compass.
  - Circles are closer near the conductor.
  - Magnetic field ∝ Strength of current
  - Magnetic field $\propto \frac{1}{\text{Distance from the conductor}}$
- **Magnetic Field Due to Current through a Circular Loop**
  - It can be represented by concentric circles at every point.
  - Circles become larger and larger as we move away.
  - Every point on wire carrying current would give rise to magnetic field appearing as straight line at centre of the loop.
  - The direction of magnetic field inside the loop is same.
- **Factors affecting magnetic field of a circular current carrying conductor**
  - **(i)** Magnetic field ∝ Current passing through the conductor
  - **(ii)** Magnetic field $\propto \frac{1}{\text{Distance from conductor}}$
  - **(iii)** Magnetic field ∝ No. of turns in the coil

Scan to know more about this topic

Magnetic effects of current in solenoid

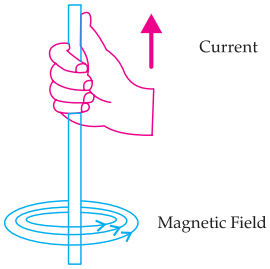
@PROCBSE

- Magnetic field is additive in nature *i.e.*, magnetic field of one loop adds up to magnetic field to another loop. This is because the current in each circular turn has some direction.
- A coil of large number of turns closely wound on a hollow cylinder of insulated material or otherwise is called a **solenoid**. The end of the solenoid having clockwise current will act as south while on the other hand having anti-clockwise current will act as north pole. Thus, a solenoid acts as a normal magnet.
- **Permanent magnets:** They are made of carbon steel, chromium steel, tungsten steel and some alloys like Alnico and Nipermag. Alnico is an alloy of aluminium, nickel and cobalt. Nipermag is an alloy of iron that contains nickel, aluminium and titanium..
- When a material is placed inside a coil carrying current, it will get magnetised. A bunch of nails or an iron rod placed along the axis of the coil can be magnetised by the current when allowed to pass through the coil. Such magnets are called electromagnets.
- **Ampere** suggested that when a current I passes through a conductor of length l placed in a perpendicular magnetic field B, then the force experienced is given by $F = IBl \sin\theta$, where θ is the angle between the length of the conductor and magnetic field.
- **Fleming's Left Hand Rule:** Stretch the thumb, forefinger and middle finger of your left hand such that they are mutually perpendicular. If fore finger points in the direction of magnetic field, middle finger in the direction of current then thumb will point in the direction of motion or force.



@PROCBSE

Mnemonics

Concept: **Right Hand Thumb Rule**	Concept: **Direction of field lines**
Mnemonics: **When current move upwards, wrap magnetic field**	Mnemonics: **O** Maria **M**r. **F**ox is moving from **N**orth to **S**outh
Interpretation: 	**Interpretation:** **O**utside **M**agnet **M**agnetic **F**ield **N**orth **S**outh

@PROCBSE

How is it done on the GREENBOARD?

Q. What is meant by solenoid? How does a current carrying solenoid behave?

Solution:

Step I: A evil of many circular turns of insulated copper wire wrapped closely in the shape of a cylinder is called a solenoid.

Step II: A current carrying solenoid behaves like a bar magnet.

Step III: To convert piece of soft iron into magnet.

Objective Type Questions — 1 mark each

A Multiple Choice Questions

Q. 1. Choose the incorrect statement from the following regarding magnetic lines of field :

(a) The direction of magnetic field at a point is taken to be the direction in which the north pole of a magnetic compass needle points.

(b) Magnetic field lines are closed curves.

(c) If magnetic field lines are parallel and equidistant, they represent zero field strength.

(d) Relative strength of magnetic field is shown by the degree of closeness of the field lines.

[NCERT Exemp.]

Ans. Correct option : (c)

Explanation : Magnetic field lines appear parallel when they are far from the magnet. But this does not mean that field strength is zero. No field line would be present where field strength becomes zero.

Q. 2. Which of the following correctly describes the magnetic field near a long straight current carrying wire?

(a) The field consists of straight lines perpendicular to the wire.

(b) The field consists of straight lines parallel to the wire.

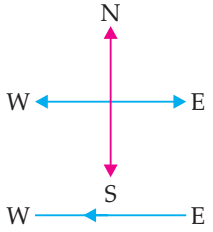
(c) The field consists of radial lines originating from the wire.

(d) The field consists of concentric circles centred on the wire. **[NCERT Exemp]**

Ans. Correct option : (d)

Explanation : The field consists of concentric circles centred on the wire. On applying right-hand thumb rule, we find the direction of magnetic field. The field is in the form of concentric circles centred on the wire carrying current.

Q. 3. A constant current flowing in a horizontal wire in the plane of the paper from East to West is shown in Figure. The direction of magnetic field at a point will be from North to South :



(a) directly above the wire.

(b) directly below the wire.

(c) at a point located in the plane of the paper, on the north side of the wire.

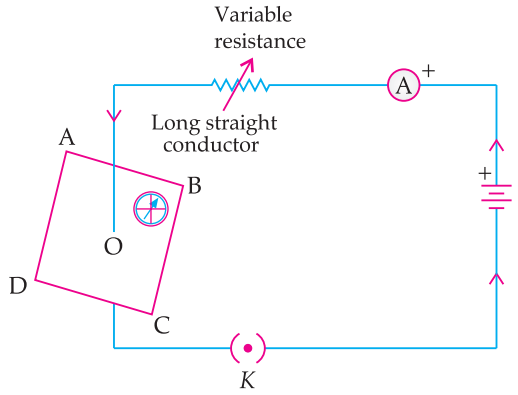
(d) at a point located in the plane of the paper, on the south side of the wire. **[NCERT Exemp.]**

Ans. Correct option : (b)

Explanation : Line WE shows a straight conductor through which current is moving from E to W. When seen from east, the magnetic field lines appear in clockwise direction, *i.e.* S to N above the wire and N to S below the wire. This is in accordance with right hand thumb rule.

Q. 4. If the key in the arrangement in the given Figure, is taken out (the circuit is made open) and magnetic field lines are drawn over the horizontal plane ABCD, the lines are :

@PROCBSE JOIN NOW!



(a) concentric circles.
(b) elliptical in shape.
(c) straight lines parallel to each other.
(d) concentric circles near the point O but of elliptical shapes as we go away from it. [NCERT Exemp.]

Ans. Correct option : (c)

Explanation : When the key is taken out, the circuit is open, no current flows and no magnetic field due to current carrying conductor. There exists only earth's magnetic field which will exhibit straight lines parallel to each other.

Q. 5. For a current in a long straight solenoid N- and S-poles are created at the two ends. Among the following statements, the incorrect statement is :

(a) The field lines inside the solenoid are in the form of straight lines which indicates that the magnetic field is the same at all points inside the solenoid.
(b) The strong magnetic field produced inside the solenoid can be used to magnetise a piece of magnetic material like soft iron, when placed inside the coil.
(c) The pattern of the magnetic field associated with the solenoid is different from the pattern of the magnetic field around a bar magnet.
(d) The N and S-poles exchange position when the direction of current through the solenoid is reversed. [NCERT Exemp.]

Ans. Correct option : (c)

Explanation : A solenoid behaves like a bar magnet. Hence, the pattern of the magnetic field associated with the solenoid is same as the pattern of the magnetic field around a bar magnet.

Q. 6. The strength of magnetic field inside a long current carrying straight solenoid is :

(a) more at the ends than at the centre
(b) minimum in the middle
(c) same at all points
(d) found to increase from one end to the other [NCERT Exemp.]

Ans. Correct option : (c)

Explanation : Magnetic field lines are straight and parallel inside the solenoid. This indicates a same magnetic field. Hence, inside the solenoid, the magnetic field is same throughout.

B Assertions and Reasons Type Questions

Directions: In the following questions/a statement of assertion (A) is followed by a statement of reason (R). Mark the correct choice as:

(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).
(b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).
(c) Assertion (A) is true but reason (R) is false.
(d) Assertion (A) is false but reason (R) is true.

Q. 1. Assertion (A): Two bar magnets attract when they are brought near to each other with the same pole.
Reason (R): Unlike poles will attract each other.

Ans. Correct option : (d)

Explanation: Two bar magnets repel when same poles face each other. Opposite poles attract each other.

Q. 2. Assertion (A): Magnetic field lines never intersect.
Reason (R): At a particular point magnetic field has only one direction.

Ans. Correct option : (a)

Explanation: Magnetic field lines never intersect each other as for two lines to intersect, there must be two north directions at a point, which is not possible.

Q. 3. Assertion (A): In Fleming's Left Hand Rule, the direction of magnetic field, force and current are mutually perpendicular.
Reason (R): Fleming's Left hand Rule is applied to measure the induced current.

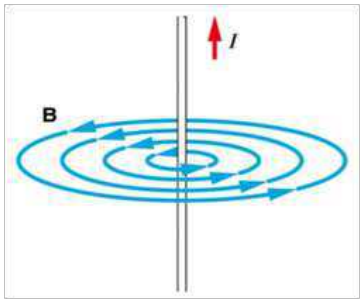
Ans. Correct option : (c)

Explanation: It is used to find the direction of force in a current carrying conductor in the presence of magnetic field.

C Very Short Answer Type Questions

Q. 1. Draw the magnetic field lines around a straight current carrying conductor. [SQP 2020]

Ans.



Q. 2. What is meant by magnetic field ?

R [Board Term-I, 2016] [DDE, 2017]

Ans. The region surrounding a magnet in which the force of the magnet can be detected is said to be its magnetic field. [CBSE Marking Scheme, 2016] **1**

@PROCBSE

COMMONLY MADE ERROR

- Candidates generally get confused while indicating the direction of magnetic field.

ANSWERING TIP

- Carefully apply right hand thumb rule.

AI **Q. 3. Why are magnetic field lines more crowded towards the pole of a magnet ?**
AE [Board Term I, 2016]

Ans. The magnet is stronger at the poles so the magnetic field lines are crowded at the poles. **1**
[CBSE Marking Scheme, 2016]

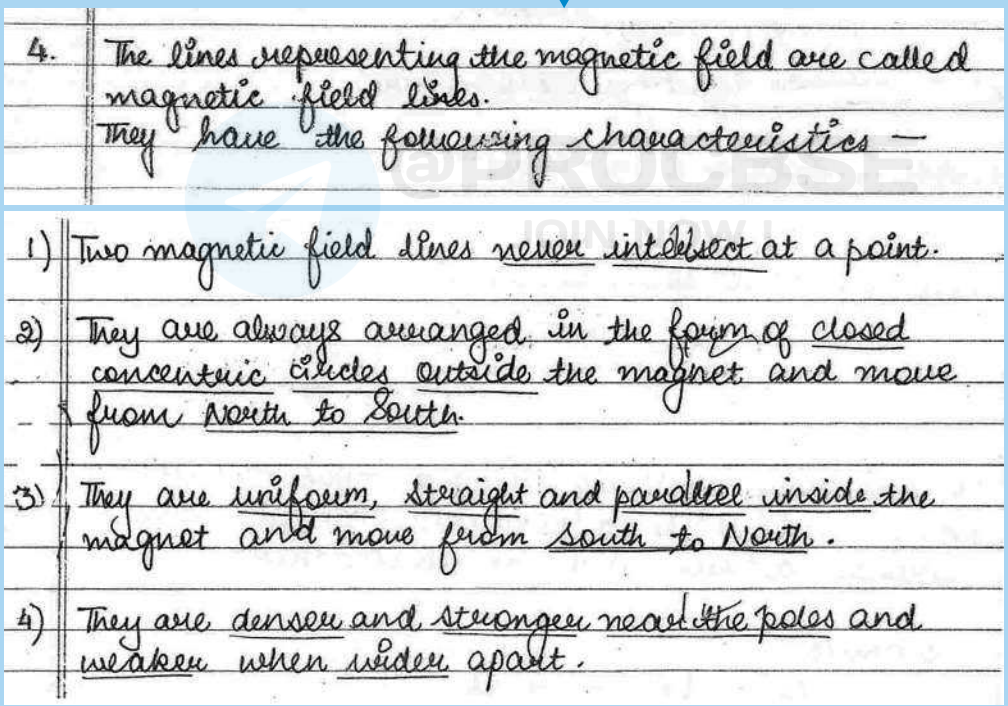
Q. 4. Why does a compass needle show deflection when brought near a current carrying conductor ?
U [Board Term I, 2016]

Ans. Due to production of magnetic field around the current carrying conductor. **1**
[CBSE Marking Scheme, 2016]

Short Answer Type Questions-I — 2 marks each

Q. 1. List four properties of magnetic field lines. R [CBSE Delhi, 2019]

Topper Answer, 2019


4. The lines representing the magnetic field are called magnetic field lines.
They have the following characteristics —

1) Two magnetic field lines never intersect at a point.

2) They are always arranged in the form of closed concentric circles outside the magnet and move from North to South.

3) They are uniform, straight and parallel inside the magnet and move from South to North.

4) They are denser and stronger near the poles and weaker when wider apart.

Q. 2. State any two factors on which the magnetic field produced by a current carrying straight conductor depends.
Mention the rule which helps to find the direction of its magnetic field. U

Ans. Factors on which the magnetic field produced by a current carrying conductor depends:

(i) Strength of current passing through the conductor. ½

(ii) Distance of the point of measurement from the conductor. ½

Right Hand Thumb Rule gives the direction of magnetic field. **1**

Q. 3. An alpha particle is placed in a magnetic field. Will it experience any force, if: C

(i) It moves in the magnetic field parallel to field lines.

(ii) It moves in the magnetic field perpendicular to field lines.

Ans. (i) No, because, the force is zero if current and field are in the same direction.

(ii) Yes, because, the force is maximum when current and magnetic field are perpendicular. **1+1**

@PROCBSE

Short Answer Type Questions-II — 3 marks each

AI **Q. 1. What is meant by solenoid ? How does a current carrying solenoid behave ? Give its main use.**
R [Board Term I, 2016]

Ans. Solenoid is a closely wound cylindrical coil of insulated metallic wire wrapped closely in the shape of a cylinder. A current carrying solenoid behaves as an electromagnet. The uniform magnetic field inside it may magnetise a steel rod permanently.
[CBSE Marking Scheme, 2016] **3**

Detailed Answer:

A coil of many circular turns of insulated copper wire wrapped closely in the shape of a cylinder is called a solenoid.

The field lines around a current-carrying solenoid is similar to that produced by a bar magnet. This means that a current carrying solenoid behaves as a magnet having north pole and south pole.

The strong magnetic field produced inside a solenoid can be used to magnetise a piece of magnetic material like soft iron when placed inside the coil.

COMMONLY MADE ERROR

- Students often forget to write "insulated" metallic wire.

ANSWERING TIP

- Metallic wire used for solenoid should be always "insulated".

Q. 2. Name, state and explain with an example the rule used to determine the direction of force experienced by a current carrying conductor placed in a uniform magnetic field. AE [Board Term I, 2016]

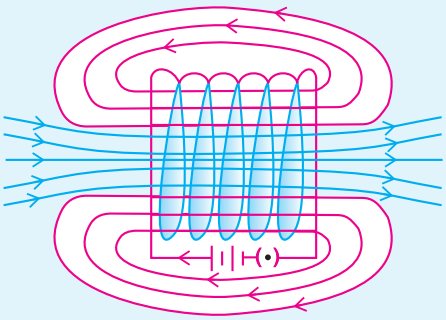
Ans. Fleming's Left Hand Rule: The direction of force which acts on the current carrying conductor placed in a magnetic field is given by Fleming's left hand rule. It states that if the forefinger, thumb and middle finger of left hand are stretched mutually perpendicular and if the forefinger point along the direction of external magnetic field, middle finger indicates the direction of current, then thumb points along the direction of force acting on the conductor.
Example: When an electron enters a magnetic field at right angles, the direction of force on electron is perpendicular to the direction of magnetic field and current according to this rule. **3**

Q. 3. Can a freely suspended current carrying solenoid stay in any direction ? Justify your answer. What will happen when the direction of current in the solenoid is reversed ? Explain.
C [Board Term- I, 2016]

Ans. A current carrying solenoid behaves like a magnet. When suspended freely, it will stay in north - south direction.
On reversing current its polarity will be reversed and so it will turn at 180°. **1 + 1 + 1**
[CBSE Marking Scheme, 2016]

Q. 4. What is solenoid? Draw the field lines of the magnetic field produced on passing current through and around a current carrying solenoid.
A [DDE 2017] [Board Term-I, 2015]

Ans. Definition: A coil of many circular turns of insulated copper wire wrapped closely in the shape of a cylinder is called solenoid.



Magnetic field lines through and around a current carrying solenoid. **1½+1½**
[CBSE Marking Scheme,2015]

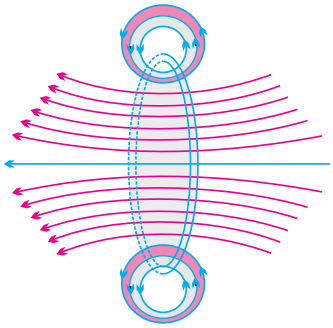
Long Answer Type Questions — 5 marks each

Q. 1. (i) Explain with the help of the pattern of magnetic field lines the distribution of magnetic field due to a current carrying a circular loop. C **3**

(ii) Why is it that the magnetic field of a current carrying coil having *n* turns, is '*n*' times as large as that produced by a single turn (loop) ? U **2**
[CBSE 2020 Delhi Set-3]

Ans. Magnetic field due to current through a circular Loop: It can be represented by concentric circle at every point. Circles become larger and larger as we move away. Every point on wire carrying current would rise to magnetic field appearing as straight line at centre of the loop. The direction of magnetic field inside the loop is same.

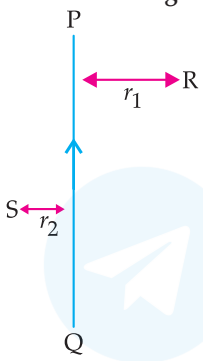
@PROCBSE



Magnetic field lines due to a current through a circular loop **3**

Magnetic field is directly proportional to number of turns (n) in the coil. As the number of turns (n) in the coil increase, the magnetic strength at the centre increases, because the current in each circular turn is having the same direction, thus the field due to each turn adds up. **2**

Q. 2. PQ is a current carrying conductor in the plane of the paper as shown in the figure below.



(i) Find the directions of the magnetic fields produced by it at points R and S? 1

Given $r_1 > r_2$, where will the strength of the magnetic field be larger? Give reasons.

(ii) Field strength are which point will be greater? 1

(iii) If the polarity of the battery connected to the wire is reversed, how would the direction of the magnetic field be changed? 1

(iv) Explain the rule that is used to find the direction of the magnetic field for a straight current carrying conductor. A **[SQP 2020] 2**

Ans. (i) The magnetic field lines produced is into the plane of the paper at R and out of it at S. **1**

(ii) Field at S > Field at P. Magnetic field strength for a straight current carrying conductor is inversely proportional to the distance from the wire. **1**

(iii) The current will be going from top to bottom in the wire shown and the magnetic field lines are now in the clockwise direction on the plane which is perpendicular to the wire carrying current. **1**

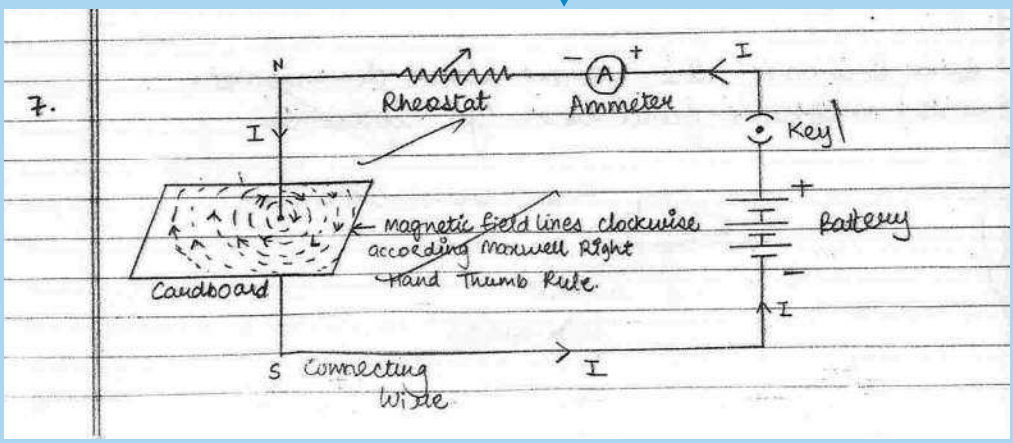
(iv) Right hand thumb rule. The thumb is aligned to the direction of the current and the direction in which the fingers are wrapped around the wire will give the direction of the magnetic field. **2**

@PROCBSE
JOIN NOW !

Q. 3. Draw the pattern of the field lines of the magnetic field around a current carrying straight conductor passing through and held perpendicular to a horizontal cardboard. State right-hand thumb rule and explain how this rule is useful to determine the direction of the magnetic field in the above case, if the direction of current in the conductor is vertically downwards.

C **[CBSE Delhi, 2019]**

Topper Answer, 2019



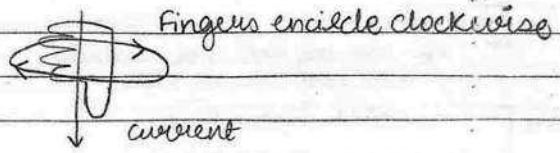
@PROCBSE

Maxwell Right Hand Thumb Rule is used.

It States that Suppose you are holding a current carrying conductor in your right hand in such a way that it points your thumb points in the direction of the current.

They the way or direction in which your fingers will encircle will give the direction of magnetic field lines.

As in this case, the current flows downwards, so the magnetic field lines go clockwise.

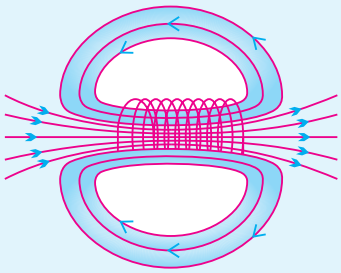


Q. 4. What is a solenoid ? Draw the pattern of magnetic field lines of (i) a current carrying solenoid and (ii) a bar magnet. List two distinguishing features between the two fields.

U [CBSE Board Delhi, Set- I, 2019]

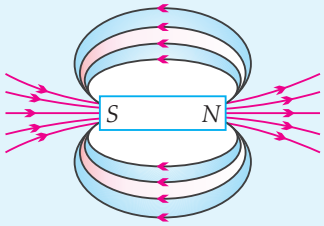
Ans. A coil of many turns of insulated copper wire wrapped closely in the shape of a cylinder. **1**

(i)



1

(ii)



1

Distinguishing features:

	Solenoid	Bar Magnet
1.	Field disappear on stopping the current.	No effect of current on field.
2.	Strength of the field can be changed by changing the current.	Strength cannot be changed.
3.	Direction can be reversed by changing the direction of current through it.	Direction is fixed and cannot be reversed.

(Any two features) 2

[CBSE Marking Scheme, 2019]

Q. 5. Draw the pattern of magnetic field lines produced around a current carrying straight conductor passing perpendicularly through a horizontal cardboard. State and apply right-hand thumb rule to mark the direction of the field lines. How will the strength of the magnetic field change when the point where magnetic field is to be determined is moved away from the straight conductor ? Give reason to justify your answer.

R [Board Outside Delhi, Set-I, 2019]

@PROCBSE

Ans.

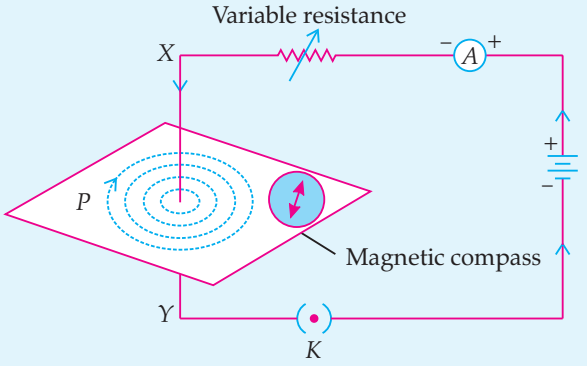


Diagram 1½ and direction ½

Statement of right hand thumb rule. **1 + 1**

The magnetic field strength decreases with increase of distance from the current carrying conductor.**1**

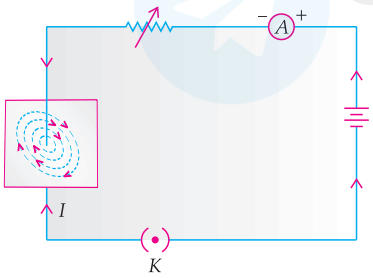
Reason: There is inverse relation between field strength and distance from current carrying conductor. **1**

Note: Direction of magnetic field should be in accordance with direction of current. **1**

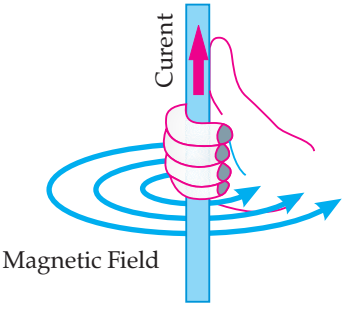
[CBSE Marking Scheme, 2019]

Detailed Answer:

Pattern of magnetic field lines produced around a current carrying straight conductor:



Right-hand thumb rule: If we are holding a current carrying straight conductor in right hand such that the thumb points towards the direction of current, then, the fingers will wrap around the conductor in the direction of the field lines of the magnetic field.



As the compass is placed farther, deflection in the needle decreases. Thus, the magnetic field produced by given current decreases as the distance from it increases. The concentric circles around the wire become larger as we move away from it.

Q. 6. (a) What are magnetic field lines ? How is the direction of magnetic field at a point in a magnetic field determined using field lines ?

(b) Two circular coils 'X' and 'Y' are placed close to each other. If the current in the coil 'X' is changed, will some current be induced in the coil 'Y' ? Give reason.

(c) State 'Fleming's right hand rule".

R **[Delhi Comptt., 2018]**

Ans. (a) Magnetic field line: Path along which a hypothetical free north pole would tend to move. **1**

Direction of magnetic field are a point is determined By drawing a tangent to the magnetic field line at that point **1**

(b) Yes. **1**

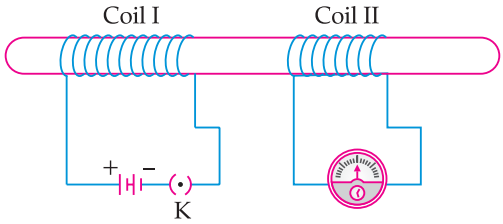
With change in current in the coil X, the magnetic field associated with it also changes around the coil Y placed near it. This change in magnetic field induces a current in the coil Y. **1**

(c) Fleming's right hand rule

Stretch the thumb, forefinger and middle finger of right hand so that they are perpendicular to each other. If the forefinger indicates the direction of the magnetic field and the thumb shows the direction of motion of the conductor, then the middle finger will show the direction of induced current in the conductor. **1**

Q. 7. (i) With the help of an activity, explain the method of inducing electric current in a coil with a moving magnet. State the rule used to find the direction of electric current thus generated in the coil.

(ii) Two circular coils-1 and coil-2 are kept close to each other as shown in the diagram. Coil-1 is connected to a battery and key and coil-2 with a galvanometer. State your observation in the galvanometer:



(a) When key *k* closed ;

(b) When key *k* is opened;

Give reason for you observations.

U **[SQP, 2018]**

Ans. (i)

(ii) (a) The galvanometer needle deflects momentarily in one direction because when the key is closed, magnetic field lines around coil-2 increases momentarily that causes induced current in coil-2.

(b) The galvanometer needle deflects momentarily but in opposite direction because when the key is opened, magnetic field lines around coil-2 decreases momentary that causes induced current in coil-2.

[CBSE Marking Scheme, 2018]

@PROCBSE

Detailed Answer:

(i)
- Take two different coils of copper wire having large number of turns (say 50 and 100 turn respectively). Insert them over a non-conducting cylindrical roll.
- Connect the coil-1, having larger number of turns, in series with a battery and a plug key. Also connect the other coil-2 with a galvanometer as shown.
- Plug in the key. Observe the galvanometer. There is a deflection in its needle. You will observe that the needle of the galvanometer instantly jumps to one side and just as quickly returns to zero, indicating a momentary current in coil-2.
- Disconnect coil-1 from the battery. You will observe that the needle momentarily moves, but to the opposite side. It means that now the current flows in the opposite direction in coil-2.

(ii) Same as CBSE Marking Scheme. **3 + 2**

AI **Q. 8. What are magnetic field lines ? List three characteristics of these lines. Describe in brief an activity to study the magnetic field lines due to a current flowing in a circular coil.**

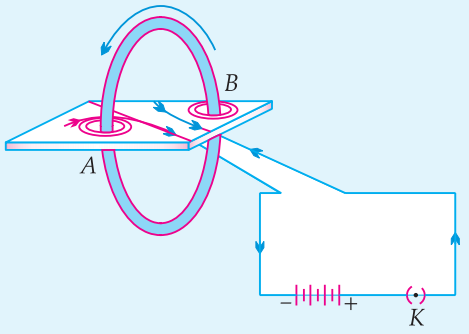
R [Board Term I, 2016]

Ans. Representation of the magnetic field path along which an imaginary free north pole would tend to move. The tangent at any point on the magnetic field line gives the direction of the magnetic field at that point.

(i) Emerge at north pole and merge at south pole. Inside the magnet, the direction of field lines is from south pole of magnet to its north pole and are closed curves.

(ii) At the points where the magnetic field is stronger, field lines are crowded and vice-versa.

(iii) No two magnetic field lines can intersect each other. **3**



2

[CBSE Marking Scheme, 2016]

(i) A rectangular cardboard having holes is used. A circular coil is passed through the holes. Coil is kept normal to the cardboard.

(ii) Ends of the coil is connected to a battery through a key.

(iii) Iron filings are sprinkled uniformly on the card board.

(iv) Key is plugged in.

(v) On tapping cardboard gently the iron filings get arranged in concentric circular loops around the holes on the cardboard indicating the magnetic field lines.

Q. 9. The magnetic field lines associated with current carrying straight conductor is in anti-clockwise direction. If the conductor was held horizontally along east-west direction, what is the direction of current through it ? Explain it with the help of diagram. Name and state the rule applied to determine the direction of magnetic field. If the conductor is held vertically and current flows from north to south, what will be the direction of magnetic field lines. Draw diagram.

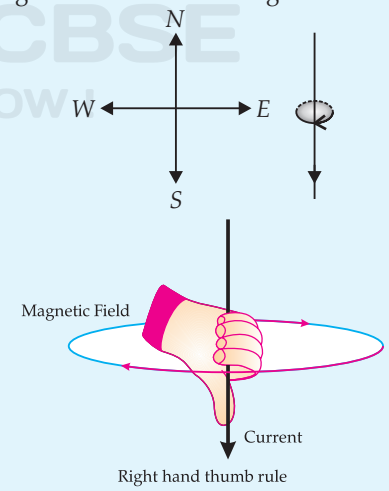
U [Board Term I, 2016]

Ans. Direction of current will be from East to West direction.



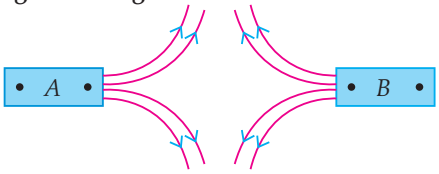
Maxwell's right hand thumb rule.

Statement: Imagine that you are holding the current carrying wire in your right hand so that your thumb points in the direction of current, then the direction of your fingers encircling the wire will give the direction of magnetic field.



[CBSE Marking Scheme, 2016] **5**

AI **Q. 10. (a) Magnetic field lines of two bar magnets A and B are as shown below. Name the poles of the magnets facing each other.** **1**



(b) Two magnetic field lines never intersect each other. Why ? **1**

(c) How does the strength of the magnetic field at the centre of a current carrying circular coil depend on the:

@PROCBSE JOIN NOW

@PROCBSE

(i) Radius of the coil,
(ii) Number of turns in the coil, and
(iii) Strength of the current flowing in the coil ? 3

AE [Board Term I, 2016]

Ans. (a) North poles.

(b) Intersection of magnetic field lines at a point means two tangents can be drawn at that point and there will be two direction of a magnetic field which is not possible.

(c) (i) Inversely proportional; more radius, less strong magnetic field.

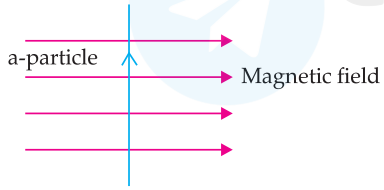
(ii) Directly proportional; more turns, more strong magnetic field.

(iii) Directly proportional; more strength of current, more strong magnetic field.

[CBSE Marking Scheme, 2016] **5**

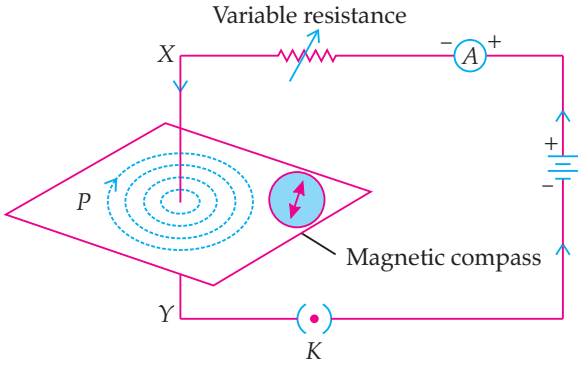
Q. 11. (i) Describe an activity to determine the direction of magnetic field produced by a current carrying straight conductor. Also show that the direction of the magnetic field is reversed on reversing the direction of current. 3

(ii) An α-particle, (which is a positively charged particle) enters a uniform magnetic field at right angles to it as shown below. Stating the relevant principle explain in which direction will this α-particle move ? U [Board Term I, 2016] **2**



Ans. (i) Take a battery (12 V), a variable resistance (or a rheostat), an ammeter (0 - 5A), a plug key and a long straight thick copper wire. Insert the thick wire through the centre, normal to the plane of a rectangular cardboard. Take care that the cardboard is fixed and does not slide up or down.

Connect the copper wire vertically between the points X and Y, in series with the battery, a plug and key. Sprinkle some iron filings uniformly on the cardboard. Keep the variable of the rheostat at a fixed position. Close the key, so that current flows through the wire. Ensure that the copper wire placed between the points X and Y remains vertically straight. Gently tap the cardboard for a few times. Observe the pattern of the iron filings. You would find that the iron filings align themselves showing a pattern of concentric circles around the copper wire. This represents the magnetic field around the current-carrying conductor. The direction of magnetic field changes on reversing the direction of current.



3

(ii) The alpha particle will move in a circular path. This is because a centripetal force acts on the particle due to the movement of particle in the magnetic field.

2

COMMONLY MADE ERROR

- Students often get confused about the motion of charged particle in magnetic field.

ANSWERING TIP

- Charged particles follow in circular path in magnetic field perpendicular point.

AI **Q. 12. (i) A coil of insulated copper wire is connected to a galvanometer. What happens if a bar magnet is:**
(a) Pushed into the coil ?
(b) Withdrawn from inside the coil ?
(c) Held stationary inside the coil ? Give reasons for your observation.
(ii) Mention one more method of inducing current in a coil. U [Board Term I, 2015]

Ans. (i) (a) When a bar magnet is pushed into the coil of insulated copper wire connected to a galvanometer, an induced current is set-up in the coil due to charge of magnetic field through it. As a result, galvanometer gives a deflection (say towards left) and returns to original position. **1½**

(b) When the bar magnet is withdrawn from inside the coil, again an induced current is set up in the coil due to charge of magnetic field through it. As a result galvanometer gives a deflection in the reverse direction (say towards right) and returns to original position. **1½**

(c) If the bar magnet is held stationary inside the coil, then there is no induced current in the coil, because there is no change in magnetic field through it. As a result, galvanometer does not show any deflection. **1**

(ii) By changing current in another coil placed near it. **1**

[CBSE Marking Scheme, 2015]

@PROCBSE JOIN NOW !

@PROCBSE

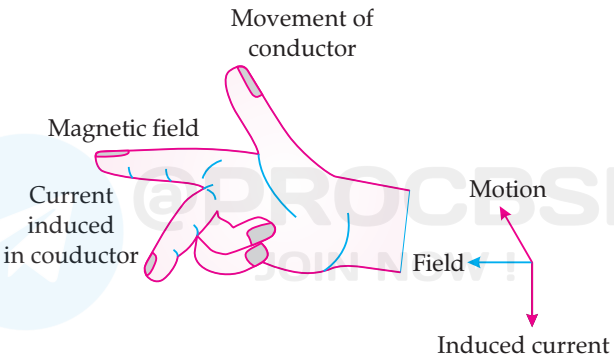
TOPIC - 2
Electric Generator and Electric Motor

Revision Notes

- **Electric motor:** It is a device used to convert electrical energy to mechanical energy. It works on the principle that force experienced by a current carrying conductor in a magnetic field.
- **Faraday's Law:** The rate at which the magnetic flux linked with a coil changes, produces the induced emf or current. More the rate, more the current and vice-versa.

$$I = \frac{Df}{R \times Dt} = \frac{\text{Change in flux}}{\text{Resistance} \times \text{Time}}$$

- **Fleming's Right Hand Rule:** Hold the thumb, the forefinger and the middle finger of right hand at right angles to each other. If the fore finger is in the direction of magnetic field and the thumb points in the direction of motion of conductor, then the direction of induced current is indicated by middle finger.



Scan to know more about this topic

Electromagnetic effect

- **Electric Generator:** Generator works on the principle of Electromagnetic Induction. It converts the mechanical energy available into electrical energy. A.C. Generator produces potential which reverses after every 180° rotation of the coil. D.C. Generator produces unidirectional current.
- An electric circuit consists of three main wiring components:
  (i) Live wire (positive) with red insulation cover.
  (ii) Neutral wire (negative) with black insulation cover.
  (iii) Earth wire with green insulation cover.
- The potential difference between live and neutral wire in India is 220 V.
- Pole → Main supply → Fuse → Electricity meter → Distribution box → To separate circuits.

Scan to know more about this topic

Domestic circuit

Mnemonics

Concept: Electrical wiring

Mnemonics: **R**are **L**awn **B**eautiful **N**ature **G**reen **E**arth

Interpretation:
Red: **L**ive
Black: **N**eutral
Green: **E**arth

@PROCBSE

How is it done on the GREENBOARD?

Q. It is necessary to connect an earth wire to electric appliance having metallic covers. Why?
How will you identify earth wire in household circuit?

Solution:

Step I: Earth wire is connected to a metalllic plate deep inside the earth so that its potential is equal to the earth's potential *i.e.* 0.

Step II: When the metallic cover of electric appliance is connected to the earth wire, the potential of the metal cover becomes 0. Hence if there is any leakage of current to the metallic cover it will go to the earth through the earth wire without passing through the user's body. Thus the user will be saved from getting electrical shock.

Step III: Identification of earth wire in household circuit is by its green insulation.

Objective Type Questions — 1 mark each

A Multiple Choice Questions

Q. 1. The phenomenon of electro-magnetic induction is :
(a) the process of charging a body.
(b) the process of generating magnetic field due to a current passing through a coil.
(c) producing induced current in a coil due to relative motion between a magnet and the coil.
(d) the process of rotating a coil of an electric motor.
[NCERT Exemp.]

Ans. Correct option : (c)
Explanation : In electro-magnetic induction phenomenon, an induced current begins to flow in a coil whenever there is a change in magnetic field in and around a coil.

Q. 2. The device used for producing electric current is called a:
(a) generator **(b) galvanometer**
(c) ammeter **(d) motor**
[NCERT Exemp.]

Ans. Correct option : (a)
Explanation : An A.C. generator is the device used for producing an electric current.

Q. 3. The essential difference between an AC generator and a DC generator is that:
(a) AC generator has an electro-magnet while a DC generator has permanent magnet.
(b) DC generator will generate a higher voltage.
(c) AC generator will generate a higher voltage.
(d) AC generator has slip rings while the DC generator has a commutator. **[NCERT Exemp.]**

Ans. Correct option : (d)
Explanation : AC generator has slip rings while the DC generator has a commutator.

Q. 4. Choose the correct option.
A rectangular coil of copper wires is rotated in a magnetic field. The direction of the induced current changes once in each:
(a) two revolutions.
(b) one revolution.
(c) half revolution.
(d) one-fourth revolution. **[NCERT]**

Ans. Correct option : (c)
Explanation : When a rectangular coil of copper wire is rotated in a magnetic field, the direction of the induced current changes once in each half revolution.

Q. 5. To convert an AC generator into DC generator :
(a) split-ring type commutator must be used.
(b) slip rings and brushes must be used.
(c) a stronger magnetic field has to be used.
(d) a rectangular wire loop has to be used.
[NCERT Exemp.]

Ans. Correct option : (a)
Explanation : Split ring type commutator reverses the direction of current after each half turn of armature. This maintains a DC current.

Q. 6. Choose the incorrect statement :
(a) Fleming's right-hand rule is a simple rule to know the direction of induced current.
(b) The right-hand thumb rule is used to find the direction of magnetic fields due to current-carrying conductors.

@PROCBSE JOIN NOW !

@PROCBSE

(c) The difference between the direct and alternating currents is that the direct current always flows in one direction, whereas the alternating current reverses its direction periodically.

(d) In India, the AC changes direction after every 1/50 second. [NCERT Exemp.]

Ans. Correct option : (d)

Explanation : In India, the AC changes direction after every 1/100 second.

Q. 7. At the time of short circuit, the current in the circuit :

(a) reduces substantially **(b) does not change**

(c) increases heavily **(d) vary continuously**

[NCERT Exemp.]

Ans. Correct option : (c)

Explanation : At the time of short circuiting the live wire and the neutral wire come into direct contact. As a result, the current in the circuit increases abruptly..

Q. 8. The most important safety method used for protecting home appliances from short circuiting or overloading is :

(a) Earthing **(b) use of fuse**

(c) use of stabilisers **(d) use of electric meter**

[NCERT Exemp.]

Ans. Correct option : (b)

Explanation : A fuse is a short length of wire designed to melt in the event of excessive current flow.

B Assertions and Reasons Type Questions

Directions: In the following questions, a statement of assertion (A) is followed by a statement of reason (R). Mark the correct choice as:

(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

(b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).

(c) Assertion (A) is true but reason (R) is false.

(d) Assertion (A) is false but reason (R) is true.

Q. 1. Assertion (A): Safety fuses are made up of materials having a low melting point.

Reason (R): Safety fuses should be resistant to electric current.

Ans. Correct option : (c)

Explanation: Safety fuses are made up of materials having a low melting point so that when excess current flow through the circuit, the fuse melts breaking the circuit and thus prevents appliances.

Q. 2. Assertion (A): Copper is used to make electric wires.

Reason (R): Copper has very low electrical resistance.

Ans. Correct option : (a)

Explanation: The low electrical resistance of copper makes it a good conductor for electricity.

Q. 3. Assertion (A): AC load line is used for long distance transmission.

Reason (R): It has very less loss of energy in long distance transmission.

Ans. Correct option : (a)

Explanation: It can be easily transmitted over long distance without much loss in energy.

Q. 4. Assertion (A): When two bulbs are operated on same voltage supply, having power 60 W and 100 W then 100 W bulb has less resistance than 60 W.

Reason (R): The power of the bulb is directly proportional to the square of the voltage.

Ans. Correct option : (b)

Explanation: Since, power (P) $= \frac{V^2}{R}$ or $R \propto \frac{1}{P}$

Hence, 100 W bulb has less resistance.

C Very Short Answer Type Questions

Q. 1. The change in magnetic field lines in a coil is the cause of induced electric current in it. Name the underlying phenomenon. C [CBSE 2020, Delhi]

Ans. Electromagnetic induction.

Q. 2. State an important advantage of using alternating current (a.c.) over direct current (d.c.).

U [CBSE 2020, Delhi]

Ans. Advantage of AC: It can be transmitted over long distance without much loss of energy.

Q. 3. Mention the colour convention for live, neutral and earth wires. R **[Board Term-I, 2015]**

Ans. Live wire — Red, Neutral Wire — Black, Earth wire — Green. [CBSE Marking Scheme, 2015] **1**

AI **Q. 4. What is the use of earth wire in domestic electric circuit?** R [Board Term I, 2012]

Ans. To ensure that any leakage of current to the metallic body of the appliance does not give shock to the user. [CBSE Marking Scheme, 2012] **1**

Short Answer Type Questions-I — 2 marks each

Q. 1. State any one point of difference in direct current and alternating current. Which current is most commonly produced at power stations in our country? R

Ans. Direct current does not change its direction with time whereas alternating current reverses its direction periodically. **1**

Most power stations produce AC in power station of India. **1**

@PROCBSE JOIN NOW

Q. 2. State any one significance of the following devices in a domestic circuit: U

(i) Electric meter

(ii) Earthing

Ans. (i) Electric meter: It is used to record the consumption of electrical energy in kWh in the circuit. **1**

(ii) Earthing: It prevents electric shock. The earth-wire is joined to the metal case of the appliance and provides a low resistance conducting path for the current. **1**

Q. 3. An electric oven of power rating 2000W is used in an electric circuit of 220V. It has a fuse of 5A rating. What happens when the oven is switched on. Explain. C

Ans. Here, P = 2000 W, V = 220 V

Using P = VI

$$I = \frac{P}{V} = \frac{2000}{220} = \frac{100}{11} A = 9.09A$$

Since the current flowing through the oven is larger than the fuse rating (5 A), the fuse wire melts and breaks the circuit, thus protecting the circuit.

Q. 4. What are the three types of wires used in household circuits. Pick out the wire used as a safety measure for electrical appliance with metallic body? R

Ans. (i) Live wire ½

(ii) Neutral wire ½

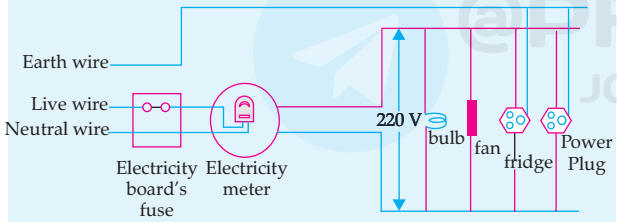
(iii) Earth wire ½

Earth wire, colour of insulation – green ½

Short Answer Type Questions-II — 3 marks each

Q. 1. Suppose your parents have constructed a two room house and you want that in the living room there should be a provision of one electric bulb, one electric fan, a refrigerator and a plug point for appliances of power up to 2 kilowatt. Draw a circuit diagram showing electric fuse and earthing as safety devices. A **[Board SQP, 2020]**

Ans.



(i) Four components should be labelled. **1**

(ii) All of them should be in parallel and there should be a fuse for safety. ½ + ½

(iii) Live and earth wires should be there. **1**

(½ to be deducted if all parts of the diagram are not labelled)

[CBSE Marking Scheme, 2020] 3

Q. 2. Give reasons for the following:

(i) There is either a convergence or a divergence of magnetic field lines near the ends of a current carrying straight solenoid. **1**

(ii) The current carrying solenoid when suspended freely rest along a particular direction. **1**

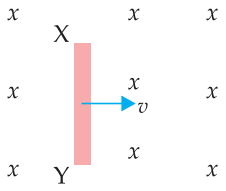
(iii) The burnt out fuse should be replaced by another fuse of identical rating. U **[CBSE 2020 OD] 2**

Ans. (i) Divergence or degree of closeness of magnetic field lines near the ends of a current carrying straight solenoid indicates a increase in the strength of the magnetic field near the ends of the solenoid. **1**

(ii) A current carrying solenoid acts as a bar magnet. We know that a freely suspended bar magnet aligns itself in the North-South direction. So, a freely suspended current carrying solenoid also aligns itself in the North-South direction. **1**

(iii) Burnt out fuse cannot be re-used. Also, a fuse wire works because of its lower melting point. If the fuse with larger rating is used with an appliance, the fuse wire shall not melt and hence would fail to serve the required purpose. So, new fuse of same rating should be used for electrical safety. **1**

Q. 3. Crosses ⊗ represent a uniform magnetic field directed into the paper. A conductor XY moves in the field toward right side. Find the direction of induced current in the conductor. Name the rule you applied. What will be the direction of current if the direction of field and the direction of motion of the conductor both are reversed ?



AE **[Board Term I, 2016]**

Ans. (i) Y to X

(ii) Fleming's right hand rule.

(iii) The direction of induced current will still be the same *i.e.*, Y to X. **1 + 1 + 1**

[CBSE Marking Scheme, 2016]

@PROCBSE JOIN NOW !

Long Answer Type Questions — 5 marks each

AI **Q. 1. What is an electromagnet ? List any two uses.**

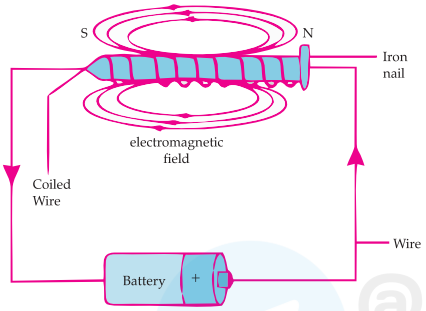
(i) Draw a labelled diagram to show an electromagnet is made.

(ii) State the purpose of soft iron core used in making an electromagnet.

(iii) List two ways of increasing the strength of an electromagnet if the material of the electromagnet is fixed. U **[CBSE 2020, Delhi]**

Ans. Electromagnet: Magnet formed by producing magnetic field inside a solenoid. Uses of electromagnet: Inside TVs, sound speakers and radios.

(i) Labelled diagram to show how an electromagnet is made:



An electromagnetic field is formed when a current passes through the wire.

(ii) Soft iron rod increases the magnetism of solenoid by a thousand fold. When the solenoid current is switched off, the magnetism is effectively switched off since the soft iron core has low retentivity.

(iii) Ways to increase the strength of an electromagnet if the material of the electromagnet is fixed are:

(a) By increasing the amount of current flowing in the solenoid

(b) By increasing the number of turns in the solenoid.

2+1+1+1

Q. 2. (a) State Fleming's left hand rule.

(b) Write the principle of working of an electric motor.

(c) Explain the function of the following parts of as electric motor.

(i) Armature (ii) Brushes (iii) Split ring

A **[CBSE Delhi/O.D., 2018]**

Ans. (a) Fleming's left-hand rule: Stretch the forefinger, middle finger and thumb of left hand in such a way that they are mutually perpendicular to each other. If the forefinger points in the direction of magnetic field, middle finger points in the direction of current then the thumb shows the direction of force or motion on the current carrying conductor.

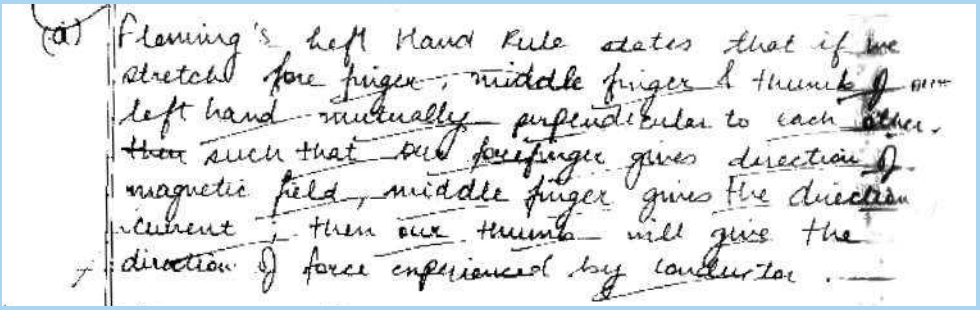
(b) Principle of working of electric motor: A coil carrying electric current placed in an external magnetic field experiences a force.

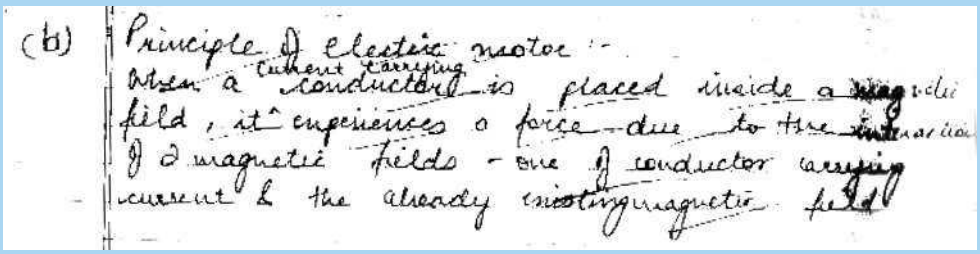
(c) (i) It is a copper coil with iron cure. Current passes this coil. When it placed in a magnetic field it experiences a force and rotnts.

(ii) Function of brushes: Helps easy transfer of charge between the coil and the external circuit.

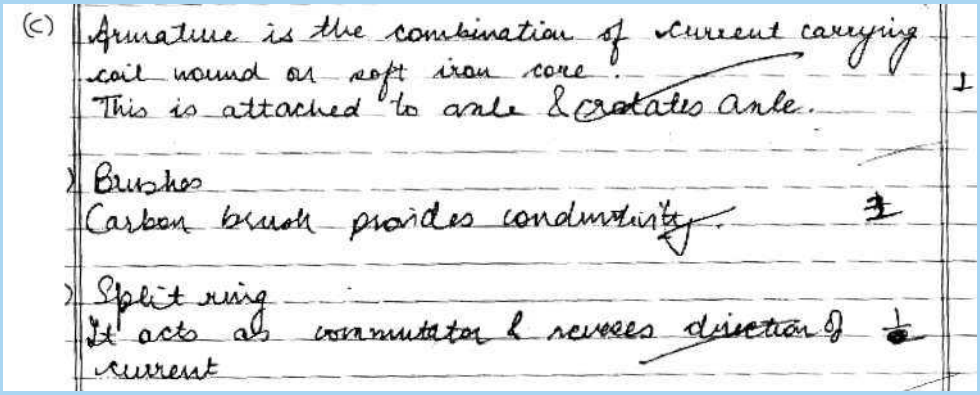
(iii) Function of split rings: Reverses the direction of current after each half rotation of the coil so that the coil can keep rotating continuously. **1 + 1 + 2**

Topper Answer, 2018


(a) Fleming's left Hand Rule states that if the stretch fore finger, middle finger & thumb of left hand mutually perpendicular to each other such that our forefinger gives direction of magnetic field, middle finger gives the direction of current then our thumb will give the direction of force experienced by conductor.


(b) Principle of electric motor :- When a current carrying conductor is placed inside a magnetic field, it experiences a force due to the interaction of 2 magnetic fields - one of conductor carrying current & the already existing magnetic field

@PROCBSE JOIN NOW


(c) Armature is the combination of current carrying coil wound on soft iron core. This is attached to axle & rotates axle. 1

Brushes
Carbon brush provides conductivity. ½

Split ring
It acts as commutator & reverses direction of current ½

AI **Q. 3. (i) What is meant by the terms alternating current and direct current ?**

(ii) Name a source of alternating current and a source of direct current.

(iii) Mention the frequency of AC supply in India.

(iv) State two important advantages of alternating current over direct current.

R **[Board Term I, 2015]**

Ans. (i) Refer to know the terms.

(ii) Source of AC current — electric generator.
Source of DC current — electric cell.

(iii) Frequency of alternating current in India is 50 Hz.

(iv) (a) AC can be easily converted to DC. Also AC can be easily stopped up or stopped down to any derived value.

(b) AC electric power can be transmitted over long distances without much loss of energy while DC cannot be Transmitted. **5**

AI **Q. 4. (a) Draw a schematic labelled diagram of domestic electric circuit.**

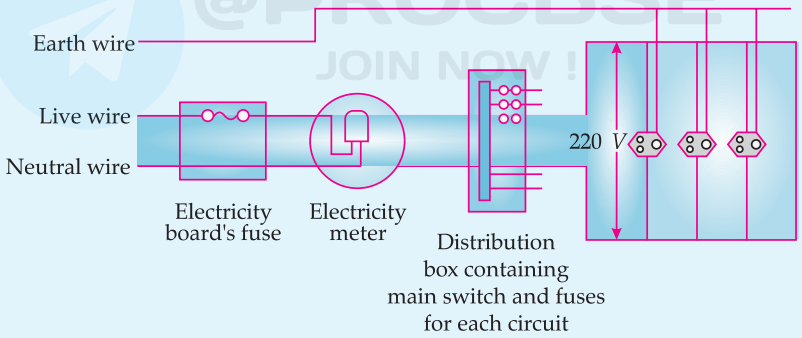
(b) Why is it necessary to provide–

(i) A fuse in an electric circuit

(ii) An earth wire to electric application metallic body? Explain.

A **[Board Term-I, 2015]**

Ans. (a)



3

Fig. A schematic diagram of one of the common domestic circuits

(b) (i) It prevents damage to appliance due to overloading or short-circuiting.

(ii) Earth wire is connected to a metallic body buried deep inside earth. It is used as safety measure. It provides a low resistance conducting path for the current any leakage of current to a metallic body does not give shock to user. **[CBSE Marking Scheme, 2015] 2**

Visual Case-based Questions — 4 marks each

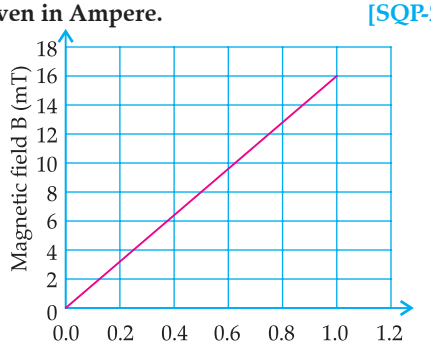
Q. 1. Read the following passage and answer any four questions from (a) to (e).

A solenoid is a long helical coil of wire through which a current is run in order to create a magnetic field. The magnetic field of the solenoid is the superposition of the fields due to the current through each coil. It is nearly uniform inside the solenoid and close to zero outside and is similar to the field of a bar magnet having a north pole at one end and a south pole at the other depending upon the direction of current flow. The magnetic field produced in the solenoid is dependent on a few factors such as, the current in the coil, number of turns per unit length etc.

The following graph is obtained by a researcher while doing an experiment to see the variation of the magnetic field with respect to the current in the solenoid.

@PROCBSE

The unit of magnetic field as given in the graph attached is in mili-Tesla (mT) and the current is given in Ampere. [SQP-2020-21]



(a) What type of energy conversion is observed in a linear solenoid? U

(i) Mechanical to Magnetic
(ii) Electrical to Magnetic
(iii) Electrical to Mechanical
(iv) Magnetic to Mechanical

(b) What will happen if a soft iron bar is placed inside the solenoid? C

(i) The bar will be electrocuted resulting in short-circuit.
(ii) The bar will be magnetised as long as there is current in the circuit.
(iii) The bar will be magnetised permanently.
(iv) The bar will not be affected by any means.

(c) The magnetic field lines produced inside the solenoid are similar to that of … A

(i) a bar magnet
(ii) a straight current carrying conductor
(iii) a circular current carrying loop
(iv) electromagnet of any shape

(d) After analysing the graph a student writes the following statements. AE

(I) The magnetic field produced by the solenoid is inversely proportional to the current.
(II) The magnetic field produced by the solenoid is directly proportional to the current.
(III) The magnetic field produced by the solenoid is directly proportional to square of the current.
(IV) The magnetic field produced by the solenoid is independent of the current.
Choose from the following which of the following would be the correct statement(s).

(i) Only IV **(ii) I and III and IV**
(iii) I and II **(iv) Only II**

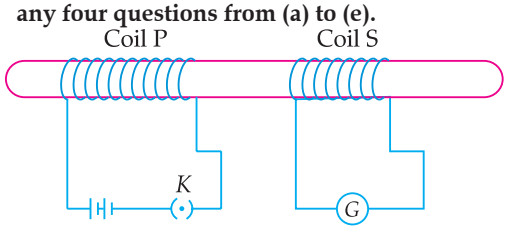
(e) From the graph deduce which of the following statements is correct. U

(i) For a current of 0.8A the magnetic field is 13 mT
(ii) For larger currents, the magnetic field increases non-linearly.
(iii) For a current of 0.8A the magnetic field is 1.3 mT
(iv) There is not enough information to find the magnetic field corresponding to 0.8A current.

Ans. (a) (ii) Electrical to Magnetic
(b) (ii) The bar will be magnetised as long as there is current in the circuit
(c) (i) A bar magnet
(d) (iv) Only II
(e) (i) For a current of 0.8A the magnetic field is 13 mT

1 + 1 + 1 + 1+1

Q. 2. In the given diagram, two coils of insulated copper wire are wound over a nonconducting cylinder as shown. Coil P has larger number of turns. Answer any four questions from (a) to (e).



(a) A momentary deflection is shown by the galvanometer , when: U

(i) Key K is open **(ii) Key K is closed**
(iii) In both the situations **(iv) In neither of the case.**

(b) When key K is opened or closed, which of the statement is false: U

(i) The current in the coil P changes.
(ii) Magnetic field linked with coil S changes.
(iii) The current is induced in the coil S.
(iv) None of the above

(c) In electromagnetic induction, current is induced in another conductor, AE

(i) By changing magnetic field
(ii) By increasing the strength of current
(iii) By decreasing the strength of the current
(iv) By using extra wire.

(d) State the rule which helps us to know direction of induced current: R

(i) Flemings right hand rule
(ii) Flemings left hand rule
(iii) Electro magnetic induction
(iv) Faraday's Law

(e) Flemings right hand rule explains: R

(i) Direction of magnetic field
(ii) Direction of motion of conductor
(iii) Only (a)
(iv) Both (a) and (b)

Ans. (a) (iii) In both the situations
(b) (iv) None of the above
(c) (i) By changing magnetic field
(d) (i) Fleming's right hand rule
(e) (iv) both (a) and (b) **1+1+1+1+1**

Q. 3. Read the following passage and answer any four questions from (a) to (e). A student fixes a sheet of white paper on a drawing board. He places a bar magnet in the centre of it. He sprinkles some iron filings uniformly around the bar magnet. Then he taps the board gently and observes that the iron filings arrange themselves in a particular pattern.

@PROCBSE JOIN NOW

(a) Why do the iron fillings arrange themselves in a particular pattern: AE

(i) Due to external force applied on the magnet.

(ii) Due to force exerted by the magnet outside the magnetic field.

(iii) Due to the force exerted by magnet within its magnetic field.

(iv) Due to pressure of magnetic field.

(b) What do the lines along which the iron fillings align represent: A

(i) North pole and south pole of the magnet

(ii) Strength of the magnet

(iii) Magnetic field lines

(iv) Gravitational force.

(c) What does the crowding of iron filings at the end of the magnet indicate? U

(i) magnetic field is strongest near the poles of the magnet.

(ii) magnetic field is weakest near the poles of the magnet.

(iii) There is no significant magnetic field at the poles of the magnet.

(iv) The significance of polarity

(d) The close field lines indicate: U

(i) Magnetic field in that region is weak

(ii) Magnetic field in that region is strong.

(iii) Magnetic field in that region is zero.

(iv) North and south poles are closer.

(e) What is SI unit of magnetic field: R

(i) Pascal **(ii) Nm^2**

(iii) Tesla **(iv) No unit**

Ans. (a) (iii) Due to the force exerted by magnet within its magnetic field.

(b) (iii) Magnetic field lines

(c) (i) magnetic field is strongest near the poles of the magnet.

(d) (ii) Magnetic field in that region is strong

(e) (iii) Tesla **1+1+1+1+1**

Q. 4. Answer any four question from (a) - (e) on the basis of your understanding of the following paragraph and the related studied concepts.

Renewable energy sources such as wind energy are vital for the Indian economy, not only from the point of view of supply, but also from the perspective of environmental and social benefits. India is the world's fifth largest wind-power producer and the largest windmill facilities in India are installed in Tamil Nadu. Muppandal is a small village of Tamil Nadu and one of the most important sites of wind-farm in the state. It uses wind from the Arabian Sea to produce renewable energy. The suitability of Muppandal as a site for wind farms stems from its geographical location as it has access to the seasonal monsoon winds.



The electrical generators used on wind turbines in sites like Muppandal, produce an output AC of 240 V and a frequency of 50 Hz even when the wind speed is fluctuating. A transformer may be required to increase or decrease the voltage so it is compatible with the end usage, distribution or transmission voltage, depending on the type of interconnection.

(a) The output frequency of wind turbine is 50 Hz. Which of the following does not explain this statement? C

(i) The fan of turbine moves 50 times in one second

(ii) In one second the output AC completes 50 cycles

(iii) The polarity of the output alternating current changes every 1/100 seconds.

(iv) In one minute the output AC completes 50 cycles

(b) Which of the following device does not work on the principle of electro magnetic induction: A

(i) Electric fan **(ii) Electric generator**

(iii) Dynamo **(iii) Electric bulb**

(c) Which device is used to increase the AC voltage to make it compatible with end user?

(i) generator **(ii) transformer**

(iii) ammeter **(iv) armature**

(d) Which device produces the electric current? R

(i) galvanometer **(ii) ammeter**

(iii) motor **(iv) generator**

(e) Fleming's left hand and Right hand rules are used in

(i) Generator and electric motor respectively.

(ii) Electric motor and generator respectively.

(iii) any rule can be used for any device.

(iv) both are not applied for generator and motor.

Ans. (a) (ii) In one sound output AC completes 50 cycles

(b) (iv) Electric bulb

(c) (ii) Transformer

(d) (iv) Generator

(e) (ii) Electric motor and generator respectively

1 + 1 + 1 + 1+1

@PROCBSE JOIN NOW

@PROCBSE

Know the Terms

- **Magnetic field lines:** Magnetic line of force are imaginary lines representing the direction of magnetic field such that the tangent at any point gives the direction of the field at that point.
- **Magnetic field:** The area around a magnet in which its effect can be experienced is called **magnetic field.**
- **Magnetic effects of current:** When electric current flows through a conductor, a magnetic field is produced around it. This is called **magnetic effects of current**.
- **Electromagnet:** An **electromagnet** is a solenoid coil that attains magnetism due to the flow of current. It works on the principle of magnetic effect of current.
- **Electromagnetic induction:** The production of electric current due to relative motion between a conductor and a magnetic field is called **electromagnetic induction.** Electric current produced due to this phenomenon is called **induced current.**
- **Self Induction:** When the current flowing through a coil changes, then the current is induced in the coil itself. This phenomena is called **self-induction**.
- **Magnetic flux:** It is defined as the product of the magnetic field and the area through which magnetic field passes perpendicularly. $\phi = nBA$, when field passes perpendicular to the plane of the coil. It is measured in weber. If B and A are at angle θ, $\phi = nBA \cos\theta$, where n is the number of turns.
- **Direct Current:** If the current always flows in the same direction, it is called **direct current**. DC can be obtained from a cell or a battery. The positive and negative polarities of DC are fixed.
- **Alternating Current:** If the current changes direction after equal intervals of time, it is called **alternating current**. The positive and negative polarities of AC are not fixed.
- **Earthing:** Connecting the outer frame of an appliance to earth to avoid any shock caused by fault or current leakage is called **earthing**.
- **Armature:** The coil having multiple turns used in electric motor or generator is called **armature**.
- **Fuse:** Fuse is a safety device commonly used in electric circuits. It is connected with the live wire.

@PROCBSE SCAN NOW !



❑❑❑

@PROCBSE

SELF ASSESSMENT TEST - 4

Maximum Time: 1 hour **MM: 25**

Q. 1. The magnetic field around a current-carrying solenoid is uniform in which region? **1**

Q. 2. How can you determine the direction of magnetic field at a given point? **1**

Q. 3. Find the direction of the magnetic field when an alpha particle which is projected towards West is deflected towards North by it. **1**

Q. 4. Directions : In the following questions, a statement of assertion (A) is followed by a statement of reason (R). Mark the correct choice as:

(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

(b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).

(c) Assertion (A) is true but reason (R) is false.

(d) Assertion (A) is false but reason (R) is true.

Assertion : An important application of electromagnetic induction is ac generator

Reason : The direction of current changes periodically and therefore the current is called alternating current

Q. 5. What are the constituent elements of alloy nipermag? Give an important use of this alloy. **2**

Q. 6. An insulated copper wire coil is connected to a galvanometer. Write your observation what happens when a bar magnet is :

(a) Held stationary inside the coil

(b) Pushed into the coil **2**

Q. 7. What is fuse used for in electric circuits ?What will happen if a fuse with defined rating not be replaced by one with larger rating? **2**

Q. 8. Name any two electrical appliance which make use of motor.

Also name and state the principle on which electric motor works. **3**

Q. 9. Define electromagnet. Suggest any two ways to determine north and south pole of an electromagnet with the help of magnetised iron bar ? **3**

Q. 10. Case Based Questions: **4**

Mahesh bought an electric iron and connected its wires into the two-pin plug. Obviously, the green wire was not connected anywhere. Few days later, his wife got a severe electric shock while ironing the clothes. The electrician told Mahesh that this situation could be averted had he connected the green wire also, using the three-pin plug. Mahesh learnt a lesson for a life-time.

Read the above passage and answer the following questions : **(Any four)**

(i) What are the colour convention for live , neutral and earth wire:

(a) Red, black, green **(b)** Red, green, black

(c) Green , black, red **(d)** Black, red , green

(ii) Which terminal was to be connected using green wire?

(a) Earthing **(b)** Live

(c) Neutral **(d)** Any of these

(iii) In domestic electric circuit, with which wire do we connect a fuse?

(a) Earthing **(b)** Live

(c) Neutral **(d)** Any of these

(iv) Electric fuse is an application of :

(a) Electromagnetic induction **(b)** Solenoid

(c) Joule's heating **(d)** Electro magnetic force

@PROCBSE JOIN NOW !

@PROCBSE

(v) Name the device used to record the consumption of electrical energy in the circuit:

(a) Electric meter **(b)** Ammeter

(c) Voltmeter **(d)** Earthing

Q. 11. Name a device which converts mechanical energy into electrical energy.

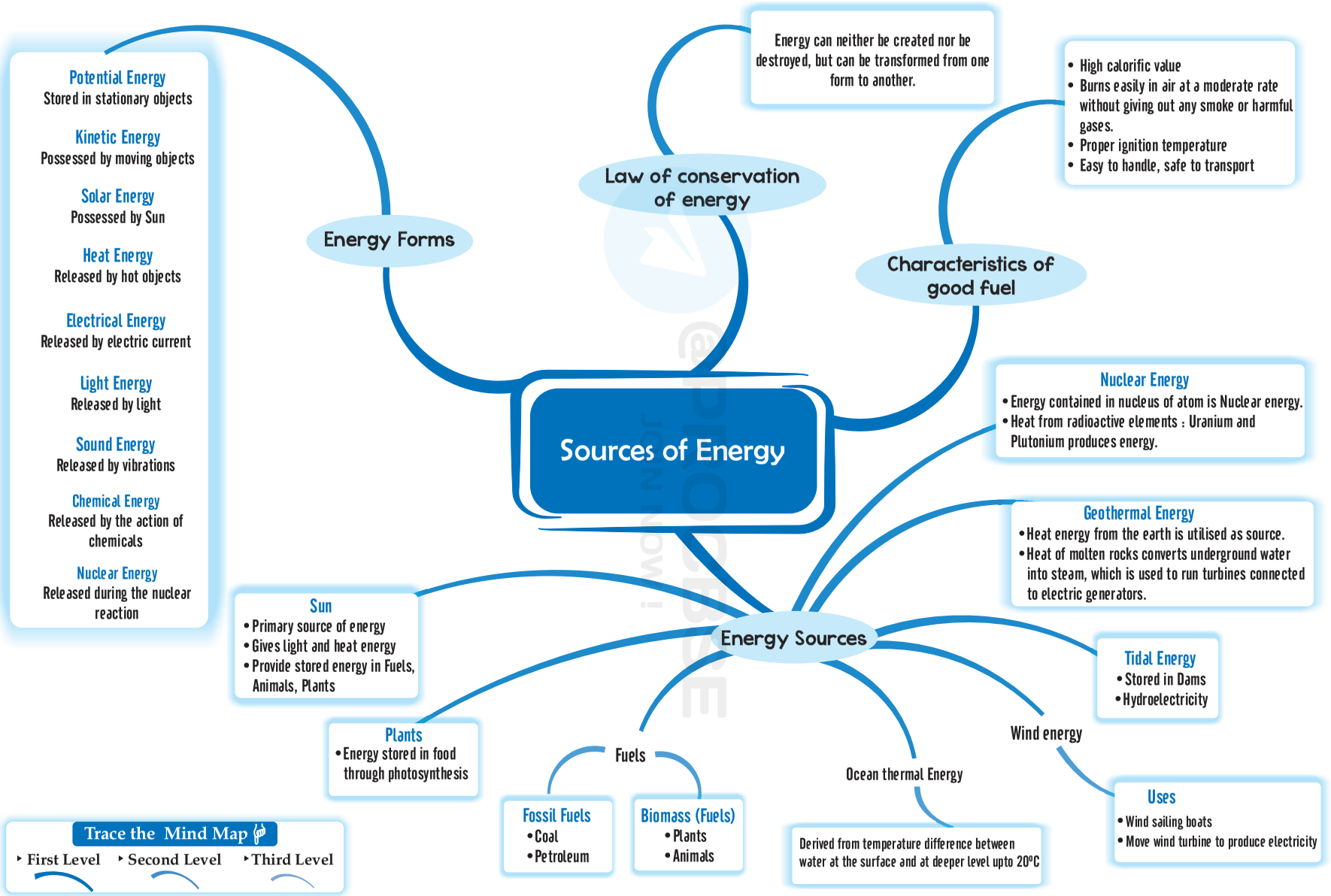
State the principle and explain the working of this device along with a well labelled diagram. **5**



■■

@PROCBSE
JOIN NOW !

@PROCBSE


Sources of Energy
Energy Forms
Potential Energy
Stored in stationary objects
Kinetic Energy
Possessed by moving objects
Solar Energy
Possessed by Sun
Heat Energy
Released by hot objects
Electrical Energy
Released by electric current
Light Energy
Released by light
Sound Energy
Released by vibrations
Chemical Energy
Released by the action of chemicals
Nuclear Energy
Released during the nuclear reaction
Law of conservation of energy
Energy can neither be created nor be destroyed, but can be transformed from one form to another.
Characteristics of good fuel
High calorific value
Burns easily in air at a moderate rate without giving out any smoke or harmful gases.
Proper ignition temperature
Easy to handle, safe to transport
Energy Sources
Nuclear Energy
Energy contained in nucleus of atom is Nuclear energy.
Heat from radioactive elements : Uranium and Plutonium produces energy.
Geothermal Energy
Heat energy from the earth is utilised as source.
Heat of molten rocks converts underground water into steam, which is used to run turbines connected to electric generators.
Tidal Energy
Stored in Dams
Hydroelectricity
Wind energy
Uses
Wind sailing boats
Move wind turbine to produce electricity
Ocean thermal Energy
Derived from temperature difference between water at the surface and at deeper level upto 20°C
Fuels
Fossil Fuels
Coal
Petroleum
Biomass (Fuels)
Plants
Animals
Plants
Energy stored in food through photosynthesis
Sun
Primary source of energy
Gives light and heat energy
Provide stored energy in Fuels, Animals, Plants
Trace the Mind Map
First Level
Second Level
Third Level

@PROCBSE

UNIT V: NATURAL RESOURCES

CHAPTER 14

SOURCES OF ENERGY

Syllabus

Different forms of energy, conventional and non-conventional sources of energy: Fossil fuels, solar energy, biogas, wind, water, tidal energy and nuclear energy, Renewable versus non-renewable sources of energy.

Trend Analysis

List of Concepts	2018	2019	2020
Sources of Energy	1 Q (1 M)		
Alternative or Non-conventional Sources of Energy		1 Q (3 M)	1 Q (4 M)

@PROCBSE JOIN NOW !

TOPIC - 1
Conventional Sources of Energy

Revision Notes

- Any system from where energy can be trapped is called a source of energy. A good source of energy is capable of providing adequate amount of energy. It should be convenient to use and easy to store and transport.
- **Law of Conservation of Energy :** Energy can neither be created nor be destroyed, but can be transformed from one form to another.
- **Qualities of a Good Source of Energy :**
  - **(i)** Energy which could do a large amount of work per unit mass or volume.
  - **(ii)** Cheap and easily accessible and provides energy for the maximum period of time.
  - **(iii)** Easy to store and transport.
  - **(iv)** Safe to handle and use.
  - **(v)** Does not cause environmental pollution.
- **Fuel :** The material which is burnt to produce heat energy is known as fuel. *e.g.,* wood, coal, LPG, kerosene.
- **Characteristics of a Good Fuel :**
  - **(i)** High calorific value (gives more heat per unit mass).
  - **(ii)** Burn easily in air at a moderate rate without giving out any smoke or harmful gases.

TOPIC - 1
Conventional Sources of Energy
Page No. 360
TOPIC - 2
Alternative or Non-Conventional Sources of Energy
Page No. 367

@PROCBSE

(iii) Easy to handle, safe to transport.
(iv) Convenient to store.
(v) Burn smoothly and does not leave behind any undesirable substances.
(vi) Less expensive.

➢ **Conventional Sources of Energy :** Sources of energy which are used since a long time. e.g., fossil fuels, biomass, energy of moving water, wind energy etc.

I. Fossil Fuels :

- Fuels developed from the fossils *e.g.*, coal, petroleum.
- Take million of years to form.
- Available in very limited amount.
- Fossil fuels are non-renewable sources of energy.
- Burning of fossil fuels leads to air pollution and green-house effect.

Scan to know more about this topic
Wind generator

II. Thermal power plants

- In thermal power plants, fossil fuels like coal are burnt to produce heat energy, which is converted into electrical energy. For example, fossil fuels are burnt to heat up water to produce steam which in turn runs turbine to generate electricity. The flow of energy is as listed below :
  Fossil fuels—Heat Energy—Mechanical Energy—Electrical Energy.

Scan to know more about this topic
Thermal power plants

III. Hydro power plants :

- Hydropower plants, convert the potential energy of falling water into electricity. The energy of water flowing through rivers has been used for rotating the wheels of water-mills operating in remote hilly areas.
- **Dams :** High rise dams are constructed on the river to collect water in large reservoirs. This water is then carried through pipes to the turbines, at the bottom of the dam to generate electricity.

Scan to know more about this topic
Hydropower plants

IV. Biomass

- The dead part of plants, trees and the waste materials of animals and man are called **Biomass.** Normally, biomass has low calorific value and produce lot of smoke when they are burnt.

(1) Wood : It is a biomass and used as a fuel for a long time.

Disadvantages :

- Produces a lot of smoke on burning.
- Do not produce much heat.

(2) Charcoal : When wood is burnt in limited supply of air, then water and other volatile materials gets removed and charcoal is formed.

$$\text{Wood} \xrightarrow{\text{Limited Supply of } O_2} \text{Charcoal}$$

Charcoal is better fuel than wood because :

(i) It has high heat generation capacity (or higher calorific value) than wood.
(ii) It does not produce smoke while burning.
(iii) Is a compact fuel, easy to handle than wood and convenient to use.

(3) Cow dung : Cow dung is an efficient and cheap good fuel. However, it is not good to burn cow dung directly as fuel because,

- It produces a lot of smoke.
- It does not burn completely, produces lot of ash as a residue.
- It has low calorific value.

(4) Biogas : Biogas is produced by decomposing cow dung, various plant materials like the residue after harvesting the crops, vegetable waste and sewage in a biogas plant. Biogas is used for lighting, cooking in the rural areas while the slurry left behind is used as excellent manure, rich in nitrogen and phosphorus.

(5) Wind Energy : The kinetic energy of the wind can be used to generate electricity. The rotatory motion of the windmill is used to turn the turbine of the electric generator.

The output of a number of windmills in a farm is coupled together to get electricity on a commercial scale.

@PROCBSE JOIN NOW !

How is it done on the GREENBOARD?

Q. What is biogas? Describe the steps involved in obtaining biogas. 3

Solution:

Step I: Biogas is a mixture of methane, carbon dioxide, hydrogen, and hydrogen sulphide.

Following steps are involved in obtaining biogas:

Step II: Digesting (decomposition of cattle-dung by anaerobic bacteria).

Step III: Formation of biogas.

Step IV: Collecting the residue left after the formation of biogas.

Objective Type Questions — 1 mark each

A Multiple Choice Questions

Q. 1. Which of the following is a non-renewable source of energy?

(a) Wood **(b) Sun**
(c) Fossil fuels **(d) Wind**

[NCERT Exemp.]

Ans. Correct option : (c)

Explanation: Fossil fuels are non-renewable source of energy because their supplies are limited and can't be recycled once used.

Q. 2. The main constituent of biogas is

(a) methane. **(b) carbon dioxide.**
(c) hydrogen. **(d) hydrogen sulphide.**

[NCERT Exemp.]

Ans. Correct option : (a)

Explanation: Biogas contains upto 75% methane. It burns without smoke and leaves no residue like ash in wood, charcoal and coal burning.

Q. 3. Choose the incorrect statement regarding wind power.

(a) It is expected to harness wind power to minimum in open space.
(b) The potential energy content of wind blowing at high altitudes is the source of wind power.
(c) Wind hitting at the blades of a windmill causes them to rotate. The rotation thus achieved can be utilised further.
(d) One possible method of utilising the energy of rotational motion of the blades of a windmill is to run the turbine of an electric generator.

[NCERT Exemp.]

Ans. Correct option : (a)

Explanation: Maximum wind power is harnessed in open space hence, option (a) is wrong.

Q. 4. Choose the incorrect statement :

(a) We are encouraged to plant more trees so as to ensure clean environment and also provide biomass fuel.
(b) Gobar gas is produced when crops, vegetable wastes, etc., decompose in the absence of oxygen.
(c) The main ingredient of biogas is ethane and it gives a lot of smoke and also produces a lot of residual ash.
(d) Biomass is a renewable source of energy.

[NCERT Exemp.]

Ans. Correct option : (c)

Explanation: The main ingredient of biogas is methane.

Q. 5. Fuel used in thermal power plants is :

(a) water. **(b) uranium.**
(c) biomass. **(d) fossil fuels.**

[NCERT Exemp.]

Ans. Correct option : (d)

Explanation : Large amount of fossil fuels such as coal, natural gas, or petroleum, are burnt every day in power stations to heat up water to produce steam which further runs the turbine to generate electricity.

B Assertions and Reasons Type Questions

Directions : In the following questions/a statement of assertion (A) is followed by a statement of reason (R). Mark the correct choice as :

(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).
(b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).
(c) Assertion (A) is true but reason (R) is false.
(d) Assertion (A) is false but reason (R) is true.

@PROCBSE JOIN NOW !

@PROCBSE

Q. 1. Assertion (A) : Charcoal is better fuel than wood.
Reason (R) : Wood is smokeless and leaves no residue.

Ans. Correct option : (c)

Explanation : Charcoal is better fuel than wood because it is smokeless and leaves no residue. It has higher heat of combustion.

Q. 2. Assertion (A) : Burning of coal or petroleum products lead to air pollution.
Reason (R) : Coal and petroleum are non renewable source of energy.

Ans. Correct option : (b)

Explanation : Coal and petroleum are non-renewable sources of energy as they take millions of years to form and are available in very limited amount. Burning of fuels releases gases like CO_2, SO_2, NO_2.

These gases cause air pollution. With rain, these pollutants fall as acid rain and cause soil pollution.

Q. 3. Assertion (A) : Biogas is a boon to the farmers.
Reason (R) : Spent slurry is used as manure and can be used to generate electricity.

Ans. Correct option : (a)

Explanation : Biogas is considered to be a boon to the farmers as the slurry left in the biogas plant is a good manure for fields.

C Very Short Answer Type Questions

Q. 1. Why is biogas considered an excellent fuel?
R [CBSE Board Delhi Set-I, 2019]

Ans. It burns completely/ burns without smoke / high calorific value.
[CBSE Marking Scheme, 2019] **1**

Detailed Answer:

Q. 2. Write the name of the main constituent of biogas. Also, state its percentage.
R [CBSE Board Delhi, Set- II, 2019]

Ans. Methane - 75%
[CBSE Marking Scheme, 2019] ½ + ½

Q. 3. Although coal and petroleum are produced by the degradation of biomass, yet we need to conserve these resources. Why?
A [Board Outside Delhi, Set- III, 2019]

Ans. They are non renewable / their formation takes millions of years / exhausted in the future. (any one point) [CBSE Marking Scheme, 2019] **1**

Detailed Answer:

Coal and petroleum take millions of years to form by the degradation of biomass. As these resources are being utilised at a much faster rate than their formation, they will be exhausted in the future very soon. Therefore, they need to be conserved.

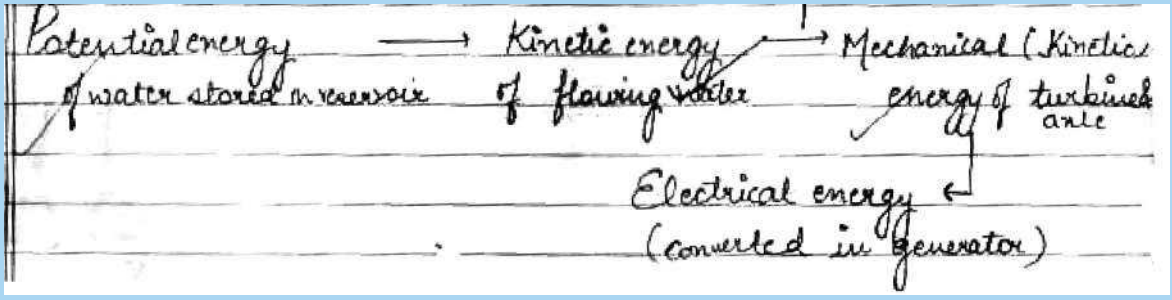
AI **Q. 4. Name two constituents of biogas.**
R [CBSE Comptt. Set-I, II, III-2018]

Ans. Methane /CH_4, Hydrogen/H_2, Hydrogen Sulphide/ H_2S, Carbon Dioxide/CO_2. **(Any two)**
[CBSE Marking Scheme, 2018] ½ + ½

Q. 5. Write the energy conversion that takes place in hydropower plant.
U [CBSE Delhi/OD Set-2018]

Ans. Potential / Kinetic / Mechanical Energy into Electrical energy.
[CBSE Marking Scheme, 2018] **1**

Topper Answer, 2018



Q. 6. Name the part of a biogas plant where reactions take place in the absence of oxygen.
R [Board Term-I, 2016]

Ans. Digester tank. [CBSE Marking Scheme, 2016] **1**

Q. 7. Name two constituent of biogas, one should be chief constituent. R [Board Term-I, 2015]

Ans. Methane : 75%
CO_2 : 25%. [½ + ½

@PROCBSE JOIN NOW !

@PROCBSE

Short Answer Type Questions-I — 2 marks each

AI **Q. 1. List any four qualities of an ideal source of energy.** U

Ans. Qualities of an Ideal Source of Energy:

(i) More heat per unit mass. ½

(ii) Less pollution and smoke free. ½

(iii) Cheap and Economical. ½

(iv) Easily available and easily handled. ½

(v) Safe to transport. **(Any four)**

Q. 2. List any two disadvantages of using fossil fuels. U

Ans. (i) Burning of coal or petroleum products lead to air pollution.

(ii) The oxides of C, N and S are released on burning of fossil fuels as acidic oxides. It leads to acidic rain and affects water and soil. **1 + 1**

Q. 3. Name the major constituent of biogas. List three characteristics to prove it as an excellent fuel. R

Ans. Methane is the major constituent of biogas. ½

Three characteristics to prove it as an excellent fuel :

(i) Smokeless.

(ii) Leaves no residue.

(iii) Higher heat of combustion. [½ + ½ + ½]

Q. 4. Mention the main use of slurry left behind in the biogas plant. State the characteristics of the slurry on which this use is based. U

Ans. Slurry is used as a manure. **1**

Slurry is rich in nitrogen and phosphorus. **1**

AI **Q. 5. Give two advantages of using nuclear energy.** R

Ans. Two advantages of using nuclear energy are :

(i) Very small mass of Uranium yields tremendous energy.

(ii) The released energy can be used to produce steam and further generate electricity. **1 + 1**

Short Answer Type Questions-II — 3 marks each

AI **Q. 1. List three environmental consequences of using fossil fuels. Suggest three steps to minimise the pollution caused by various energy sources.**

R **[Board Outside Delhi, Set-II, 2019]**

Ans. Consequences :

(i) Cause air pollution

(ii) The acidic oxides lead to acid rain

(iii) High concentration of green house gas (CO_2) and its effect

(iv) Global warming **(any 3 points)** ½ × 3

Steps to minimize the pollution :

(i) Use of alternate source of energy

(ii) Use of various devices to reduce emission of harmful gases.

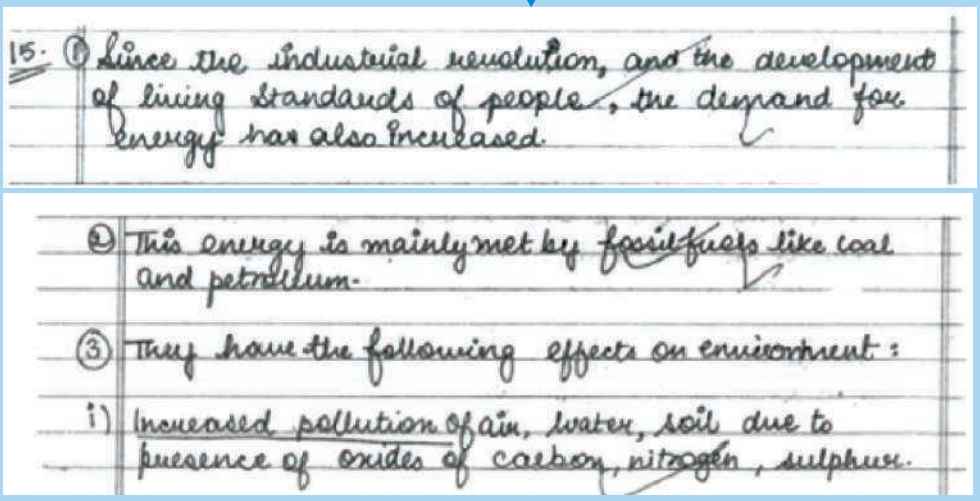
(iii) By increasing efficiency of combustion process

(or any other) ½ × 3

[CBSE Marking Scheme, 2019]

Detailed Answer:

Topper Answer, 2019

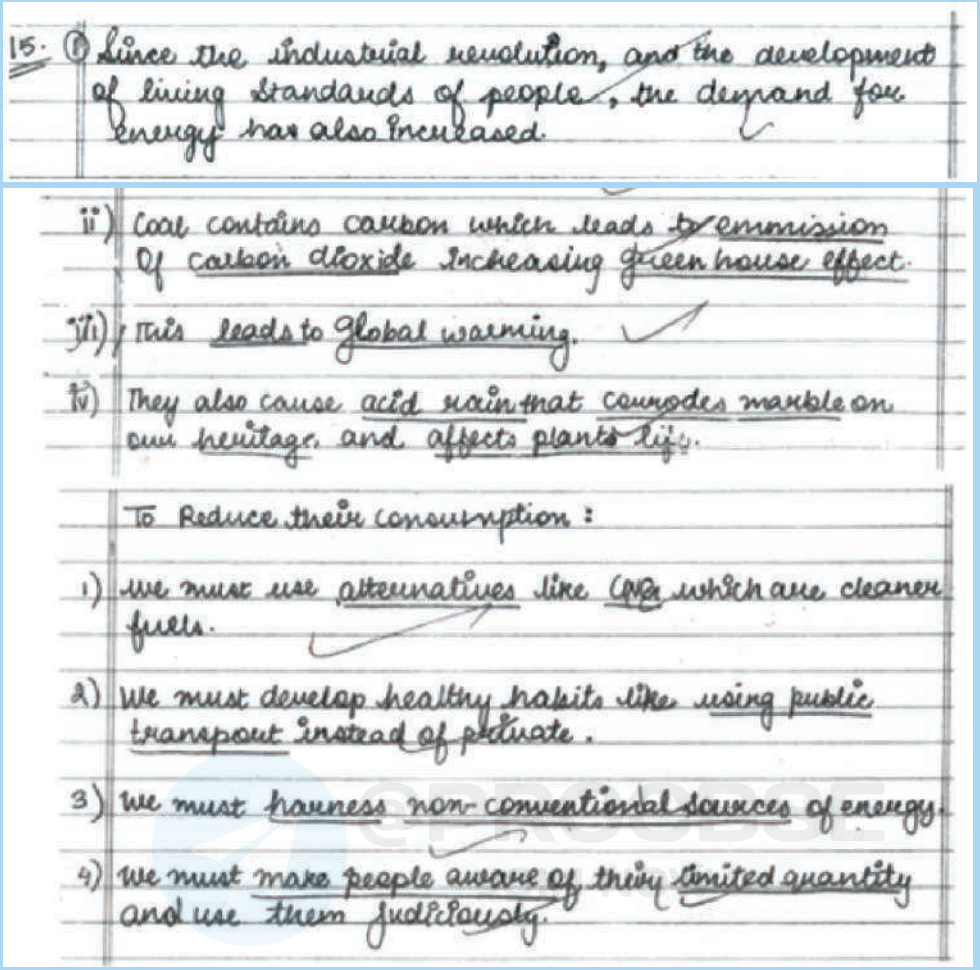

15. (1) Since the industrial revolution, and the development of living standards of people, the demand for energy has also increased.

(2) This energy is mainly met by fossil fuels like coal and petroleum.

(3) They have the following effects on environment :

i) Increased pollution of air, water, soil due to presence of oxides of carbon, nitrogen, sulphur.

@PROCBSE


15. (i) Since the industrial revolution, and the development of living standards of people, the demand for energy has also increased.

ii) Coal contains carbon which leads to emmission of carbon dioxide increasing green house effect.

iii) This leads to Global warming.

iv) They also cause acid rain that corrodes marble on our heritage, and affects plants life.

To Reduce their consumption :

1) We must use alternatives like CNG which are cleaner fuels.

2) We must develop healthy habits like using public transport instead of private.

3) We must harness non-conventional sources of energy.

4) We must make people aware of their limited quantity and use them judiciously.

AI Q. 2. What is biogas? Describe the steps involved in obtaining biogas. U **[CBSE SQP 2018-19]**

Ans. Biogas is a mixture of methane, carbon dioxide, hydrogen, and hydrogen sulphide.

Following steps are involved in obtaining biogas:

(i) Mixing (Slurry of cattle-dung and water).

(ii) Digesting (decomposition of cattle-dung by anaerobic bacteria).

(iii) Formation of biogas.

(iv) Collecting the residue left after the formation of biogas. **[CBSE Marking Scheme, 2018-19] 3**

Q. 3. If energy can neither be created nor destroyed, explain with an example why we should worry about our energy resources? U **[CBSE Term I, 2016]**

Ans. The law of conservation of energy states that energy can neither be created nor be destroyed. But, it can only be converted from one form to another. Despite this fact, the world is facing energy crisis. The reason behind it is that energy is converted into non-usable forms.

Fossil fuels like coal, petroleum etc. are the sources of energy which have accumulated in nature over a long time and cannot be replaced. We should worry about such sources because these sources of energy are getting depleted and sooner or later, will no longer be available to us. **3**

Q. 4. Write two points of differences between renewable and non-renewable sources of energy. Give one example of each. U **[Board Term-I, 2016]**

Ans. Renewable - Supply can be renewed, environment friendly.

Eg : wind, sun, water **(Any one)**

Non-Renewable - Supply is limited, cause environment pollution.

Eg : coal, petroleum **(Any one)**

[CBSE Marking Scheme, 2016] 3

Detailed Answer :

S. No.	Renewable source of energy	Non-renewable source of energy
(i)	Produced continuously in nature and are inexhaustible.	Takes long time for production and may get exhausted.
(ii)	These sources of energy do not cause any pollution.	These sources are the major cause of environmental pollution.

@PROCBSE

(iii)	Example - Wind, Sun, Water.	Example - Coal, Petroleum.

COMMONLY MADE ERROR

- Students often write differences in paragraph form.

ANSWERING TIP

- Differences when asked should be written in tabular form and the points should be compatible.

Q. 5. Make a list of three features due to which LPG is considered to be a good fuel?
U [CBSE Term-I, 2016]

Ans. (i) Releases large amount of energy on burning.
(ii) Easy to store.
(iii) Easy to transport.
(iv) Does not produce smoke.
(v) Environment friendly. **(Any three)**
[CBSE Marking Scheme, 2016] **[1×3]**

Q. 6. List three advantages of harnessing wind energy.
U [CBSE Term I, 2016]

Ans. The advantages of harnessing wind energy are :
(i) It is an environment-friendly and efficient source of renewable energy.
(ii) It requires no recurring expenses for the production of electricity.
(iii) It does not cause any pollution. **1 + 1 + 1**
[CBSE Marking Scheme, 2016]

Q. 7.Explain generation of electricity in a thermal power plant. A [CBSE Term I, 2015]

OR

Mention the transformation of energy that takes place in a thermal power plant. Briefly.
C [CBSE Term I, 2015]

Ans. In thermal power plant, heat energy is transformed into electrical energy. Chemical energy of coal is used as a fuel in thermal power plant. Large amount of fossil fuels are burnt everyday in power stations to heat up water to produce steam which further runs the turbine to generate electricity. Many thermal plants are set up near coal or oil fields. In these plants fuel is burnt to produce heat energy which is converted into electrical energy. **3**

Long Answer Type Questions 5 marks each

AI **Q. 1. What are the environmental consequences of using fossil fuels? Suggest the steps to minimise the pollution caused by various sources of energy including non-conventional sources of energy causing global warming.** A [NCERT Exemp.]

Ans. Following are the environmental consequences of using fossil fuels :
(i) Increased level of carbon dioxide is resulting in global warming. Global warming is causing drastic changes in weather patterns across the world. ½
(ii) Oxides of sulphur and nitrogen cause acid rain. Acid rain is harmful for buildings and monuments and also for living beings. ½
(iii) The burning of fossil fuels produces greenhouse effect of gases like carbon dioxide and results in global warming. ½
(iv) Increase in air pollution is causing more cases of respiratory diseases. ½
(v) The burning of fossil fuels also releases oxides of nitrogen and sulphur that are acidic oxides. These lead to acid rain which affects our water and soil resources. ½
Steps to minimise pollution caused by various sources of energy :
(i) Increased use of public transport. ½
(ii) Increased use of bicycle. ½
(iii) Follow the principles of 3R of conservation (*i.e.*, Reduce, Reuse and Recycle). By doing this, we can minimise the demand for energy. This will help in reducing pollution. **1**
(vi) The effect of greenhouse gases released by burning of fossil fuels and biogas can be minimised by planting more trees. ½

COMMONLY MADE ERROR

- Students write irrelevant stories. Be specific. Read question carefully and write only what is asked.

ANSWERING TIP

- Always write the answer pointwise and each point must reflect a separate idea. Do not repeat the same point in different words.

Q. 2. On what basis would you classify energy sources as
(a) renewable and non-renewable?
(b) exhaustible and inexhaustible?
Are the options given in (a) and (b) the same?
AE [NCERT Ex.]

@PROCBSE JOIN NOW !

Ans. (a) The source of energy that is regenerated in nature is known as renewable source of energy.

Sun, wind, moving water and biomass are some of the examples of renewable sources of energy.

The source of energy that does not regenerate in nature is known as non-renewable source of energy.

Coal, petroleum and natural gas are some of the examples of non-renewable sources of energy. **2½**

(b) Exhaustible sources are those sources of energy, which will deplete and exhaust after a few hundred years. Coal and petroleum are the exhaustible sources of energy.

Inexhaustible resources of energy are those sources, which will not exhaust in future. These are unlimited. Biomass is one of the inexhaustible sources of energy.

So, the options given in (a) and (b) are the same.

2½

TOPIC - 2
Alternative or Non-Conventional Sources of Energy

Revision Notes

Alternative or Non-conventional Sources of Energy

Scan to know more about this topic

Solar energy

- Non-conventional energy sources are energy sources that are infinite, natural and restorable. e.g., tidal energy, solar energy.
- **Reasons for alternate source of energy :**

  (i) To reduce the pressure on fossil fuels making them last for a much longer time.

  (ii) To reduce the pollution level and to save the environment.

I. Solar Energy :

- Sun is the ultimate source of energy.
- Energy obtained from the sun is called solar energy. A large number of devices like solar cooker, solar furnaces, solar cells and solar water heaters utilizes solar energy directly.
- **Solar Cooker :** A black surface absorbs more heat than a white surface. Solar cookers and solar heaters use this property. A solar cooker is covered with a glass plate and have a mirror to focus sun rays.
- **Solar cell :** It is a device which converts solar energy *i.e.*, light energy directly into electricity. They are made up of semi-conductors like–silicon, germanium and selenium. A solar cell can develop a voltage of 0.5–1 V and can produce only about 0.7 W of electricity. However a number of solar cells are combined to form solar panel to produce enough amount of electricity.
- **Solar cell panel :** It absorbs sunlight as a source of energy to generate electricity. It comprises a large number of photo voltaic solar cells and can provide much higher power for many uses.

Scan to know more about this topic

Energy from sea

II. Energy from the Sea :

- **Ocean Thermal Energy (OTE)** : There is always a temperature difference between water at the surface and at deeper level up to 20°C. This form of energy is called ocean thermal energy which can be converted into electricity.
- **Wave Energy :** Energy from oceans is also available in the form of sea-waves. Due to blowing of wind on the surface of ocean, huge sea-waves move on its surface. It has lot of kinetic energy due to high speed. Energy possessed by huge waves near the seashore can be trapped to generate electricity.
- **Tidal Energy :** The rise of ocean water due to attraction of moon is called '**high tides**' whereas fall of ocean water is called '**low tides**'. The difference in sea-levels gives us tidal energy. A turbine fixed at the opening of the dam constructed across narrow opening of the sea converts tidal energy to electricity.

Scan to know more about this topic

Green Energy

- **Geothermal Energy :** The heat from inside the earth heats up the water below the surface. This hot water can be used under favourable conditions as a source of energy. This energy with hot water below the earth is called geothermal energy. This energy is used to run a turbine to produce electricity.

III. Nuclear energy :

- The nucleus of a heavy atom such as uranium, plutonium or thorium when bombarded with low-energy neutrons, can be split apart into lighter nuclei. This reaction is called nuclear fission. In this reaction, a tremendous amount of energy is released. This energy is called nuclear energy. The released energy can be used to produce steam and

@PROCBSE

further generate electricity. When nuclear fission reaction takes place, neutrons that are released are made to bombard other uranium nuclei to produce more fission. Such self-sustained reactions are called chain reactions.

- Disadvantages of nuclear power generation are complexity in storage and disposable of fuel, environmental contamination and risk of accidental leakage of radiations.

How is it done on the GREENBOARD?

Q. What are solar cells ? Explain the structure of solar panel. List two principal advantages associated with solar cells. 3

Solution:

Step I: A device that converts solar energy directly into electrical energy.

Structure of solar panel:

Step II: Large number of solar cells combine in an arrangement called solar cell panel.

Advantages associated with solar cells are :

Step III: They have no moving parts.

Step IV: They require little maintenance and work quite satisfactorily without the use of any focusing device.

Objective Type Questions — 1 mark each

A Multiple Choice Questions

Q. 1. Most of the sources of energy we use represent stored solar energy. Which of the following is not ultimately derived from the Sun's energy?

(a) Geothermal energy **(b) Wind energy**
(c) Nuclear energy **(d) Biomass**

[NCERT]

Ans. Correct option : (c)

Explanation: Nuclear energy is released during nuclear fission or fusion. These reactions produce tremendous amount of energy. The energy released during these reactions comes from the mass of elements (mass converts into energy). There is no role of sunlight on these reactions. Hence, nuclear energy is not ultimately derived from Sun's energy. Geothermal energy, wind energy and biomass are all ultimately derived from solar energy.

Q. 2. Ocean thermal energy is due to

(a) energy stored by waves in the ocean.
(b) temperature difference at different levels in the ocean.
(c) pressure difference at different levels in the ocean.
(d) tides arising out in the ocean. [NCERT Exemp.]

Ans. Correct option : (b)

Explanation: Ocean thermal energy conversion (OTEC) uses the principle of a heat engine. It works by converting a temperature difference into energy. This means the difference in temperature between the warmer water on the surface and the cooler water in the depths of the ocean can be converted into electricity.

Q. 3. Which part of the solar cooker is responsible for greenhouse effect?

(a) Coating with black colour inside the box
(b) Mirror
(c) Glass sheet
(d) Outer cover of the solar cooker [NCERT Exemp.]

Ans. Correct option : (c)

Explanation: Solar cookers are covered with a glass plate which traps infra-red radiations (heat) from sunlight and does not allow them to escape. In other words, we can say that it provides greenhouse effect.

Q. 4. A solar water heater cannot be used to get hot water on

(a) a sunny day. **(b) a cloudy day.**
(c) a hot day. **(d) a windy day.**

[NCERT Ex.]

Ans. Correct option : (b)

Explanation: A solar water heater uses solar energy to heat water. It requires day light (intense sunlight) to function properly. On a cloudy day, the sunlight reflects back in the sky from the clouds and is unable to reach the ground. Therefore, solar energy is not available for the solar heater to work properly. Hence, solar water heater does not function on a cloudy day.

@PROCBSE JOIN NOW !

@PROCBSE

B Assertions and Reasons Type Questions

Directions : In the following questions, a statement of assertion (A) is followed by a statement of reason (R). Mark the correct choice as :

(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

(b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).

(c) Assertion (A) is true but reason (R) is false.

(d) Assertion (A) is false but reason (R) is true.

Q. 1 Assertion (A) : Solar heating devices are painted black.

Reason (R) : Black bodies are good absorbers of heat, so temperature rises quickly.

Ans. Correct option : (a)

Explanation : Solar heating devices are painted black as black bodies are good absorbers of heat.

Q. 2. Assertion (A) : Dam is a barrier that is built across a river or a stream

Reason (R) : Large dam can ensure the storage of adequate water for irrigation and also for generating electricity.

Ans. Correct option : (b)

Explanation : Dam is a barrier that stops or restricts the flow of water or underground streams. A dam is built to control water through placement of a blockage of earth, rock across a stream or river. They usually store water in a reservoir, which is then used for a variety of applications such as irrigation and municipal water supplies.

Q. 3. Assertion (A) : Solar cell is a device which converts solar energy *i.e.*, light energy directly into electricity.

Reason (R) : They are made up of semi-conductors like-silicon, germanium and selenium.

Ans. Correct option : (b)

Explanation : Solar cell panel absorb sunlight as a source of energy to generate electricity. It comprises of a large number of photo voltaic solar cells and can provide much higher power for many uses.

C Very Short Answer Type Questions

Q. 1. If you could use any source of energy for heating your food, which one would you prefer? State one reason for your choice.

A [CBSE Delhi, Set- III, 2019]

Ans. Fuel energy / microwave / hot plate / solar energy. Easily available **(Or any other source of energy with reason)** [CBSE Marking Scheme, 2019] **1**

AI **Q. 2. Name the component of a solar cooker that produces a green house effect inside it.**

R [CBSE Term-I, 2016]

Ans. Glass plate / sheet that covers the box. **1**

[CBSE Marking Scheme, 2016]

Q. 3. Name any one material used to make a solar cell and also mention the range of voltage produced by a typical cell. C [CBSE Term-I, 2016]

Ans. Silicon, Germanium. **(Any one) 1**

(Each solar cell produces a voltage of 0.5 volt.)

[CBSE Marking Scheme, 2016]

Q. 4. List two forms of energy in which solar energy manifests itself in oceans. U **[Board Term I, 2012]**

Ans. Ocean thermal energy and Sea-wave energy.

½ + ½

Q. 5. Why is a solar cooker painted black from outside? U [CBSE Term-I, 2016]

Ans. A black surface absorbs more heat as compared to white or a reflecting surface. **1**

[CBSE Marking Scheme, 2016]

Short Answer Type Questions-I — 2 marks each

Q. 1. (i) What is solar cell panel?

(ii) Name any two elements that are used for making solar cell panels. R

Ans. (i) A combined arrangement of a large number of solar cells which can generate sufficient electricity through photovoltaic effect for practical use is known as solar cell panel.

(ii) Silver, Silicon. **1**

Q. 2. (a) Hydrogen is used as a rocket fuel. Why?

(b) List two limitations of using solar cookers. U

Ans. (a) Hydrogen is comparatively a cleaner fuel than any other gaseous fuel, as on its burning only water is produced which does not pollute the environment. **1**

(b) (i) Cannot be used in night/cloudy days.

(ii) Direction of reflector has to be changed from time to time. ½ + ½

AI **Q. 3. List two reasons which limit the usage of solar cells for harnessing energy for domestic use.** U

Ans. (i) Availability of the special grade silicon for making solar cells is limited.

(ii) The process of manufacturing is expensive, silver used for interconnections of the cells in the panel further adds to the cost. **1+1**

@PROCBSE

Short Answer Type Questions-II — 3 marks each

Q. 1. What are solar cells? Explain the structure of solar panel. List two principal advantages associated with solar cells.

R [Board Outside Delhi, Set-I, 2019]

Ans. A device that converts solar energy directly into electrical energy. **1**

Large number of solar cells are combined in an arrangement called Solar Cell Panel. **1**

Advantages :

(i) They have no moving parts.

(ii) Require little maintenance and work quite satisfactorily without the use of any focusing device.

(iii) These cells can be set up in remote & inaccessible areas where laying of a power transmission may be expensive. **(Any two)** ½ + ½

[CBSE Marking Scheme, 2019]

AI **Q. 2. Explain the term, geothermal energy. How can it be exploited? Though it is economical yet it is not harnessed in most of the countries. Why?**

U [Board Term-I, 2016]

Ans. Geothermal energy is heat energy trapped in hot regions called hot spots when molten rocks are pushed upwards.

When underground water comes in contact with hot spots, steam is generated. Steam trapped in rocks is routed through a pipe to a turbine to generate electricity.

Very few commercially viable sites are available where such energy can be exploited. **3**

Q. 3. Explain ocean-thermal energy and how can it be harnessed. Mention any two limitations in obtaining the energy from the oceans? AE

Ans. The difference in temperature between warm surface water heated by the sun and colder water found at ocean depth is a source of energy called Ocean thermal energy. The difference in temperature is exploited in OTE conversion plants.

The warm surface water is used to boil a volatile liquid like ammonia. The vapours are used to run the turbine of a generator. **2**

Limitations :

(i) Efficient commercial exploitation is difficult. ½

(ii) Expensive set up. ½

Q. 4. What is geothermal energy? How can it be used commercially? List in tabular form three distinguishing features between a thermal power plant and a geothermal power plant. R

Ans. The underground water comes in contact with 'hot spots' present in the earth's crust and steam is generated. This energy possessed by the hot water below the earth is called Geothermal energy. **1**

It can be used to produce electricity. ½

S. No.	Thermal Power Plant	Geothermal Power Plant
(i)	Uses coal as fuel.	Uses underground hot water.
(ii)	Causes pollution.	Does not cause pollution.
(iii)	The fuel used is very expensive.	The fuel is free of cost.

½ × 3 = 1½

Q. 5. (i) Name the device used to convert :

(a) Solar energy into heat.

(b) Solar energy into electricity.

(ii) Mention two limitations of solar energy. R

Ans. (i) (a) Solar cooker. **(b)** Solar cell. ½ + ½

(ii) Two Limitations :

(a) Solar heating devices are useful only at certain times during the day. **1**

(b) High cost and low efficiency of solar cell panels. **1**

Long Answer Type Questions — 5 marks each

Q. 1. Make a list of conventional and non-conventional sources of energy. Give a brief description of harnessing one non-conventional source of energy.

R [NCERT Exemp.]

Ans. Conventional Sources of Energy

(i) Fossil fuels

(ii) Hydro-electric power plant

(iii) Thermal power plant

(iv) Biomass **1**

Non-conventional Sources of Energy

(i) Solar energy **(ii)** Tidal energy

(iii) Nuclear energy **(iv)** Ocean thermal energy **1**

Harnessing Tidal Energy :

(i) For this, a cylindrical structure is vertically placed in coastal areas where tides come. ½

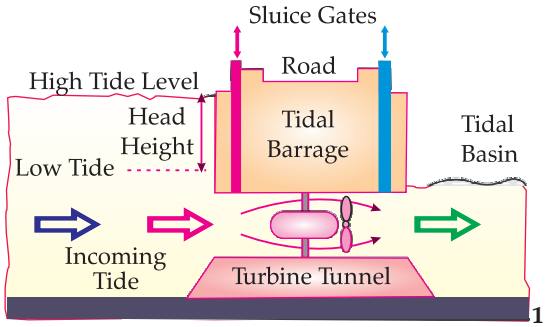
(ii) A turbine is fitted at the top of this cylinder. ½

(iii) When the tide comes, air gushes through the cylinder. This turns the turbine and electricity is generated. ½

(iv) When the tide goes, air moves in opposite direction. This also turns the turbine and electricity is generated. ½

@PROCBSE JOIN NOW !

@PROCBSE



1

Q. 2. Why is there a need for harnessing non-conventional sources of energy? How can energy be harnessed from the sea in different ways?

A [NCERT Exemp.]

Ans. The population of world is increasing at a very rapid rate due to which demands for energy is increasing day by day. Following are the main reasons because of which there is a need to harness non-conventional sources of energy :

(i) Limited non-renewable fuels : Today, fossil fuels are the main energy sources for us. But it takes millions of years for the formation. The rate at which we are using them means they are not going to last many years from now. They would be definitely exhausted sooner rather than later. **1**

(ii) Polluting fuels : Burning of fossil fuels releases greenhouse gas. Carbon monoxide can be poisonous even in low concentration. Oxides of sulphur and nitrogen cause acid rain. Air pollution also results in increased cases of respiratory problems. **1**

The energy from the sea energy can be harnessed from the sea in following ways :

(a) Tidal energy : Tidal energy or tidal power can be defined as the energy that is the result of the Moon and the Sun's gravitational influence on the ocean. Height differences between high and low tides create tidal currents in coastal areas, and these currents can be strong enough to drive turbines. The turbine fixed at the opening of the dam converts tidal energy to electricity. **1**

(b) Ocean thermal energy : OTEC uses the principle of a heat engine. It works by converting a temperature difference into energy. This means the difference in temperature between the warmer water on the surface and the cooler water in the depths of the ocean can be converted into electricity. **1**

(c) Wave energy : The kinetic energy possessed by huge waves near the seashore can be trapped to generate electricity. The waves are generated by strong winds blowing across the sea. Wave energy would be a viable proposition only where waves are very strong. A wide variety of devices has been developed to trap wave energy for rotation of turbine and production of electricity. **1**

AI **Q. 3. How can solar energy be harnessed? Mention any two limitations in using solar energy. How are these limitations overcome?** AE [NCERT Exemp.]

Ans. Solar cooker : Solar cooker is a device which is composed of a rectangular box with a mirror at the top. The box has a glass cover. Mirror is kept in erect position so that reflected sunlight can go inside the box. Utensils are kept in the box. Glass cover on the top prevents heat from escaping the box. **1**

Solar cell : A solar cell is also called photo-voltaic cell. It converts solar energy into electrical energy. Electrical energy, thus produced needs to be stored in inverters so that it can be used even during night. **1**

Solar furnace : Solar furnace is made of concave mirror. The heating device is kept at the focus of this furnace. Heat from sun is concentrated at the focus which helps in generating lot of heat. Solar furnace can be used to heat water and steam generated by this process can be used to generate electricity. **1**

Limitations of solar energy :

(i) Access to direct sunlight is needed for solar panels to perform at their best. Solar energy is not available in night or when the sun is hidden under clouds. ½

(ii) The domestic use of solar cells for production of electricity is not possible due to high cost. ½

Ways to overcome the limitations of solar energy :

(iii) First limitation can be overcome by converting solar energy into electrical energy and storing them for future use. ½

(iv) Second limitations can be overcome by taking certain steps by government to reduce price of solar cells. ½

COMMONLY MADE ERROR

- Students often write irrelevant stories. Instead of pointwise, they write answer in the form of essay.

ANSWERING TIP

- Always write the answer point wise and each point must reflect a separate idea. Do not repeat the same point in different words.

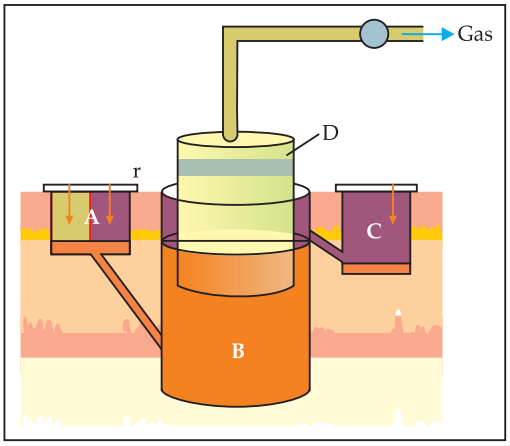
@PROCBSE JOIN NOW

@PROCBSE

Visual Case-based Questions — 4 marks each

Q. 1. Read the following and answer any four questions from (a) to (e) that follow on the basis of information provided and studied concepts.

A biogas plant is where biogas is produced by fermenting biomass. [CBSE–QB 2021]



(a) In which of the parts would you find anaerobic bacteria

(i) A **(ii)** B
(iii) C **(iv)** D

(b) Which one of the following is NOT correct for biogas

(i) its carbon neutral
(ii) its non-renewable
(iii) it depends on micro-organisms
(iv) yields rich manure

(c) Which of the following best indicates the steps of

(i) Waste water feed → biogas storage → generator → biogas
(ii) Waste water feed → digester → biogas → biogas storage → generator
(iii) Generator → waste water feed → digester → biogas → biogas storage
(iv) Waste water feed → biogas → digester → biogas storage → generator

(d) Biogas is a better fuel than animal dung cake because

(i) Biogas is a renewable source of energy
(ii) Animal dung cake has higher calorific value
(iii) Biogas has high heating capacity
(iv) Biogas burns without smoke.

(1) (i) only **(2)** (ii) only
(3) (iii) and (iv) **(4)** (i) and (ii)

(e) Biogas is formed in the

(i) presence of air only
(ii) presence of water only
(iii) presence of air and absence of water
(iv) presence of water and absence of air.

Ans. (a) (ii) B
(b) (ii) its non-renewable
(c) (ii) Waste water feed → digester → biogas → biogas storage → generator
(d) (iii) (3) and (4)
(e) (iv) presence of water and absence of air

Q. 2. Read the following and answer any four questions from (a) to (e) that follow on the basis of information provided and studied concepts.

In Kunjpura village, located in Karnal district, Haryana, Aditya Aggarwal and his older brother Amit Aggarwal run Tee Cee Industries, a steel plant set up by their ancestors in 1984. Along with this, they also run a gaushala that houses 1,200 cows that can no longer produce milk.

The cow shelter was manageable but running the steel plant was turning out to be expensive because they spent a whopping Rs 5 lakh every month on electricity.

The brothers struck upon an idea. Why not run the factory with the biogas produced from cow dung from the shelter and other gaushalas, along with bio and agri-waste like sewage, farm waste, etc. This led Aditya and Amit to start Amrit Fertilisers, a biogas project, in 2014, without any government support.

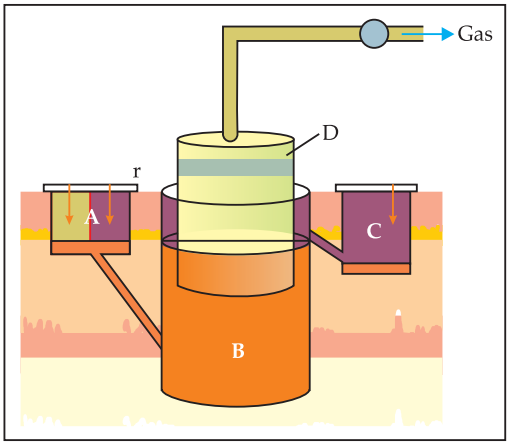
(a) Biogas is a mixture of the following gases.

(i) Ethane, Carbon monoxide, Nitrogen and Butane
(ii) Methane, Hydrogen, Carbon dioxide and Nitrogen
(iii) Butane, Carbon monoxide, Propane and Hydrogen
(iv) Carbon monoxide, Sulphur dioxide and Hydrogen

(b) Raw material used in bio gas plant is

(i) Animal dung **(ii)** crop residue
(iii) Food waste **(iv)** All of the above

(c) The correct labelling in a biogas plant is given in



(i) A-Manure B-Slurry C-Gas tank D-Digester
(ii) A-Slurry B-Digester C-Manure D-Gas tank
(iii) A-Gas tank B-Manure C-Digester D-Slurry
(iv) A-Digester B-Gas tank C-Slurry D-Manure.

@PROCBSE JOIN NOW!

@PROCBSE

(d) Biogas is a better fuel than animal dung cake because

(1) Biogas has lower calorific value.

(2) Animal dung cake has higher calorific value.

(3) Biogas has high heating capacity.

(4) Biogas burns without smoke.

(i) (1) only **(ii) (2) only**

(iii) (3) and (4) **(iv) (1) and (2)**

(e) Biogas is formed in the

(i) presence of air only.

(ii) presence of water only.

(iii) absence of air only.

(iv) presence of water and absence of air.

Ans. (a) (ii)

(b) (iv)

(c) (ii)

(d) (iii)

(e) (iv)

Q. 3. Read the following passage and answer any four questions from (a) to (e):

Fossil fuels are at the verge of getting exhausted. It is because of their non-replenishment, increasing demand, increasing population and more energy dependent technologies. Therefore, one has to look upto the sources which can be regenerated and cause the minimum possible environmental damage.

(a) "I" am a fossil fuel that is very important for daily use. I am non-renewable source and regarded as the cleanest source of energy. I am found deep inside the earth in the gaseous state. Who am "I"?

(i) Petroleum

(ii) Gasoline

(iii) Geothermal Energy

(iv) Natural Gas

(b) If the temperature of the earth keeps increasing due to the burning of fossil fuels and all other reasons that cause the Global Warming, then what all can happen to the earth?

I. Changes in weather.

II. Melting of all the glaciers into water. This will cause an increase in the sea level and widespread decrease in the snow and ice.

III. Deforestation

(i) I and III only

(ii) All of these

(iii) I and II only

(iv) II and III only

(c) Seema and Meena are good friends. Both live in the same colony and work in the same company. They both use their cars to go to office which runs on petrol. As petrol is a non-renewable resource it cannot be replenished within a short duration of time. As a common friend of both what best advise will you give them to save petrol.

(d) Does burning of fossil fuel causes water pollution. Explain.

(e) Which of the given problems is associated with the burning of coal?

(i) It causes acid rain.

(ii) Carbon dioxide is released.

(iii) Ash with toxic metal impurities are produced.

(iv) All of the above

Ans. (a) (iv) Natural gas.

(b) (iii) If the temperature of the earth keeps increasing due to the burning of fossil fuels and all other reasons that causes the Global Warming, then there could be serious changes in the weather- the cold days and night can decrease and also due to high temperature all the glaciers will melt which means the ice and snow will convert in water, thus increasing the sea level. Deforestation is not caused by change in temperature

(c) (i) Go to office by bus/public transport

(ii) Use cycle

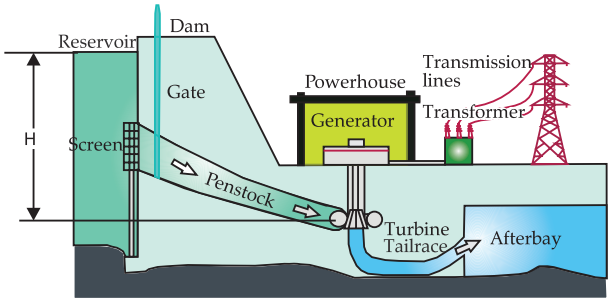
(iii) They can do car pool **(Any two)**

(d) Burning of fossil fuels releases gases like SO_2, NO_2, CO_2 etc, which mix up with water on raining and causes acid rain.

(e) (iv) On burning coal, carbon dioxide is released. Coal also releases acidic oxides, which combine with water vapour to form acid rain. Ash with toxic metal impurities are also produced.

(Any four) 1 + 1 + 1 + 1

Q. 4. Study the given diagram and answer any of the four questions from (a) to (e) :



(a) The given picture is of :

(i) Geothermal plant

(ii) Hydropower plant

(iii) Thermal power station

(iv) None of these

(b) In a hydro-power plant :

(i) potential energy possessed by stored water is converted into electricity.

(ii) kinetic energy possessed by stored water is converted into potential energy.

(iii) electricity is extracted from water.

(iv) water is converted into steam to produce electricity.

(c) Why this plant is considered as renewable source of energy?

@PROCBSE JOIN NOW !

@PROCBSE

(d) List two negative impacts of this plant on the ecosystem.

(e) Which one of the following forms of energy leads to least environmental pollution in the process of its harnessing and utilisation?

(i) Nuclear energy

(ii) Solar energy

(iii) Thermal energy

(iv) Geothermal energy

Ans. (a) (ii) The given picture represents the hydropower plant.

(b) (i) The water in a reservoir behind a hydro-power dam is an example of gravitational potential energy. The stored energy in the reservoir is converted into kinetic energy (motion) as the water flows down a large pipe called a penstock and spins a turbine, to generate electricity.

(c) It is because water can be replenished by water cycle.

(d) Negative impacts of hydropower plant on ecosystem are :

(i) A large variety of plants, animals and their habitats get submerged in water.

(ii) It decreases the fertility of the soil in the downstream area and affect crops.

(e) (ii) Solar energy leads to least environmental pollution in the process of its harnessing and utilisation. **(Any four) 1 + 1 + 1 + 1**

Q. 5. Read the passage and answer any of the four questions from (a) to (e) :

All of our energy comes from the sun, which is our nearest star. The sun sends out huge amounts of energy through its rays every day. We call this energy solar energy or radiant energy. Without the sun, life on earth would not exist, since our planet would be totally frozen. The sun's energy is stored in coal, natural gas, water and wind. Coal, oil, and natural gas are known as fossil fuels. Fossil fuels were formed over millions of years ago when the remains and fossils of prehistoric plants and animals sank to the bottom of swamps and oceans. These animal and plant remains were slowly covered and crushed by layers of rock, mud, sand, and water. The pressure of all those layers caused the plants and animals to break down and change into coal, oil and natural gas. We use the energy in these fossil fuels to make electricity. As of the year 2019, most of the energy we use comes from fossil fuels. However, fossil fuels are known as non-renewable sources of energy. They cannot be used over and over again. This means that one day they will run out!

(a) Geothermal and nuclear energy is not derived from the Sun's energy.

(i) True

(ii) False.

(b) Which among the following is not a renewable source of energy?

(i) Solar energy

(ii) Biomass energy

(iii) Hydro-power

(iv) Geothermal energy

(c) The energy source that uses collectors to heat water or air in buildings is

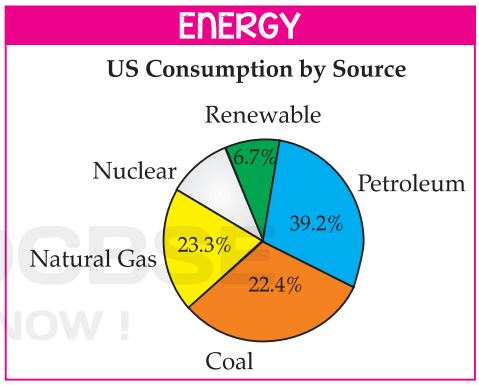
(i) Wind energy

(ii) Solar energy

(iii) Electrical energy

(iv) Water energy

(d) The pie chart below shows the consumption of various energy sources in the USA. Depending on the data given, if we consider that the quantity of all these sources are equal, then which source of energy is most likely to exhaust first?



(e) Choose the correct statement.

(i) Sun can be taken as an inexhaustible source of energy.

(ii) There is infinite storage of fossil fuel inside the Earth.

(iii) Hydro energy and wind energy plants are non polluting sources of energy.

(iv) Waste from a nuclear power plant can be easily disposed off.

Ans. (a) (i) True

(b) (ii) Biomass is not a renewable source among the options. Biomass is produced by the burning of the wood.

(c) (ii) The energy source that uses collectors to heat water or air in buildings is solar energy. These collectors are called as solar cells.

(d) According to the data given, if all the sources of energy at present are in equal quantities then petroleum is most likely to exhaust first as it is being used the most *i. e.* 39.2 % of all the energy sources.

(e) (i) The Sun has an enormous amount of energy at the present rate for nearly 5 billion years and will continue radiating at that rate for about 5 billion years more. So, it can be taken as an inexhaustible source of energy. **(Any four) 1 + 1 + 1 + 1**

@PROCBSE JOIN NOW !

@PROCBSE

Know the Terms

- **Conventional or Non-Renewable Sources** : Energy sources which are used traditionally for many years and deplete over a period of time are called conventional or non-renewable sources. *e.g.*, coal, petroleum, natural gas etc.
- **Non-Conventional or Renewable Sources :** Energy sources which do not deplete and are scarcely used by the population are called non-conventional or renewable sources *e.g.*, Solar energy, wind energy, tidal energy etc.
- **Solar constant :** The amount of solar energy received per square meter per second on the surface of earth is called **solar constant**. It is approximately 1.4 (kJ/m^2s).
- **Wavelength :** Length of a wave or separation between two points in successive waves which are in same phase is called wavelength. It is expressed in meter.
- **Frequency :** The number of wave motions in one second is called frequency. It is expressed in Hertz (Hz).
- **Nuclear fission reaction :** The action in which a heavy nucleus of an atom splits into two or more smaller nuclei as fission product, with the evolution of large amount of energy when it is bombarded with slow moving neutron is called **nuclear fission**.
- **Chain reaction :** A nuclear reaction in which the bombarding particle is obtained as one of the product, due to which the reaction once initiated proceeds on its own is called a **chain reaction**.
- **Nuclear fusion reaction :** A reaction in which two or more lighter nuclei fuse to form a heavy nucleus and large amount of energy is given out is called **nuclear fusion reaction**.

OSWAAL LEARNING TOOL
To learn from Oswaal Concept Video
Visit: http:qrgo.page.link OR Scan this code

@PROCBSE
JOIN NOW !

❑❑❑

@PROCBSE

Our Environment

Ecosystem

Components

- **Abiotic**
  - Soil
  - Water
  - Air
  - Light
  - Temperature
- **Biotic**
  - Plants
  - Animals
  - Micro-organism

Types

- **Artificial**
  - Crop
  - Field
  - Garden
  - Aquarium
- **Natural**
  - Forest
  - Grassland
  - Terrestrial
  - Aquatic
  - Pond

Flow of energy

Top Carnivores ← Carnivores ← Herbivores ← Producers ← Sunlight

Trophic Levels

- **First trophic level:** Producer
- **Second trophic level: Primary Consumer** — Herbivores
- **Third trophic level: Second Consumer** — Small Carnivores
- **Fourth trophic level: Tertiary Consumer** — Large Carnivores

Representation

- **Food Chain**

Trophic Level	Grassland Biome	Pond Biome	Ocean Biome
Primary Producer	Grass	algae	phytoplankton
Primary Consumer	grasshopper	mosquito larva	zooplankton
Secondary Consumer	rat	dragonfly larva	fish
Tertiary Consumer	snake	fish	seal
Quaternary Consumer	hawk	raccoon	white shark

- **Food Web**

Wastes

Waste Management

- Land Fills
- Recycling
- Sewage Treatment
- Incineration
- Use of Disposable: paper cups

Effects of Wastes

- Ozone Depletion
- Problem of Waste Disposable
- Pollution

Types of Wastes

- Biodegradable Wastes
- Non-biodegradable Wastes

Trace the Mind Map

First Level → Second Level → Third Level

@PROCBSE
JOIN NOW !

@PROCBSE

CHAPTER

15 OUR ENVIRONMENT

Syllabus

Ecosystem, Environmental problems, ozone depletion, waste production and their solution, biodegradable and non-biodegradable substances.

Trend Analysis

List of Concepts	2018	2019	2020
	OD	OD/D	OD
Ecosystem, Food chain, Ten percent energy law			1 Q (3 M)
Biodegradable and non-biodegradable substances, Global warming, Ozone depletion, Waste disposal	1 Q (3 M)	1 Q (3 M)	1 Q (1 M) Or 1 Q (3 M)

@PROCBSE JOIN NOW !

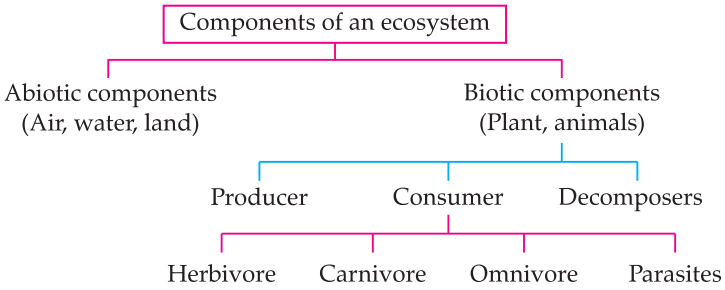
TOPIC - 1
Ecosystem and Food Chain

Revision Notes

- Everything that surrounds us is environment. It includes both living (biotic) and non-living (abiotic) components.
- Interaction between these biotic and abiotic components forms an ecosystem.
- In an ecosystem, living components depend on each other for their food which gives rise to food chains and food webs in nature.
- Human activities lead to environmental problems such as depletion of ozone layer and production of huge amount of garbage.
- **Ecosystem:** All the interacting organisms in an area together with the non-living constituents of the environment form an ecosystem. *e.g.*, forest, pond etc.
- **Types of Ecosystem**: It is of two types:
  (a) Natural Ecosystem: The ecosystem which exists in nature on its own. *e.g.*, forest, lake, ocean, etc.
  (b) Artificial Ecosystem: Man-made ecosystem is called *artificial ecosystem*. *e.g.*, crop field, aquarium, garden, etc.

TOPIC - 1
Ecosystem and Food Chain
Page No. 377
TOPIC - 2
Biodegradable and Non-Biodegradable Substances and Global Warming
Page No. 388

@PROCBSE



Scan to know more about this topic

Energy flow

- Herbivores, carnivores, omnivores and parasites are the various type of consumers.
- **Consumers** are those organisms which depend upon the producers for food, either directly or indirectly by feeding on other consumers for their sustenance. They are also called *heterotrophs*.
- **Parasites** are those organisms that live outside (ectoparasites) or inside (endoparasites) the body of another organisms, *i.e.*, host *e.g.*, parasites of human include fleas and lice.
- **Decomposers** are those micro-organisms that obtain energy from the chemical break down of dead organisms or animals or plant wastes. Decomposers break down the complex organic substances into simple inorganic substances that go into the soil and are used up again by the plants.
- Food chain is the sequence of organisms through which food energy flows in an ecosystem. It is a succession of organisms that eat other organisms and may, in turn, be eaten themselves. **Examples:**

Grass	→	Grasshopper	→	Frog	→	Snake	→	Eagle
(Producer)		(Herbivore)		(Carnivore)		(Carnivore)		(Top Carnivore)

- **Trophic Levels** are the various steps or levels in the food chain where transfer of food or energy takes place. Producers are the first trophic level, herbivores are the second trophic level, carnivores or secondary consumers are the third trophic level and large carnivores or tertiary consumers are the fourth trophic level.
- **Food Web** is the network of various food chains which are interconnected at various trophic levels. Since an organism can occupy position in more than one food chain, in a food web it occupies more than one trophic level. It represents the feeding relationship within the community.
- **Energy Flow:** The flow of energy through different steps in the food chain is unidirectional. This means that the energy that is captured by the autotrophs does not revert back to the solar input and the energy which passes to the herbivores does not come back to autotrophs.
- **10 Percent Law**: It states that only 10 per cent of food energy is transferred from one trophic level to the next level. The remaining 90 per cent energy is used in life processes (digestion, growth, reproduction, etc.) by the present trophic level.
- Due to this gradual decrease in energy, food chains contain 3 - 4 trophic levels.
- **Biological Magnification:** The concentration of harmful chemicals goes on increasing with every next trophic level in a food chain. This is called as *biological magnification*.
- Maximum concentration of such chemicals get accumulated in human bodies as human occupy the top level in any food chain.

Scan to know more about this topic

Biological magnification

Mnemonics

Concept: Major components of environment

Mnemonics: **WASAP**

Interpretation:
W - Water
A - Air
S - Soil
A - Animals
P - Plants

@PROCBSE

How is it done on the GREENBOARD?

Q. (a) Define ecosystem.
(b) Autotrophs are at the first level of food chain. Give reason.
(c) In a food chain of frogs, grass, insects and snakes assign trophic level to frogs. To which category of consumers do they belongs to ? 3

Ans. Step I: (a) Ecosystem is the functional unit of the environment comprising living and non living components.

Step II: (b) The first trophic level in a food chain is always producers (plants) because they have the ability to trap solar energy with the help of chlorophyll. As a result, they produce food by photosynthesis.

Step III: (c) Frogs are secondary consumers.

Objective Type Questions — 1 mark each

A Multiple Choice Questions

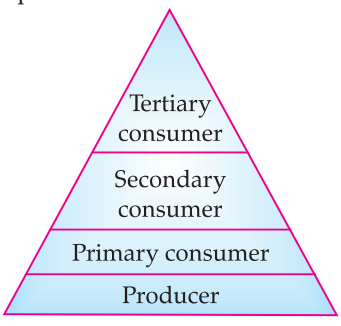
Q. 1. In the given food chain, suppose the amount of energy at fourth trophic level is 5 kJ, what will be the energy available at the producer level?
Grass → Grasshopper → Frog → Snake → Hawk

(a) 5 kJ **(b) 50 kJ**
(c) 500 kJ **(d) 5,000 kJ**

[NCERT Exemp.]

Ans. Correct option : (d)

Explanation : According to 10% law, only 10% of energy is transferred to the next trophic level and remaining 90% energy is used in life processes by present trophic level.



Trophic levels

Therefore,
Energy available to Grass = 10% of 5000 kJ.
Energy available to Grasshopper = 10% of 500 kJ
Energy available to Frog = 10% of 5000 kJ = 50 kJ
Energy available to Hawk= 10% of 50 kJ = 5 kJ

Q. 2. In an ecosystem, the 10% of energy available for transfer from one trophic level to the next is in the form of:

(a) heat energy. **(b) light energy.**
(c) chemical energy. **(d) mechanical energy.**

[NCERT Exemp.]

Ans. Correct option : (c)

Explanation : In an ecosystem, the 10% of energy available for transfer from one trophic level to the next is in the form of chemical energy. The producers or green plants capture the energy in sunlight and convert it into chemical energy which is passed onwards to the other trophic level.

Q. 3. Organisms of a higher trophic level which feed on several types of organisms belonging to a lower trophic level constitute the ..... .

(a) food web. **(b) ecological pyramid.**
(c) ecosystem. **(d) food chain.**

[NCERT Exemp.]

Ans. Correct option : (a)

Explanation : Food web is a network of food chains. Each organism is generally eaten by two or more kinds of organisms which are again eaten by several other organisms and so instead of straight line food chain, the series of organisms dependent on one another for their food can be shown by branched chain which is called as a *food web*.

Q. 4. Which group of organisms are not constituents of a food chain?

(i) Grass, lion, rabbit, wolf
(ii) Plankton, man, fish, grasshopper
(iii) Wolf, grass, snake, tiger
(iv) Frog, snake, eagle, grass, grasshopper

(a) (i) and (iii) **(b) (iii) and (iv)**
(c) (ii) and (iii) **(d) (i) and (iv)**

[NCERT Exemp.]

Ans. Correct option : (c)

@PROCBSE

Explanation : Food chain (ii): It is an aquatic food chain so grasshopper cannot be a part of it.

In food chain (iii): Wolf, snake and tiger, all are carnivores. There are no herbivores to eat grass therefore grass cannot be a part of food chain (iii).

Q. 5. The percentage of solar radiation absorbed by all the green plants for the process of photosynthesis is about :

(a) 1%. **(b) 5%.**
(c) 8%. **(d) 10%.**

[NCERT Exemp.]

Ans. Correct option : (a)

Explanation : Green plants in a terrestrial ecosystem capture about 1% of the energy of sunlight that falls on the leaves and converts it into food energy.

Q. 6. Select the mismatched pair in the following and correct it.

(a) Bio-magnification — Accumulation of chemicals at the successive trophic levels of a food chain
(b) Ecosystem — Biotic components of environment
(c) Aquarium — A man-made ecosystem
(d) Parasites — Organisms which obtain food from other living organisms

[NCERT Exemp.]

Ans. Correct option: (b)

Explanation : Both biotic and abiotic components of environment constitute an ecosystem.

B Assertions and Reasons Type Questions

Directions: In the following questions, a statement of assertion (A) is followed by a statement of reason (R). Mark the correct choice as:

(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).
(b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).
(c) Assertion (A) is true but reason (R) is false.
(d) Assertion (A) is false but reason (R) is true.

Q. 1. Assertion: Food chain is responsible for the entry of harmful chemicals in our bodies.
Reason: The length and complexity of food chains vary greatly. A [CBSE SQP, 2020]

Ans. Correct option : (b) **1**

Q. 2. Assertion: Greater number of individuals are present in lower trophic levels.
Reason: The flow of energy is unidirectional.

[CBSE SQP, 2020]

Ans. Correct option : (b) **1**

Q. 3. Assertion (A): Herbivores are called first order consumers.
Reason (R): Tiger is a top carnivore.

Ans. Correct option : (b)

Explanation : Herbivores obtain their food from plants. Hence, are known as *first order carnivores*. The carnivores like tiger that cannot be preyed upon further, lie at the top of food chain and hence termed as top carnivores. **1**

Q. 4. Assertion (A): Flow of energy in a food chain is unidirectional.
Reason (R): Energy captured by autotrophs does not revert back to the solar input and it passes to the herbivores.

Ans. Correct option : (a)

Explanation : The flow of energy through different steps in the food chain is unidirectional. This means that energy captured by autotrophs does not revert back to the solar input and it passes to the herbivores.

Q. 5. Assertion (A): First trophic level in a food chain is always a green plant.
Reason (R): Green plants are called producers.

Ans. Correct option : (a)

Explanation : Green plants are producers. The first trophic level in a food chain is the producers i.e. those organisms which produce food by photosynthesis.

Q. 6. Assertion (A): Decomposers keep the environment clean.
Reason (R): They recycle matter by breaking down the organic remains and waste products of plants and animals.

Ans. Correct option : (a)

Explanation : Decomposers keep the environment clean by decomposing or consuming the dead remains of other organisms.

Q. 7. Assertion (A): The concentration of harmful chemicals is more in human beings.
Reason (R): Man is at the apex of the food chain.

Ans. Correct option: (a)

Explanation : Harmful chemicals accumulate progressively at each trophic level. Since the man is at the apex of all the food chains, the concentration of harmful chemicals may be more in human beings. The phenomenon involved is known as biomagnification.

C Very Short Answer Type Questions

AI **Q. 1. Give reason why a food chain cannot have more than four trophic levels.** A [Board SQP, 2020]

Ans. The loss of energy at each step is so great that very little usable energy remains after four trophic levels. **1**

Q. 2. What is ecosystem? R [Delhi Set 31/1/1 2017]

Ans. Ecosystem is the functional unit of the environment comprising of the living and non-living components. [CBSE Marking Scheme, 2017] **1**

AI **Q. 3. List two man-made ecosystems.**

R [Foreign Set 2017]
[Board Term II, 2012]

Ans. Garden and pond. ½+½

Q. 4. List two biotic components of an ecosystem .

R [OD Comptt. 2017]

@PROCBSE

Ans. Plants, animals, micro-organisms. **(Any two)** ½ + ½
[CBSE Marking Scheme, 2017]

COMMONLY MADE ERROR

- Students start explaining biotic components instead of just giving the example.

ANSWERING TIP

- Comprehend what is being asked before answering by reading the question carefully. Don't waste time in elaborating the answer.

AI **Q. 5. Why is forest considered as a natural ecosystem ?**
U [Delhi 31/1/2 2017]

Ans. A forest ecosystem is a natural woodland unit consisting of all plants, animals and micro-organisms, in an area functioning together with all of the non-living physical factors of the environment. **1**

Q. 6. Why is a lake considered to be a natural ecosystem?
U [Delhi 31/1/3 2017]

Ans. Because a lake is a self-sustaining system. **1**
[CBSE Marking Scheme, 2017]

AI **Q. 7. In the following food chain, 100 J of energy is available to the lion. How much energy was available to the producer?** A [CBSE, OD, Set-1, 2017]

Plants ⟶ Deer ⟶ Lion

Ans. Plants are producers. So, energy available to the producer is 10,000 J.
[CBSE Marking Scheme, 2017] **1**

OR

Topper Answer, 2017

Energy available to producer → 10,000 J

@PROCBSE JOIN NOW !

COMMONLY MADE ERROR

- Commonly made error: Students often write vague answer. It seems they are unaware of ten percent law.

ANSWERING TIP

- Learn laws, principles and key-words/acronyms with proper understanding. Remember 10 percent law of energy transfer.

Q. 8. In the following food chain, plants provide 500 J of energy to rats. How much energy will be available to hawks from snakes? A [OD 31/2 2017]

Plants ⟶ Rats ⟶ Snakes ⟶ Hawks

Ans. Snakes $= 500 \times \frac{10}{100} = 50$ J

Hawks $= 50 \times \frac{10}{100} = 5$ J

(According to 10 percent Law) ½+½

Q. 9. List two natural ecosystems.
R [Board Term II, Delhi Set I, 2016]

Ans. Natural ecosystem—Forest/Lake/Pond/River.
(Any two) ½ + ½
[CBSE Marking Scheme, 2016]

Q. 10. We often use the word environment. What does it mean? C [Board Term II, Foreign I, 2016]

Ans. Environment is everything that surrounds us. It is the physical, chemical and biological conditions of the region. **[CBSE Marking Scheme, 2016] 1**

Q. 11. Why do producers always occupy the first trophic level on every food chain?
AE [Board Term II, Foreign Set II, 2016]

Ans. Because producers (plants) have the ability to trap solar energy with the help of chlorophyll.
[CBSE Marking Scheme, 2016] **1**

Q. 12. In a food chain of frog, grass, insect and snake assign trophic level to frog.
A [Board Term II, O.D. Set III, 2016]

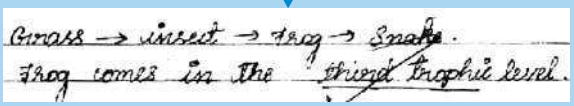
Ans. Grass ⟶ Insect ⟶ Frog ⟶ Snake

Frog is 3rd trophic level. ½ + ½
[CBSE Marking Scheme, 2016]

@PROCBSE

OR

Topper Answer, 2016



COMMONLY MADE ERROR

- Student are unaware of the concept of trophic level. So they write vague answer.

ANSWERING TIP

- Lay stress on understanding the concept instead of rote learning.

AI Q. 13. The first trophic level in a food chain is always a green plant. Why?

C [Board Term II, O.D. Set II, 2015]

Ans. Green plants are producers. The first trophic level in a food chain is producer *i.e.* those organisms which produce food by photosynthesis. **1**

[CBSE Marking Scheme, 2015]

Q. 14. The following organisms form a food chain. Which of these will have the highest concentration of non- biodegradable chemicals? Name the phenomenon associated with it: Insects, Hawk, Grass, Snake, Frog.

A [Board Term II, Foreign Set I, 2015]

Ans. Hawk.
Biomagnification. ½ + ½

[CBSE Marking Scheme, 2015]

COMMONLY MADE ERROR

- Students forget to write the name of the phenomenon. It seems they are not aware of this technical term.

ANSWERING TIP

- Always use biological/technical terms rather than common names. Use correct spelling of biological terms.
- Learn the concept of biomagnification with the help of proper example.

Short Answer Type Questions-I — 2 marks each

AI Q. 1. Why must we conserve our forests? List two factors responsible for causing deforestation.

A [OD 31/2 2017]

Ans. Forests help in preventing soil erosion / protect biodiversity / maintain ground water level / help in rainfall / provide raw materials / prevent floods / (any other two points). ½+½
Exploitation by industries / increase in population / urbanization / cattle grazing / (any other two points) [CBSE Marking Scheme, 2017] ½+½

Q. 2. State two advantages of conserving (i) forests and (ii) wildlife. A [OD 31/1/ 2017]

Ans. Conserving forests helps in (i) retaining sub soil water and (ii) checking floods/ any other **1**
Conserving wild life helps in (i) maintaining ecological balance and (ii) protecting the nature (or any other) ½ × 4 [CBSE Marking Scheme, 2017]

Detailed Answer:

Two advantages of conserving forests are:

(i) Forests maintain balance between abiotic and biotic factors of the environment.

(ii) They provide us various products in the form of food, medicines, wood and raw materials for different industries. **1**

Advantages of conserving wildlife are ;

(i) For protecting biodiversity.

(ii) Some wildlife of animals are essential for the survival of other animals. **1**

Q. 3. With the help of an example of a food chain, prove that the flow of energy in the biosphere in unidirectional. A [OD Comptt. 31/2 2017]

Ans. Sun $\xrightarrow{1\%\text{ Energy}}$ Producer/Plant $\xrightarrow{10\%\text{ Energy}}$ Primary consumer/Herbivore $\xrightarrow{10\%\text{ Energy}}$ Secondary consumer/Carnivore $\xrightarrow{10\%\text{ Energy}}$ Top Carnivore.

The above concept explained with the help of an example highlighting.

(1) At each trophic level only 10% of the energy is passed on to the next an the rest is either utilized for its own metabolic activities or is lost in the environment as heat.

(2) Lost energy is not returned to the previous level/ Solar input.

@PROCBSE

COMMONLY MADE ERROR

- Students often explain the flow of energy in biosphere, but they forget to give the example and lose marks.

ANSWERING TIP

- Comprehend what is being asked before answering by reading the question carefully.

AI **Q. 4. Why are bacteria and fungi called decomposers? List any two advantages of decomposers to the environment?** U **[Delhi Comptt. 31/1/3 2017]**

Ans. Bacteria and fungi break down/decompose the dead remains and waste products or organisms. **1**

Advantages:

(i) Natural replenishment of soil

(ii) Recycling of nutrients in the soil. **1**

[CBSE Marking Scheme, 2017]

Detailed Answer:

Bacteria and fungi are called decomposers because they decompose or consume the dead remains of other organisms.

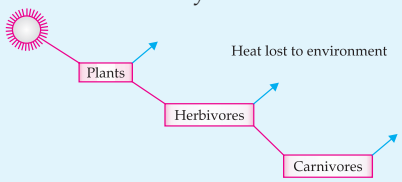
Advantages.

(i) Decomposers degrade garbage and the organic wastes which would otherwise cause environment problems.

(ii) Decomposers recycle the nutrients through biochemical cycle. **1+1**

Q. 5. Draw a labelled diagram to illustrate energy flow in an ecosystem. U **[Board Term II, 2015]**

Ans. Energy flow is unidirectional, dissipated at each level. Matter flow is cyclic and no loss of matter. **1**



[CBSE Marking Scheme, 2015]

COMMONLY MADE ERROR

- Students often draw incorrect energy flow chart. Many of them forget to label the part.

ANSWERING TIP

- Practice self-explanatory diagrams/flow chart with proper labelling, arrows and headings.

Q. 6. Differentiate between the food habits of organisms belonging to first and second trophic levels.

U **[Board Term II, 2015]**

Ans. Difference between food habits of organisms belonging to first trophic level and second trophic level:

(a) The organisms at the first trophic levels are primary producers which make organic compounds using inorganic inputs like light, water, carbon dioxide etc. E.g. Plants.

(b) The organisms at the second trophic level are primary consumer. They are herbivores who eat plants (producers) for nutrition. E.g., Deer. **1+1**

[CBSE Marking Scheme, 2015]

Short Answer Type Questions-II — 3 marks each

Q. 1. (a) Define ecosystem.

(b) Autotrophs are at the first level of food chain. Give reason.

(c) In a food chain of frogs, grass, insects and snakes, assign trophic level to frogs. To which category of consumers do they belongs to?

[Outside Delhi, Set- II, 2020]

Ans. (a) Ecosystem: It is the functional unit of the environment comprising living and non living components.

(b) The first trophic level in a food chain is always producers (plants) because they have the ability to trap solar energy with the help of chlorophyll. As a result, they produce food by photosynthesis.

(c) Frogs are secondary consumers. **1×3=3**

COMMONLY MADE ERROR

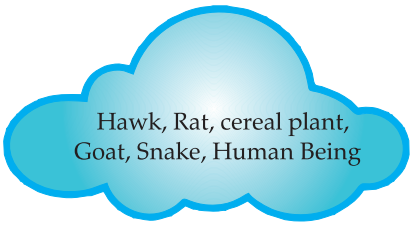
- Students often write incorrect definitions.

ANSWERING TIP

- The definition should be crisp and precise. Keywords should be highlighted in definitions.

Q. 2. (a) From the following groups of organisms create a food chain which is the most advantageous for Human being in terms of energy.

@PROCBSE



(b) State the possible disadvantage if the cereal plant is growing in soil rich in pesticides.

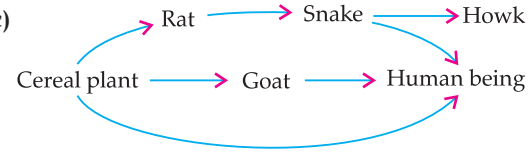
(c) Construct a food web using the organisms mentioned above. A [Outside Delhi, Set- I, 2020]

Ans. (a) Short food chains are more efficient in terms of energy. The shorter the food chain is, more is the available amount of energy.

Cereal Plant → Human being

(b) Harmful for human consumption as the traces of pesticide will be carried by food.

(c)



1×3=3

Q. 3. (a) State with reason the consequence of decrease in number of carnivores in an ecosystem.

(b) In a food chain, state the trophic level at which the concentration of harmful chemicals is maximum. Why is it so? [Outside Delhi, Set-II, 2020]

Ans. (a) The carnivores keep the populations of other carnivores and herbivores help to keep check. If there were no carnivores, the herbivore populations would rise exponentially and they will rapidly consume large amounts of plants and fungi, growing until there is not enough food to sustain them. Eventually, the herbivores would starve, leaving only those plants that were distasteful or poisonous to them. Species diversity would, therefore, drop dramatically.

(b) The increase in concentration of harmful chemical substances like pesticides in the body of living organisms at each trophic level of a food chain is called biological magnification. The level of biomagnification would increase as the trophic level increases and would be highest for topmost trophic level. It is because certain harmful substances, usually ones not found in nature but introduced by man, may get accumulated into plants and/or animals. These poisonous substances may not be broken down in the body or excreted easily. Instead, they accumulate in the tissues, and as the living organism eats more, the concentration of these substances increases and pass from one trophic level to the next. The maximum concentration is accumulated at the top carnivore's level.

1½ + 1½=3

Q. 4. (i) Create a terrestrial food chain depicting four trophic levels.

(ii) Why do we not find food chains of more than four trophic levels in nature? A [Board SQP, 2020]

Ans. A food chain showing Ist trophic level (½ mark), IInd trophic level (½ mark), IIIrd trophic level (½ mark) and IVth trophic level (½ mark).

A flow chart or a diagrammatic representation showing all the four tropic levels would also be accepted

According to the 10% law, the amount of energy available will not be sufficient for the survival of the organism in the 5th trophic level.

[CBSE Marking Scheme, 2020]

Detailed Answer:

(i) Rice (Producers) → Rat (Herbivores) → Snake (Carnivores) → Peacock (Top carnivores)

(ii) This is because according to 10 percent law of energy transfer, only 10 percent of the energy passes from one trophic level to the next. Thus, the amount of energy goes on decreasing with the successive trophic levels.

Q. 5. How will you create an artificial aquatic ecosystem, which is self-sustainable? A [CBSE SQP, 2020]

Ans. (a) Large jar filled with water, oxygen, food and aquatic plants and animals.

(b) Oxygen/oxygen pump.

(c) Fish food.

(d) Aquatic plants/Producers provide O_2 during photosynthesis.

(e) Aquatic animals/Consumers release CO_2 for the process of photosynthesis.

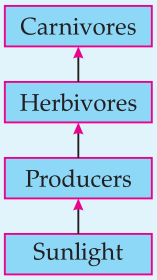
(f) Decomposers are also important for natural cleaning of the aquarium. **½ × 6**

[CBSE Marking Scheme, 2020]

Q. 6. Define an ecosystem. Draw a block diagram to show the flow of energy in an ecosystem.

R [Board Delhi, Set- I, 2019]

Ans. Ecosystem: The system where all the living organisms in an area together interact with the non–living constituents of the environment.



1 + 2 [CBSE Marking Scheme, 2019]

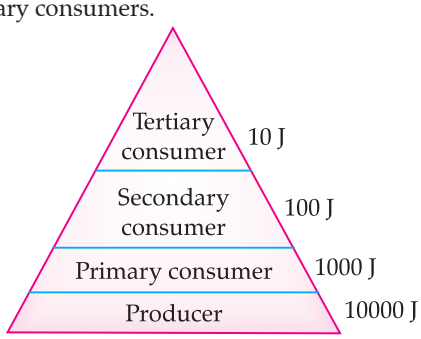
Detailed Answer:

An ecosystem can be defined as a functional unit of nature, where living organisms interact among themselves and with the surrounding physical environment.

Diagram to show the flow of energy in an ecosystem: Assuming 10,000 J of energy is available

@PROCBSE

to the producers, then 1000 J will be available to the primary consumers, 100 J will be available to secondary consumers and 10 J will be available to tertiary consumers.



3

Q. 7. Define a food chain. Design a terrestrial food chain of four trophic levels. If a pollutant enters at the producer level, the organisms of which trophic level will have the maximum concentration of the pollutant in their bodies? What is this phenomenon called?

R **[Board Outside Delhi, Set- III, 2019]**

Ans. Chain of organisms formed as a result of eating or being eaten by organisms is called *food chain* / A series of organisms feeding on one another, is called *food chain*. **1**

Grass → Insect → Frog (grasshopper) → Snake
(Producer) (Herbivore) (Carnivore) (Top Carnivore) **1**

(Any other example of food chain)

- Tertiary trophic level / snake ½
- Biological magnification / Biomagnification

[CBSE Marking Scheme, 2019] ½

Detailed Answer:

Food chain is the series formed of organisms feeding on one another at various biotic levels.

Terrestrial Food Chain:

PRODUCERS (Plants) → PRIMARY CONSUMERS (Rabbit) ↓ → SECONDARY CONSUMERS (Fox) ↓ TERTIARY CONSUMERS (Lion)

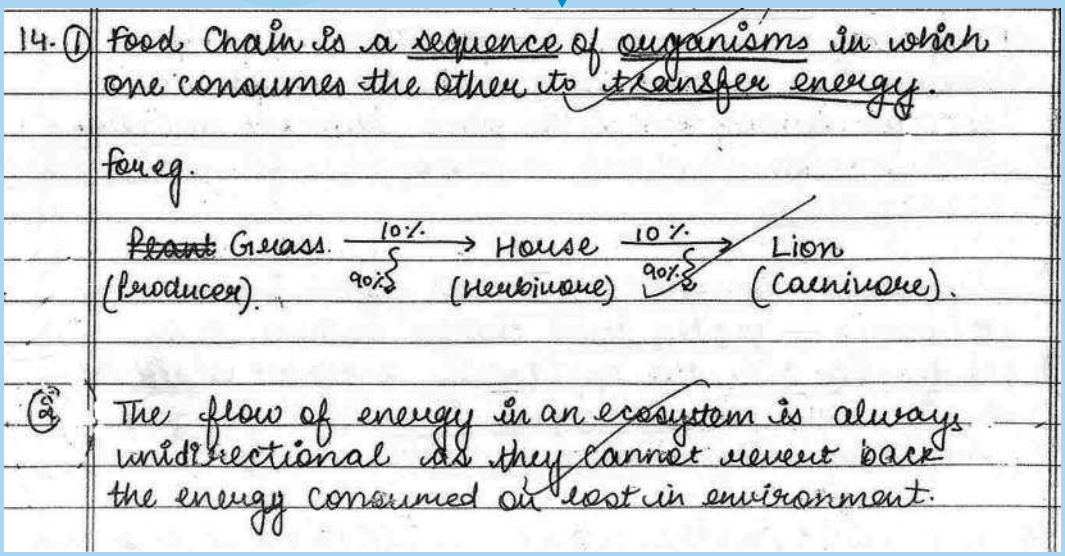
The organisms at the highest (top) trophic level have the maximum concentration of the pollutant in their bodies. This phenomenon is known as biological magnification. **1+1+1**

Q. 8.What is a food chain? Why is the flow of energy in an ecosystem unidirectional? Explain briefly.

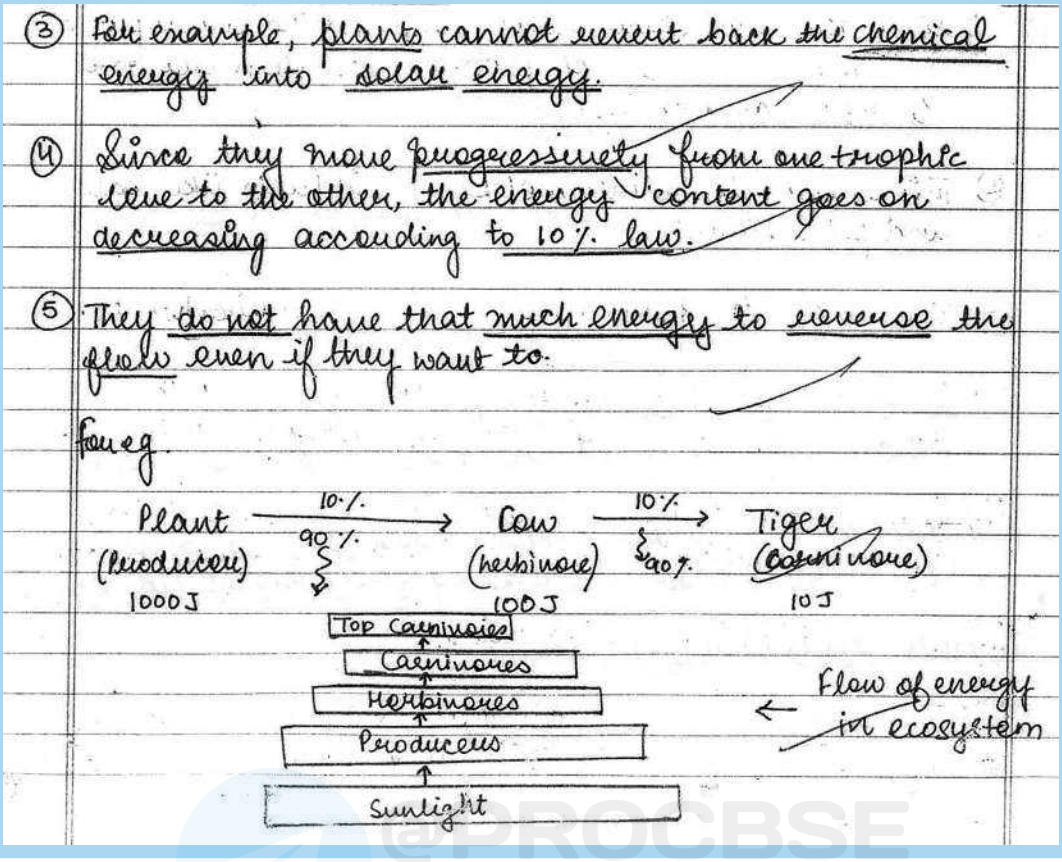
[CBSE Delhi, 2019]

Topper Answer, 2019

Ans.



@PROCBSE



Q. 9. The flow of energy between various components of the environment has been extensively studied. Give an outline of the findings.

U [CBSE SQP 2018-19]

Ans. **(i)** Flow of energy is unidirectional.

(ii) Terrestrial plants take about 1% of the Sun's energy and change it to chemical energy.

(iii) A great amount of energy is lost as heat/ used for digestion/doing work/growth and reproduction.

(iv) Only 10% of organic matter present at each trophic level (and available to the next trophic level).

(v) Food chains are mainly of 3-4 trophic levels (because of 10 percent law).

(vi) The number of producers are maximum (the number reduces in subsequent trophic levels).

(vii) Food webs are more common (as compared to isolated food chains).

(viii) Biological magnification can be observed.

(Any three) 3

[CBSE Marking Scheme, 2018-19]

Q. 10. Your mother always thought that fruit juices are very healthy for everyone. One day she reads in the newspaper that some brands of fruit juices in the market have been found to contain certain level of pesticides in them. She got worried as pesticides are injurious to our health.

(a) How would you explain to your mother about fruit juices getting contaminated with pesticides?

(b) It is said that when these harmful pesticides enter our body as well as in the bodies of other organisms they get accumulated and beyond a limit may cause harm and damage our organs. Name the phenomenon and write about it.

C [CBSE Board, Foreign Scheme, 2017]

Ans. (a) (i) Farmers generally use pesticides on fruit crops to protect their crops from plant diseases. However, pesticides may contaminate the fruit and therefore fruit juices also become contaminated. ½

(ii) Using contaminated ground water for irrigation also makes the fruits infected with contaminants. ½

(b) Biological magnification or bio-magnification is the accumulation of chemicals in the individuals of higher trophic level. Chemicals are non-biodegradable and their concentration increases at each trophic level. Humans, being at the top of food chain, also receive higher concentration of these harmful chemicals resulting into various health problems. **2**

Q. 11. Give reason to justify the following:

The existence of decomposers is essential in a biosphere. A [Board Term II, Delhi Set I, 2016]

Ans. The existence of decomposers is essential in a biosphere because they breakdown complex organic substances into simple inorganic substances that can be absorbed by the plants.

@PROCBSE JOIN NOW

Thus, decomposer:
(a) replenish the soil naturally,
(b) helps in removing the biodegradable waste. **3**
[CBSE Marking Scheme, 2016]

AI **Q. 12. What is an ecosystem? List its two main components. We do not clean natural ponds or lakes, but an aquarium needs to be cleaned regularly. Why is it so? Explain.**
U **[Board Term II, O.D. Set II, 2015]**

Ans. Ecosystem is the structural and functional unit of biosphere, comprising of all the interacting organisms in an area together with the non–living constituents of the environment.
Two main components of Ecosystem are:
(i) Biotic component
(ii) Abiotic component
An aquarium is an artificial and incomplete ecosystem compared to pond or lakes which are natural, self–sustaining and complete ecosystem where there is a perfect recycling of materials.
We need to clean the aquarium because of the:
(i) absence of natural decomposer.
(ii) stagnancy of water. **1 + 1 + 1**

AI **Q. 13. 'Energy flow in food chains is always unidirectional'. Justify this statement. Explain how the pesticides enter a food chain and subsequently get into our body.**
C **[Board Term II, Delhi Set I, 2015]**
[Board Term II, Outside Delhi Set I, III, 2014]

Ans. (i) In a food chain the energy moves progressively through the various trophic levels and is no longer available to the organisms of the previous trophic level/ energy captured by the autotrophs does not revert back to the solar input. **1**
(ii) Pesticides used for crop protection when washed away/down into the soil/water bodies absorbed by plants/ producers. **1**
(iii) On consumption they enter our food chain and being non-biodegradable, these chemicals get accumulated progressively and enter our body. **1**
[CBSE Marking Scheme, 2015]

Long Answer Type Questions — 5 marks each

Q. 1. Suggest any four activities in daily life which are eco-friendly. A **[NCERT Exemp.]**

Ans. Activities in daily life which are eco-friendly are given below :
(i) Use of compost and vermicompost in place of fertilisers. **1**
(ii) Separation of biodegradable and non-biodegradable substances. **1**
(iii) Gardening **1**
(iv) Use of gunny bags or paper bags in place of polythene. **1**
(v) Rain water harvesting **1**

COMMONLY MADE ERROR

- Students often repeat the points and write irrelevant stories.

ANSWERING TIP

- Always write the answer point wise and each point must reflect a separate idea. Do not repeat the same point in different words.

Q. 2. Explain some harmful effects of agricultural practices on the environment.
AE **[NCERT Exemp.]**

Ans. Some harmful effects of agricultural practices on the environment are :
(i) Excess use of ground water for agriculture lowers the water level. **1**
(ii) Excessive use of fertilisers affects the soil pH and kills useful microbes. **1**
(iii) Excessive use of chemical pesticides lead to biomagnification. **1**
(iv) Extensive agriculture causes loss of soil fertility. **1**
(v) Burning of agricultural waste like paddy and wheat straw results into the formation of smog that pollutes environment substantially. ½
(v) It affects our natural eco-system. ½

AI **Q. 3. (a) Indicate the flow of energy in an ecosystem. Why is it unidirectional? Justify.**
(b) What will happen if decomposers are absent in an ecosystem?

Ans. (a) The flow of energy is generally from
Sun → producer → herbivore → carnivore.
Since the flow of energy is progressively from one trophic level to another and does not revert back, it is said to be unidirectional. Further, the available energy decreases in the higher trophic levels making it impossible for energy to flow in the reverse direction.
(b) Decomposers include micro-organisms such as bacteria and fungi that obtain nutrients by breaking down the remains of dead plants and animals.
It breaks down the complex organic substances of garbage, dead animals and plants into simpler inorganic substances that go into the soil and are used up again by the plants.
In the absence of decomposers, recycling of material in the biosphere will not take place. **2 ½ + 2 ½**

@PROCBSE

TOPIC - 2
Biodegradable and Non-Biodegradable Substances and Global Warming

Revision Notes

- **Waste Materials:** Improvements in lifestyle have resulted in accumulation of large amounts of waste materials.
- **Garbage contains following type of materials:**
  - **(a) Biodegradable Wastes:** Substances which can be decomposed by the action of micro-organisms are called as *biodegradable wastes*. *e.g.*, fruit and vegetable peels, cotton, jute, dung, paper, etc.
  - **(b) Non-biodegradable Wastes:** Substances which cannot be decomposed by the action of micro-organisms are called as non-biodegradable wastes. *e.g.*, plastic, polythene, metals, synthetic fibres, radioactive wastes, pesticides, etc.

Scan to know more about this topic

Reduce, Reuse and Recycle

- **Methods of Waste Disposal:**
  - **(a) Biogas Plant:** Biodegradable waste can be used in biogas plant to produce biogas and manure.
  - **(b) Sewage Treatment Plant:** The drain water can be cleaned in sewage treatment plant before adding it to rivers.
  - **(c) Land Fillings:** The wastes are buried in low lying areas and are compacted by rolling with bulldozers.
  - **(d) Composting:** Organic wastes are filled in a compost pit and covered with a layer of soil, after about three months garbage changes to manure.
  - **(e) Recycling:** Non-biodegradable waste are recycled to make new items.
  - **(f) Reuse:** It is a conventional technique to use an item again *e.g.*, newspaper for making envelops.
- Ozone (O_3) is not the isotope of oxygen. It is a molecule formed by three atoms of oxygen. Ozone performs an essential function of shielding the surface of the earth from ultraviolet radiation of the sun.

$$O_2 + O \longrightarrow O_3$$

Scan to know more about this topic

Ozone layer

- Ozone layer is a layer of the earth's atmosphere in which most of the atmosphere's ozone is concentrated.
- Ozone layer protects the earth from harmful UV radiations.
- There are several reasons for depletion of the ozone layer.
- The foremost is the use of chlorofluorocarbons (CFCs). The other factor responsible for ozone destruction is the pollutant nitrogen monoxide (NO).
- When the harmful chemicals like chlorofluorocarbons (CFCs) are released into the air, it accumulates in the upper atmosphere and reacts with ozone resulting in reduction in thickness of the ozone layer.
- Thus, the ozone layer in the atmosphere becomes thinner and gets depleted allowing more ultraviolet rays to pass through it. This phenomenon is referred as *the Ozone hole*.
- The Antarctic hole in ozone layer is caused due to chlorine molecules present in chlorofluorocarbons (CFCs), that are used by human beings.

How is it done on the GREENBOARD?

Q. Plastic cups were used to serve tea in trains in early days- these could be returned to the vendors, cleaned and reused. Later, Kulhads were used instead of plastic cups. Now, paper cups are used for serving tea. What are the reasons for the shift from Plastic to Kulhads and then finally to paper cups ? 3

Ans. Step I: Plastic cups are non-biodegradable and harm the environment. They were, thus, replaced by Kulhads.

Step II: Making Kulhad, which is made of clay on a large scale resulted in the loss of top fertile soil.

Step III: Now, disposable paper cups are used because the paper can be recycled, it is biodegradable and is eco-friendly material, which does not cause environmental pollution.

@PROCBSE JOIN NOW !

@PROCBSE

Objective Type Questions — 1 mark each

A Multiple Choice Questions

Q. 1. Which one of the following green house gases is a contributor due to incomplete combustion of coal and petroleum?

(a) Oxides of nitrogen
(b) Methane
(c) Carbon monoxide
(d) Carbon dioxide [Board SQP, 2020]

Ans. Correct option : (c)
Explanation : Incomplete combustion of coal and petroleum releases carbon monoxide, which is a contributor of greenhouse effect.

Q. 2. Depletion of ozone is mainly due to _____.

(a) chlorofluorocarbon compounds.
(b) carbon monoxide.
(c) methane.
(d) pesticides. [NCERT Exemp.]

Ans. Correct option : (a)
Explanation : Depletion of ozone layer occurs due to chlorofluorocarbons (CFCs). Other chemicals do not cause depletion of ozone layer in the environment.

Q. 3. Excessive exposure of humans to UV-rays results in

(i) damage to immune system.
(ii) damage to lungs.
(iii) skin cancer.
(iv) peptic ulcers.
(a) (i) and (ii) **(b) (ii) and (iv)**
(c) (i) and (iii) **(d) (iii) and (iv)**
[NCERT Exemp.]

Ans. Correct option : (c)
Explanation : Excessive exposure of humans to ultraviolet (UV)-rays results in :
(i) Skin cancer.
(ii) Damage to the immune system of the body.

Q. 4. Which of the followings are environment-friendly practices?

(a) Carrying cloth-bags to put purchases in while shopping.
(b) Switching off unnecessary lights and fans.
(c) Walking to school instead of getting your mother to drop you on her scooter.
(d) All of the above. [NCERT Ex.]

Ans. Correct option : (d)
Explanation : The eco-friendly habits that we should adopt in our day-to-day life are:
(i) Switch off the lights when not in use.
(ii) Walk to school or use bicycle.
(iii) Always carry cotton bags instead of using plastic bags.

B Assertions and Reasons Type Questions

Directions: In the following questions, a statement of assertion (A) is followed by a statement of reason (R). Mark the correct choice as:

(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).
(b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).
(c) Assertion (A) is true but reason (R) is false.
(d) Assertion (A) is false but reason (R) is true.

Q. 1. Assertion (A): CFCs deplete the ozone layer.
Reason (R): CFCs are used as refrigerants and in fire extinguishers.

Ans. Correct option : (a)
Explanation: Ozone layer is getting depleted at the higher levels of the atmosphere due to effect of chlorofluorocarbons (CFCs) which are used as refrigerants and in fire extinguishers.

Q. 2. Assertion (A): Polythene bags and plastic containers are non-biodegradable substances.
Reason (R): They can be broken down by micro-organisms in natural simple harmless substances.

Ans. Correct option : (c)
Explanation: Substances like polythene bags and plastics are non-biodegradable because they cannot be broken down by micro-organisms into simpler harmless substance in nature. Substances that can be broken down by micro-organisms in natural simple harmless substances are biodegradable substances.

Q. 3. Assertion (A): Ozone is both beneficial and damaging.
Reason (R): Stop the release of chlorofluorocarbons to protect the ozone.

Ans. Correct option : (b)
Explanation: Ozone is damaging as it is a deadly poison. It is beneficial as it shields the surface of the earth from UV radiations of the Sun. We should stop the release of Chlorofluorocarbons (CFCs) to protect the ozone.

C Very Short Answer Type Questions

Q. 1. Explain how ozone being a deadly poison can still perform an essential function for our environment. A [Board SQP, 2021]

Ans. Ozone layer protects us from harmful effects of UV radiation. **1**

Q. 2. State the essential function performed by Ozone at the higher levels of the atmosphere.

R [Delhi Comptt. 31/1/1 2017]

@PROCBSE

Ans. It shields the surface of the earth from ultraviolet (UV) radiation from the sun. **1**

Q. 3. What is biodegradable substance?
R [Delhi Comptt. 2017]

Ans. Substances that can be broken down by micro-organisms in natural simple harmless substances. **1**

Q. 4. Why should biodegradable and non-biodegradable wastes be discarded in two different dustbins?
R [OD Comptt. 31/1 2017]

Ans. (i) Saves time/ energy in segregation.
(ii) Biodegradable items can be sent directly for composting.
(iii) Non-biodegradable items can be sent for a appropriate reuse/recycle. ½ × 2 **[Any two]**
[CBSE Marking Scheme, 2017]

Detailed Answer:
Separation should be done actually to save our resources for future benefits and to save our environment from pollution.

Q. 5. The depletion of ozone layer is a cause of concern. Why? A [Board Term II, O.D. Set I, 2016]

Ans. Ultraviolet rays from the sun penetrate down the atmosphere and cause health hazards/skin cancer in human beings. [CBSE Marking Scheme, 2016] **1**

Detailed Answer:
Ozone layer shields the earth surface from ultraviolet (UV) radiation of the Sun. These UV-rays may reach the earth due to depletion of ozone layer and cause health hazards/skin cancer in human beings. Therefore, it is a cause of concern.

Q. 6. Why is excessive use of CFCs a cause of concern?
AE [Board Term II, Foreign Set III, 2016]

Ans. When CFC's reach upper layers of the atmosphere, they cause depletion of ozone layer, and allow harmful UV radiations to reach the surface of the earth to create health hazards. ½ + ½
[CBSE Marking Scheme, 2016]

AI **Q. 7. Write one negative effect, on the environment, of affluent life style of few persons of a society.**
AE [Board Term II, O.D. Set II, 2016]

Ans. Use of excessive non-biodegradable material in packaging:
Excessive use of natural resources like coal and petroleum which causes pollution.
Affluent lifestyle results in generation of excessive waste materials. **(Any one) 1**
[CBSE Marking Scheme, 2016]

AI **Q. 8. Write the full name of the group of compounds mainly responsible for the depletion of ozone layer.** R [Board Term II, Foreign Set I, 2015]

Ans. Chlorofluorocarbons. **1**
[CBSE Marking Scheme, 2015]

COMMONLY MADE ERROR
- Students often write incorrect spelling of the chemical compound i.e. chlorofluorocarbon.

ANSWERING TIP
- Learn the spelling of chlorofluorocarbon carefully as incorrect spelling may deduct your marks.

AI **Q. 9. What is the function of ozone in the upper atmosphere?** R [Board Term II, Delhi Set I, 2015]

Ans. Ozone layer protects the earth from harmful radiations like high energy ultraviolet radiations.
[CBSE Marking Scheme, 2015] **1**

Short Answer Type Questions-I — 2 marks each

Q. 1. How is ozone both beneficial and damaging? How can we prevent the damaging effect of ozone?
U [CBSE SQP 2019]

Ans. Damaging as it is a deadly poison. Beneficial as it shields the surface of the earth from UV radiations of the Sun.
By not using synthetic chemicals like CFCs, that deplete Player. **1 + 1**
[CBSE Marking Scheme, 2019]

Q. 2. What is Ozone? Name the chemicals that damage the Ozone layer. R [Delhi Comptt. 2017]

Ans. Ozone is a gas made up of three oxygen atoms, occurs naturally in small amounts in the upper atmosphere and protects life on Earth from the Sun's ultraviolet (UV) radiations. The chemical that damage Ozone layer is Chlorofluorocarbon (CFCs). **1+1**

COMMONLY MADE ERROR
- Students often write incorrect spelling of Chloro-fluorocarbon.

ANSWERING TIP
- Practice writing the correct spelling of CFCs and all biological terms.

AI **Q. 3. How can you help in reducing the problem of waste disposal? Write any two methods.**
U [OD Comptt. 31/3 2017]

@PROCBSE JOIN NOW !

Ans. Segregation of waste at the point of its generation for convenient disposal.

Change in attitude producing less waste by adopting 3 R's policy.

1+1 [CBSE Marking Scheme, 2017]

Detailed Answer:

We can help in reducing the problem of waste disposal by these methods:

(i) By separating biodegradable substances from non-biodegradable substances.

(ii) By reducing, reusing and recycling non-biodegradable substances. **1+1**

Q. 4. Give any two ways in which biodegradable substances would affect the environment.

Ans. (i) They produce foul smell during decomposition process. **1**

(ii) They may produce harmful gases such as ammonia, methane and carbon dioxide. **1**

COMMONLY MADE ERROR

- Students often write the effects of non-biodegradable substances on environment, instead of biodegradable.

ANSWERING TIP

- Read the questions properly before answering. Learn the concept of biodegradable and non-biodegradable substances carefully along with their effects on environment.

AI **Q. 5. Write the harmful effects of using plastic bags, on the environment. Suggest alternatives to plastic bags.** A

Ans. Plastic bags are non-biodegradable wastes, they are not degraded, they begin to stink, emitting foul gases, spoil the beauty of places and contaminate soil, water and air with toxins.

Cloth bags are used instead of plastic bags because they are stronger, more durable and washable. **1+1**

Short Answer Type Questions-II — 3 marks each

Q. 1. Plastic cups were used to serve tea in trains in early days- these could be returned to the vendors, cleaned and reused. Later, Kulhads were used instead of plastic cups. Now, paper cups are used for serving tea.

What are the reasons for the shift from Plastic to Kulhads and then finally to paper cups?

A [CBSE SQP, 2021]

Ans. Plastic cups are non-biodegradable and harm the environment. They were, thus, replaced by Kulhads.

Making Kulhad, which is made of clay on a large scale resulted in the loss of top fertile soil.

Now, disposable paper cups are used because the paper can be recycled, it is biodegradable and is eco-friendly material, which does not cause environmental pollution. **1**

[CBSE Marking Scheme, 2021]

Q. 2. (a) Write two harmful effects of using plastic bags on the environment. Suggest alternatives to the usage of plastic bags.

(b) List any two practices that can be followed to dispose off the waste produced in our homes.

A [Outside Delhi, Set- I, 2020]

Ans. (a) Harmful effects of plastic bags:

(i) Plastics do not undergo degradation, thus stay in soil for many years. This may affect the soil fertility and degrades the soil quality.

(ii) When plastic artifacts enter the drainage and sewerage system, they block the pipes and drains causing water logging.

(iii) Littering of plastics in open spaces creates unhygienic conditions, as it act as breeding ground for insects and mosquitoes. (Any two)

We can reduce the use of plastic bags and carry jute bags and paper bags to carry items from the market.

(b) Measures taken for proper disposal of waste produced at our homes are:

(i) Prepare a compost pit for kitchen wastes.

(ii) Safe disposal of plastic bags.

(iii) Segregation of biodegradable and non biodegradable wastes.

(iv) Fruit peels can be placed near trees or plants, which on decomposition will enrich the soil with nutrients.

(v) Recycling of paper wastes. (Any two) **2+1=3**

@PROCBSE JOIN NOW !

@PROCBSE

COMMONLY MADE ERROR

- Students often repeat the same point again and again. Many of them write answers in paragraph form rather than point wise.

ANSWERING TIP

- Always write the answer point wise and each point must reflect a separate idea. Do not repeat the same point in different words.

Q. 3. (a) Explain the role of UV radiation in producing ozone layer.

(b) Mention the reaction involved.

(c) Why is excessive use of CFCs a cause of concern?

[Outside Delhi, Set- II, 2020]

Ans. (a) Ozone is formed in the upper atmosphere when solar UV radiation dissociated molecules of oxygen (O) and then this oxygen atom (O) combines with an oxygen molecule.

(b) Reaction involved: $O_2 \longrightarrow O + O$

$$O + O_2 \longrightarrow O_3$$

(c) When CFC's reach upper layers of the atmosphere, they cause depletion of ozone layer, and allow harmful UV radiations to reach the surface of the earth to create health hazards. **1×3=3**

COMMONLY MADE ERROR

- Students often write incorrect reactions. They often do mistake while writing the symbols of Oxygen (O_2) and Ozone (O_3).

ANSWERING TIP

- Carefully learn the reactions involved in formation of ozone layer. Students are advised to read the questions carefully and answer the questions part-by-part.

Q. 4. How is ozone layer formed? State its importance to all life forms on earth? Why the amount of ozone in the atmosphere dropped sharply in the 1980s?

[Outside Delhi, Set- III, 2020]

Ans. Formation of ozone in Atmosphere: Ozone is continuously formed by the action of UV rays on molecular oxygen, and also degraded into molecular oxygen in the stratosphere. The high energy ultraviolet radiations split ozone into molecular and atomic oxygen with large amount of heat. This heat is used in warming the stratosphere.

$$O_3 \rightarrow O_2 + [O] + \text{Heat}$$

This oxygen atom then recombine with oxygen (O_2) molecule to form ozone molecule.

$$O_2 + [O] \rightarrow O_3$$

The ozone layer acts as a protective blanket around the earth which shields the entire earth from harmful ultraviolet radiations that come from the sun. Ozone depletion is the reduction in concentration of ozone layer. It is formed due to an increased concentration of ozone-depleting substances such as chlorofluorocarbons (CFCs). CFCs are used in refrigerants, ACs, fire extinguishers, aerosols spray etc. **1×3=3**

Q. 5. Write the essential function performed by ozone at the higher levels of the Earth's atmosphere? How is it produced? Name the synthetic chemicals mainly responsible for the drop of amount of ozone in the atmosphere. How can the use of these chemicals be reduced?

R **[Board Outside Delhi, Set-I, 2019]**

Ans. It shields the surface of the earth from the UV radiation from the sun. 1

$O_2 \xrightarrow{UV} O + O$

$O_2 + O \longrightarrow O_3$ {or description of this process in words} 1

Chloro Fluoro Carbons (CFC's) ½

Reduce the use of CFC's by (a) minimizing the leakage through air conditioners and refrigerators / finding substitute chemicals that are ozone friendly. **[CBSE Marking Scheme, 2019]** ½

Detailed Answer:

Ozone protects the surface of earth from harmful ultraviolet (UV) radiations emitted by the sun.

Ozone is a product of UV radiation acting on oxygen (O_2) molecule. The higher energy UV radiations split apart some molecular oxygen (O_2) into free oxygen (O) atoms. These atoms combine with molecular oxygen to form ozone.

$$O_2 \xrightarrow{UV} O + O$$

$$O + O_2 \rightarrow \underset{\text{(Ozone)}}{O_3}$$

Chlorofluorocarbons (CFCs) are mainly responsible for the drop of amount of ozone in the atmosphere. Use of these chemicals can be reduced by using alternate products that do not harm the ozone layer. Also, safe disposal of old appliances like refrigerators prevents its emission.

COMMONLY MADE ERROR

- Students often given incorrect explanation. Many of them forget to answer the sub parts of the question.

ANSWERING TIP

- Learn the concept of ozone layer and ozone depletion carefully. Lay emphasis on the hazards of CFCs on environment.

@PROCBSE

Q. 6. Students in a school listened to the news read in the morning assembly that the mountain of garbage in Delhi, suddenly exploded and various vehicles got buried under it. Several people were also injured and there was traffic jam all around. In the brain storming session, the teacher also discussed this issue and asked the students to find out a solution to the problem of garbage. Finally they arrived at two main points – one is self management of the garbage we produce and the second is to generate less garbage at individual level.

(a) Suggest two measures to manage the garbage we produce.

(b) As an individual, what can we do to generate the least garbage? Give two points.

(c) List two values the teacher instilled in his students in this episode. AE **[CBSE Delhi/OD Set-2018]**

Ans.(a) Incineration/Waste compaction/Biogas generation/Composting/Segregation and safe disposal/ Vermicomposting **(Any other) (any two)**

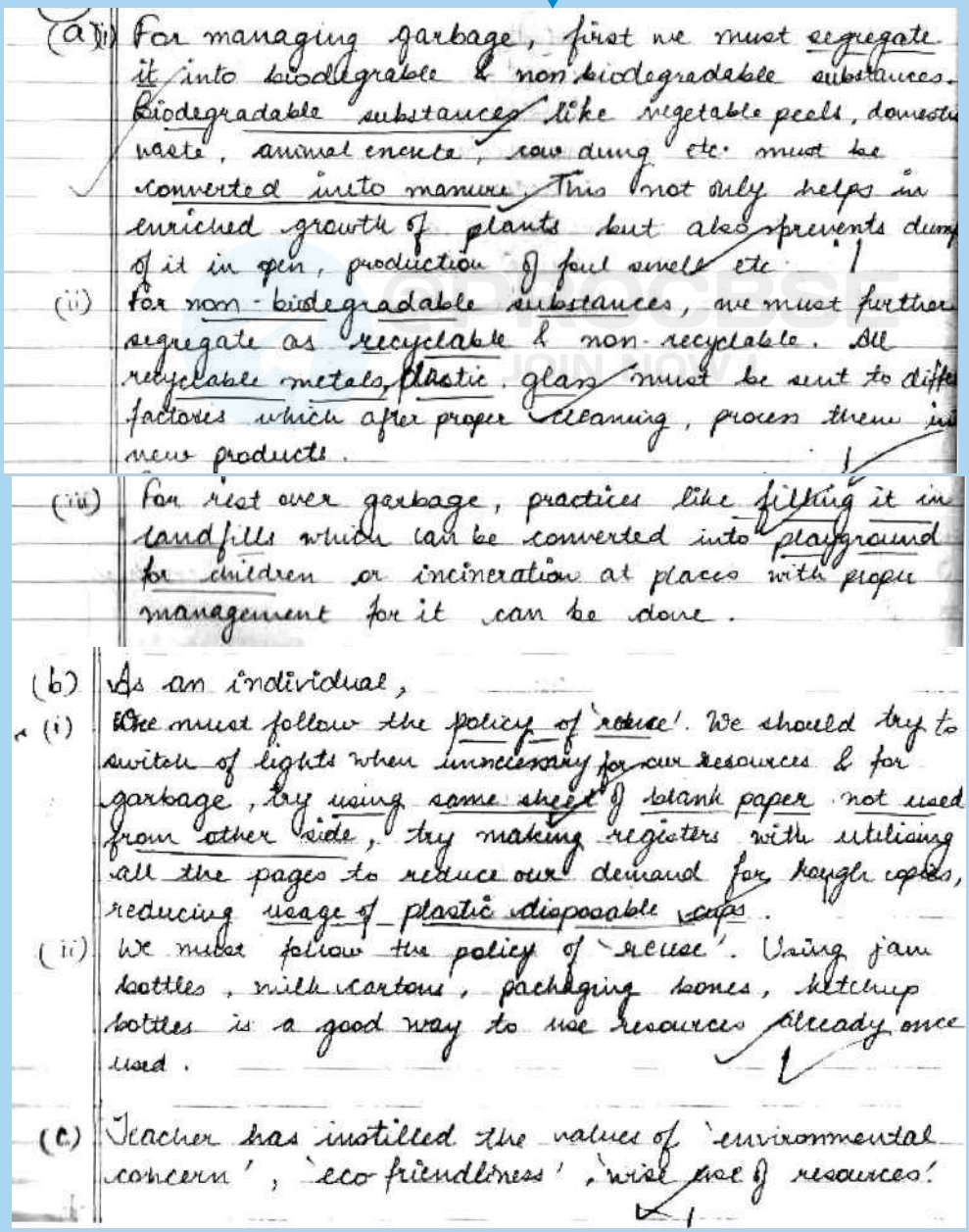
(b) Reuse of empty bottles, books etc.

Reduce the use of non-biodegradable substances like polythene, thermocol, etc. **(Any other)**

(c) Awareness about environment, scientific attitude, concern for community health and personal health. **(Any two) 1+1+1**

[CBSE Marking Scheme, 2018]

Topper Answer, 2018



(a) (i) For managing garbage, first we must segregate it into biodegrable & non biodegradable substances. Biodegradable substances like vegetable peels, domestic waste, animal excreta, cow dung etc. must be converted into manure. This not only helps in enriched growth of plants but also prevents dumping of it in open, production of foul smells etc. 1

(ii) For non-biodegradable substances, we must further segregate as recyclable & non-recyclable. All recyclable metals, plastic, glass must be sent to different factories which after proper cleaning, process them into new products. 1

(iii) For rest over garbage, practices like filling it in landfills which can be converted into playground for children or incineration at places with proper management for it can be done.

(b) As an individual,

(i) One must follow the policy of 'reduce'. We should try to switch of lights when unnecessary for our resources & for garbage, try using same sheet of blank paper not used from other side, try making registers with utilising all the pages to reduce our demand for rough copies, reducing usage of plastic disposable cups.

(ii) We must follow the policy of 'reuse'. Using jam bottles, milk cartons, packaging boxes, ketchup bottles is a good way to use resources already once used. 1

(c) Teacher has instilled the values of 'environmental concern', 'eco friendliness', 'wise use of resources'. 1

@PROCBSE

Q. 7. You have been selected to talk on 'ozone layer and its protection' in the school assembly on 'Environment Day'.

(a) Why should ozone layer be protected to save the environment?

(b) List any two ways that you would stress in your talk to bring in awareness amongst your fellow friends that would also help in protection of ozone layer as well as the environment.

C [Delhi 31/1/2017]

Ans. (a) Because Ozone layer protects/shields the earth from harmful UV radiations of the sun. **1**

(b) Conducting poster making competition highlighting effects of ozone layer depletion. **1**

(c) Conducting street plays highlighting the ways of environment protection. **1**

[CBSE Marking Scheme, 2017]

Detailed Answer:

(i) Ozone layer helps in shielding the Earth from the harmful UV radiations coming from sun. If ozone layer gets depleted, UV radiations can directly reach the earth's surface and drastically affect the life on earth.

(ii) Ozone layer can be protected by:

(a) Stopping the release of Chlorofluorocarbon

(b) Removing the pollutant nitrogen monoxide

(c) Reduce the usage of air conditioners.

AI **Q. 8. Differentiate between biodegradable and non-biodegradable substances with the help of one example each. List two changes in habit that people must adopt to dispose non-biodegradable waste, for saving the environment.**

U [Board Term II, O.D. Set I, 2015]

Ans.

S. No.	Biodegradable Substance	Non–biodegradable Substance
(i)	The substance which are broken down into simpler, harmless substance in nature in due course of time by the biological processes such as action of microorganisms.	The substances which cannot be broken down into simpler, harmless substances in nature. These substances may be in solid, liquid or gaseous form and may be inert and accumulate in the environment.
(ii)	*e.g.*, Domestic waste products, sewage.	*e.g.*, DDT and polythene bags.

Two methods of disposal of non–biodegradable waste are:

(i) Recycling: The wastes are treated and same value materials are extracted for reuse.

(ii) Incineration: Medical and toxic waste are burnt at high temperature in incineration. Incinerators transform the waste into ashes. **2+1**

Long Answer Type Questions — 5 marks each

Q. 1. Name the wastes which are generated in your house daily. What measures would you take for their disposal? A [NCERT Exemp.]

Ans. The wastes which are generated in our house daily are :

(i) Paper wastes like newspapers, bags, kitchen wastes, etc.

(ii) Plastic bags.

(iii) Vegetable or fruit peels. **2**

Measures taken for proper disposal are:

(i) Prepare a compost pit for kitchen wastes.

(ii) Safe disposal of plastic bags.

(iii) Segregation of biodegradable and non-biodegradable wastes.

(vi) Fruit peels can be placed near trees or plants, which on decomposition will enrich the soil with nutrients.

(v) Recycling of paper wastes. **(Any three) 3**

Q. 2. Suggest suitable mechanisms for waste management in fertiliser industries.

A [NCERT Exemp.]

Ans. Effluents and harmful gases are the major pollutants which are generated in a fertiliser, chemical or pesticides factory. Scientific mechanism for reduction in emission of pollutants in environment is :

For reduction of gaseous pollutants, electro-static precipitators (ESP) are commonly used. ESP works on the principle of "opposite charges attract." When the gaseous emissions containing unburnt pollutants such as coal particles, unburnt carbon, SO_x, NO_x, etc. enters this field, ash particles gets charged and attracted towards the collecting plates due to the force produced by the electric field. Thereby, reducing the gaseous emissions in the atmosphere. **2½**

In addition to this, industrial waste water generated from the fertiliser industry contains pollutants that may contaminate our natural water resources. For safe disposal of industrial waste water, effluent treatment plant (ETP) is set up to treat the waste water. An ETP is used to purify water and remove any toxic and non-toxic materials or chemicals from it. They use evaporation and drying methods, and other auxiliary techniques such as centrifuging, filtration, incineration for chemical processing and effluent treatment. The treated water can be used in the industrial process and for irrigation of plantation. **2½**

Q. 3. Why is damage to the ozone layer a cause for concern? What steps are being taken to limit this damage? R [NCERT Ex.]

@PROCBSE JOIN NOW !

@PROCBSE

Ans. Ozone layer is a protective shield around the Earth.

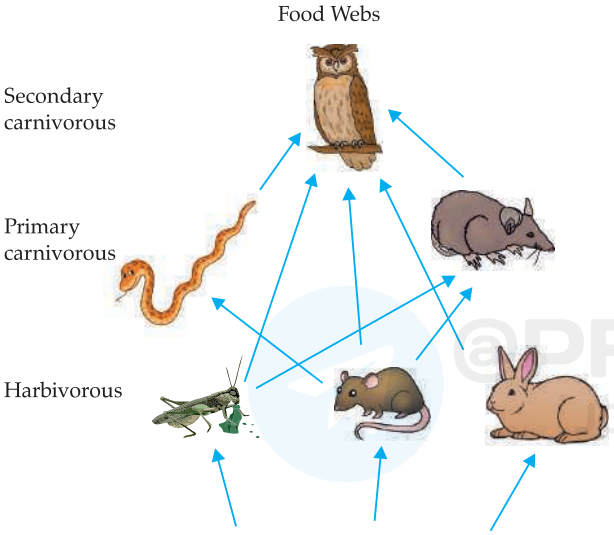
It prevents harmful ultraviolet radiation of the Sun from reaching the Earth. Air pollutants, like chlorofluorocarbons (CFCs), are causing depletion of ozone layer.

Depletion of ozone layer is allowing greater amount of UV radiation to reach the Earth. UV radiation can affect the ecosystem by affecting photosynthesis in plants, destroying planktons and decomposers. In human beings, UV radiation may cause skin cancer, cataract and damage to immune system.

Many developed as well as developing nations of the world have agreed to sign and obey the directions of UNEP (United Nations Environment Programme) to cease the production of CFCs or to limit their production to some extent. **5**

Visual Case-based Questions — 4 marks each

Q. 1. Read the following and answer any four the questions from (a) to (e):
Food chains are very important for the survival of most species. [CBSE–QB 2021]



(a) If 10,000 J solar energy falls on green plants in a terrestrial ecosystem, what percentage of solar energy will be converted into food energy?
(i) 10,000 J
(ii) 100 J
(iii) 1000 J
(iv) It will depend on the type of the terrestrial plant.

(b) If Ravi is consuming curd/yogurt for lunch, which trophic level in a food chain he should be considered as occupying ?
(i) First trophic level **(ii)** Second trophic level
(iii) Third trophic level **(iv)** Fourth trophic level

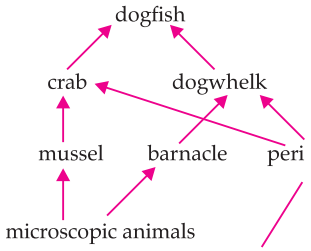
(c) The decomposers are not included in the food chain. The correct reason for the same is because decomposers:
(i) Act at every trophic level of the food chain
(ii) Do not breakdown organic compounds
(iii) Convert organic material to inorganic forms
(iv) Release enzymes outside their body to convert organic material to inorganic forms

(d) Matter and energy are two fundamental inputs of an ecosystem. Movement of
(i) Energy is bidirectional and matter is repeatedly circulating.
(ii) Energy is repeatedly circulation and matter is unidirectional.
(iii) Energy is unidirectional and matter is repeatedly circulating.
(iv) Energy is multidirectional and matter is bidirectional.

(e) Which of the following limits the number of trophic levels in a food chain?
(i) Decrease in energy at higher trophic levels
(ii) Less availability of food
(iii) Polluted air
(iv) Water

Ans. (a) (ii) 100 J
(b) (iii) Third Trophic level
(c) (i) Act at every trophic level of the food chain
(d) (iii) Energy is unidirectional and matter is repeatedly circulating
(e) (i) Decrease in energy at higher trophic level

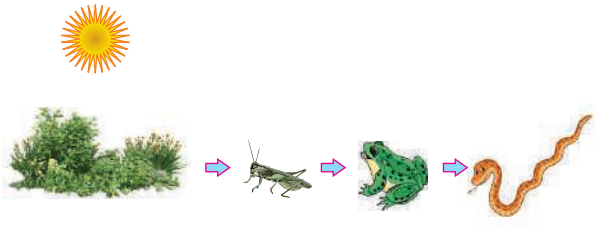
Q. 2. Read the following and answer any four questions from (a) to (e):
Observe the food web and answer the questions given below - [CBSE–QB 2021]



(a) The mussel can be described as
(i) Producer
(ii) Primary consumer
(iii) Secondary consumer
(iv) decomposer

(b) Which trophic level is incorrectly defined?
(i) Carnivores – secondary or tertiary consumers
(ii) Decomposers – microbial heterotrophs
(iii) Herbivores – primary consumers
(iv) Omnivores – molds, yeast and mushrooms

(c) The given figure best represents:

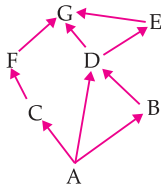


@PROCBSE

(i) Grassland food chain **(ii)** Parasitic food chain
(iii) Forest food chain **(iv)** Aquatic food chain

(d) Why do all food chains start with plants?
(i) Because plants are easily grown
(ii) Because plants are nutritious
(iii) Because plants can produce its own energy
(iv) Because plants do not require energy

(e) In the food web, which two organisms are competing for food?



(i) A and B **(iii)** A and C
(ii) D and F **(iv)** B and D

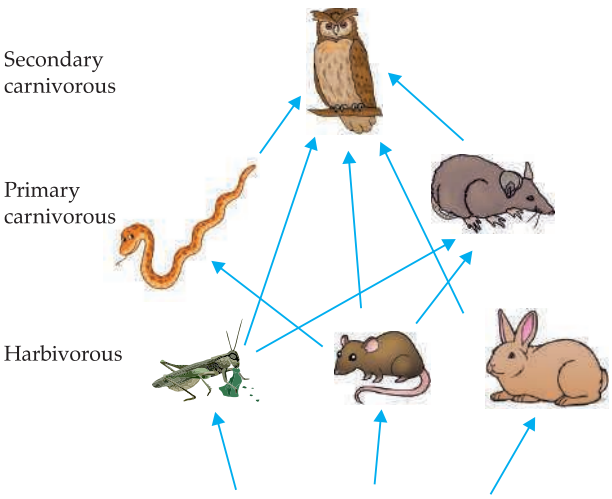
Ans. (a) (iii) Secondary consumer
(b) (iv) Omnivores
(c) (i) Grassland food chain
(d) (iii) Because plants can produce its own energy
(e) (iv) (B) & (D)

Q. 3. Read the following and answer any four questions from (a) to (e) **[CBSE–QB 2021]**

Food chains are very important for the survival of most species. When only one element is removed from the food chain it can result in extinction of a species in some cases. The foundation of the food chain consists of primary producers.

Primary producers, or autotrophs, can use either solar energy or chemical energy to create complex organic compounds, whereas species at higher trophic levels cannot and so must consume producers or other life that itself consumes producers. Because the sun's light is necessary for photosynthesis, most life could not exist if the sun disappeared. Even so, it has recently been discovered that there are some forms of life, chemotrophs, that appear to gain all their metabolic energy from chemosythesis driven by hydrothermal vents, thus showing that some life may not require solar energy to thrive.

Food Webs



(a) If 10,000 J solar energy falls on green plants in a terrestrial ecosystem, what percentage of solar energy will be converted into food energy?
(i) 10,000 J
(ii) **100 J**
(iii) 1000 J
(iv) It will depend on the type of the terrestrial plant.

(b) Mr. X is eating curd/yogurt. For this food intake in a food chain he should be considered as occupying
(i) First trophic level **(ii)** Second trophic level
(iii) Third trophic level **(iv)** Fourth trophic level

(c) The decomposers are not included in the food chain.
The correct reason for the same is because decomposers:
(i) Act at every trophic level of the food chain
(ii) Do not breakdown organic compounds
(iii) Convert organic material to inorganic forms
(iv) Release enzymes outside their body to convert organic material to inorganic forms

(d) Matter and energy are two fundamental inputs of an ecosystem. Movement of
(i) Energy is bidirectional and matter is repeatedly circulating.
(ii) Energy is repeatedly circulation and matter is unidirectional.
(iii) Energy is unidirectional and matter is repeatedly circulating.
(iv) Energy is multidirectional and matter is bidirectional.

(e) Which of the following limits the number of trophic levels in a food chain?
(i) Decrease in energy at higher trophic levels
(ii) Less availability of food
(iii) Polluted air
(iv) Water

Ans. (a) (ii) 100 J
(b) (iii) Third Trophic level
(c) (i) Act at every trophic level of the food chain
(d) (iii) Energy is unidirectional and matter is repeatedly circulating
(e) (i) Decrease in energy at higher trophic level

Q. 4. Read the following and answer the questions any four from (a) to (e): **[CBSE–QB 2021]**

Biosphere is a global ecosystem composed of living organisms and abiotic factors from which they derive energy and nutrients. And ecosystem is defined as structural and functional unit of the biosphere comprising of living and non-living environment that interact by means of food chains and chemical cycles resulting in energy flow, biotic diversity and material cycling to form a stable, self-supporting system.

Biotic vs. Abiotic Factors

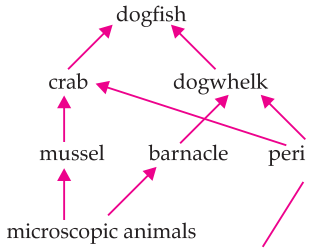
Living	Non-Living
Examples	Examples

@PROCBSE

Plants	**Water**
Animals	**Sunlight**
Fungi	**Soil**
Bacteria	**Air**
	Temperatu

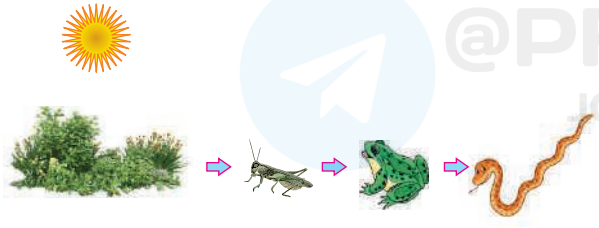
(a) Which trophic level is incorrectly defined?
(i) Carnivores – secondary or tertiary consumers
(ii) Decomposers – microbial heterotrophs
(iii) Herbivores – primary consumers
(iv) Omnivores – molds, yeast and mushrooms

(b) The diagram below shows a food web from the sea shore



The mussel can be described as
(i) Producer **(ii)** Primary consumer
(iii) Secondary consumer **(iv)** Decomposer

(c) The given figure best represents:



(i) Grassland food chain **(ii)** Parasitic food chain
(iii) Forest food chain **(iv)** Aquatic food chain

(d) Consider the following statements concerning food chains:
(i) Removal of 80% tigers from an area resulted in greatly increased growth of vegetation
(ii) Removal of most of the carnivores resulted in an increased population of herbivores.
(iii) The length of the food chains is generally limited to 3 – 4 trophic levels due to energy loss
(iv) The length of the food chains may vary from 2 to 8 trophic levels
Which two of the above statements are correct?
(1) (i), (iv) **(2)** (i), (ii)
(3) (ii), (iii) **(4)** (iii), (iv)

(e) Which of the following group of organisms are not included in ecological food chain?
(i) Carnivores **(ii)** Saprophytes
(iii) Herbivores **(iv)** Predators

Ans. (a) (iv) Omnivores – molds, yeast and mushrooms
(b) (iii) Secondary consumer
(c) (i) Grassland food chain
(d) (iii) (2), (3)
(e) (ii) Saprophytes

Q. 5. Waste management is essential in today's society. Due to an increase in population, the generation of waste is getting doubled day by day. Moreover, the increase in waste is affecting the lives of many people. [CBSE–QB 2021]
Waste management is the managing of waste by disposal and recycling of it. Moreover, waste management needs proper techniques keeping in mind the environmental situations. For instance, there are various methods and techniques by which the waste is disposed of. You must have come across 5 R's to save the environment: refuse, reduce, reuse, repurpose and recycle.

(a) Choose the waste management strategy that is matched with correct example.

(i)	Refuse	Choose products that use less packaging
(ii)	Reduce	Give unwanted toys and books to hospitals or schools
(iii)	Reuse	Not using single use plastic
(iv)	Repurpose	Making flower pot from used plastic bottle

(b) Recycling of paper is a good practice but recycled paper should not be used as food packaging because
(i) recycled papers take lots of space
(ii) recycled papers can't cover food properly
(iii) recycled papers can cause infection
(iv) recycled papers are costly

(c) According to the 'Solid Waste Management Rule 2016', the waste should be segregated into three categories. Observe the table below and select the row that has correct information

	Wet waste	Dry waste	Hazardous waste
(i)	Cooked food, vegetable peels	Used bulbs, fluorescent lamps	Plastic carry bags, bottles, newspaper, cardboard
(ii)	Coffee and tea powder, garden waste	Plastic carry bags, bottles, newspaper, cardboard	Expired medicines, razors, paint cans
(iii)	Leftover food, vegetable peels	Coffee and tea powder, garden waste	Insect repellents, cleaning solutions
(iv)	Uncooked food, tea leaves	Old crockery, frying pans	Coffee and tea powder, garden waste

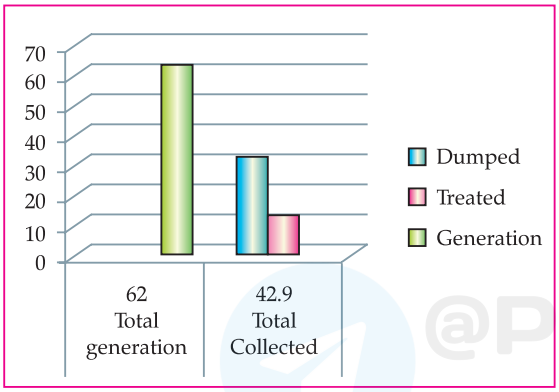
@PROCBSE JOIN NOW

(d) Effective segregation of wastes at the point of generation is very important. Select the appropriate statements giving the importance of waste segregation.

(1) less waste goes to the landfills
(2) better for public health and the environment
(3) help in reducing the waste
(4) resulting in deterioration of a waste picker's health

(i) both (1) and (2)
(ii) both (1) and (3)
(iii) both (2) and (3)
(iv) both (1) and (4)

(e) The given graph shows the amount of waste generated, dumped and treated in percentage. Identify the reason of low success rate of waste management process.



(i) only 15% of urban India's waste is processed
(ii) less than 60% of waste is collected from households
(iii) more than 60% of waste is collected from households
(iv) both a and b

Ans. (a) (iv)
(b) (iii)
(c) (ii)
(d) (i)
(e) (iv)

Q. 6. Read the following passage and answer any four questions from (a) to (e).

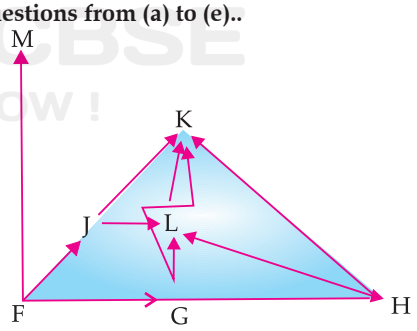
Human body is made up of five important components, of which water is the main component. Food as well as potable water is essential for every human being. The food is obtained from plants through agriculture; Pesticides are being used extensively for a high yield in the fields. These pesticides are absorbed by the plants from the soil along with water and minerals and from the water bodies these pesticides are taken up by the aquatic animals and plants. As these chemicals are not biodegradable, they get accumulated progressively at each trophic level. The maximum concentration of these chemicals gets accumulated in our bodies and greatly affects the health of our mind and body.

(a) Why is the maximum concentration of pesticides found in human beings?
(b) Give one method which could be applied to reduce our intake of pesticides through food to some extent.
(c) Various steps in a food chain represent:
(i) Food web **(ii) Trophic level**
(iii) Ecosystem **(iv) Biomagnification**
(d) With regard to various food chains operating in an ecosystem, man is a:
(i) Consumer
(ii) Producer
(iii) Producer and consumer
(iv) Producer and decomposer

A **[Delhi, Set-I, 2020]**

Ans. (a) It is because humans are at the top of the food chain and due to biomagnification, the concentration of pesticides increases as one goes up the trophic levels.
(b) Organic farming should be done or more bio-pesticides should be used.
(c) (b) Trophic level
(d) (a) Consumer **1×4=4**

Q. 7. Study the following food web and answer any four questions from (a) to (e)..



(a) Which of these is the producer?
(i) K **(ii) L**
(iii) J **(iv) F**
(b) Which organisms are primary consumers?
(i) F, L, H, K **(ii) M, G, J, H**
(ii) J, L, K, M **(iv) F, K, M, H**
(c) Which organisms will receive maximum energy in the ecosystem?
(i) M **(ii K**
(iii) F **(iv) None of these**
(d) Which organisms represent top level carnivores?
(i) K **(ii) M**
(iii) G **(iv) Both (i) and (ii)**
(e) What will happen if we kill all the organisms in one trophic level?
(i) Population of organisms in previous trophic level will increase.
(ii) Population of organism in previous trophic level will decrease.

@PROCBSE JOIN NOW !

@PROCBSE

(iii) Population of organism in next trophic level will increase.

(iv) This will not affect the population of any trophic level.

Ans. (a) (iv) F is the producer.

(b) (ii) M, G, J, H

(c) (iii) F

(d) (iv) K

(e) (iii) If we kill all the organisms in one trophic level, the population of organisms in next trophic level will increase. **(Any four) 1 + 1 + 1 + 1**

Q. 8. Read the following passage given below and answer the any of the four questions from (a) to (e). A water body characterized by nutrient rich water supports abundant growth of phytoplanktons and other water plants on its surface. Over time, the water body gets filled with a large number of such plants and the process is called *Eutrophication*. In such water bodies, dissolved oxygen content is nil or very less.

(a) Eutrophicated water usually looks turbid green in colour because of

(i) Excessive growth of phytoplanktons

(ii) Accumulation of minerals and nutrients

(iii) Water body becoming polluted

(iv) Release of degraded plant chlorophyll in water

(b) In eutrophicated water body, growth rate of phytoplankton is high because of:

(i) Light penetrating the lower surfaces of water body

(ii) Enrichment of nutrients in the water body

(iii) Less of dissolved oxygen in the water body.

(iv) Aquatic fauna flourishes well in eutrophicated water body.

(c) Aquatic fauna thrives well in eutrophicated water body because there is plenty of phytoplankton on which they could feed on. (True or False)

(d) There is an extremely low level of dissolved oxygen in a eutrophicated water body because:

(i) Excessive growth of bacterial decomposers feeding on dead material which consume the dissolved oxygen

(ii) Plants grow to such a great extent that they do not allow free flow of water hence oxygen in the atmosphere does not get mixed with water.

(iii) The dissolved oxygen in water reacts with minerals and nutrients to form compounds and hence greatly reduces the quantity of oxygen.

(iv) Oxygen released is consumed by fishes in the eutrophicated water and hence the quantity of dissolved oxygen is very low.

(e) We do not clean ponds or lakes, but an aquarium needs to be cleaned . Why?

Ans. (a) (i) Eutrophicated water usually looks turbid green in colour because of excessive growth of phytoplanktons.

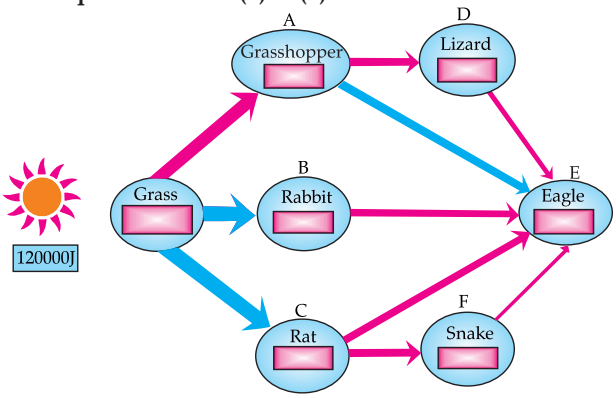
(b) (ii) In eutrophicated water body, growth rate of phytoplankton is high because of enrichment of nutrients in the water body.

(c) False.

(d) (i) There is an extremely low level of dissolved oxygen in a eutrophicated water body because excessive growth of bacterial decomposers feeding on dead material which consume the dissolved oxygen.

(e) A pond or lake is a natural ecosystem. They are self-sustaining and complete, in them, all the organisms of food chain are available. If any organism dies, there are decomposers to decompose their bodies into simpler substances. An aquarium, on the contrary is an artificial and incomplete ecosystem. The abiotic components are not supplied naturally to it. It may not have all the biotic components in it. If a fish die in an aquarium in the absence of decomposer, it will lie there as a rotten body, polluting the water of aquarium. Thus, an aquarium needs regular cleaning. **(Any four) 1+1+1+1**

Q. 9. Food chains and the energy flow within an ecosystem provide an important understanding of contingencies and mutual dependencies of organisms. The given below flow chart depicts the energy flow within some members of a grassland ecosystem. The grass in the below ecosystem transducer 120,000 J of sunlight and fixes it into 12,000 J of energy. It is established that 90% of the energy of one trophic level is not passed to the next trophic level. Further assume that the energy transferred from one trophic level to the next is equally shared among the different organisms at that trophic level. Based on the information given and your knowledge, answer any of the four questions from (a) to (e).



(a) How many food chains are present in the food web depicted above?

(i) 2 **(ii) 3**

(iii) 5 **(iv) 6**

(b) Based on the above information, indicate the amount of energy that an organism (A to F) may have received from an organism from the previous trophic level.

(c) In the food web depicted above, identify the most energy efficient link for tertiary consumer.

@PROCBSE

(i) Rabbit (ii) Rat
(iii) Lizard (iv) Grasshopper

(d) The first trophic level in a food chain is always a green plant. Why?

(e) Flow of energy in an ecosystem is always
(i) unidirectional (ii) bidirectional
(iii) multidirectional (iv) no specific direction

Ans. (a) (iii) There are five food chains depicted in the above flow chart.

(b) A = 1200 J, B = 1200 J, C = 1200 J, D = 120 J, E = 12 or 120 J, F = 120 J

(c) (i) Tertiary consumer here is Eagle, so for eagle the most energy efficient link is rabbit, as the rabbit is not being eaten in any other food chain.

(d) Green plants are producers. The first trophic level in a food chain is producer i.e., those organisms which produce food by photosynthesis.

(e) (i) Flow of energy in an ecosystem is always unidirectional. **(Any four) 1 + 1 + 1 + 1**

Q. 10. Read the given passage and answer any of the four questions from (a) to (e) given below:

A farmer is growing a crop regularly in his field. He uses chemical fertilizers, pesticides, organic manure as well as bio-fertilizers. Very close to his field is a factory which emits smoke as a byproduct. There is also a huge lake in the nearby area. 4

(a) A considerable increase in plant life in the lake was noticed after the farming activity intensified. The most likely reason for this could be:
(i) Chemical fertilizers leached into the lake from the field.
(ii) Pesticides leached into the lake from the field.
(iii) Organic manure leached into the lake from the field.
(iv) Smoke particles from the industry got settled in moist surroundings of the lake.

(b) Consider the following food chain in the same lake.
Aquatic plant → Small fish → Big fish → Birds
Which of the above organisms is likely to show minimum amount of pesticide concentration in them after considerable time?
(i) Aquatic plants.
(ii) Small fish.
(iii) Big fish.
(iv) Birds.

(c) Will the levels of this magnification be different at different levels of the ecosystem?

(d) An expert agriculturist suggests to the farmer to minimize the use of chemical fertilizers and instead use biofertilizers as they have many advantages over chemical fertilizers.
Which of the following is NOT true for biofertilizers?
(i) They are economical
(ii) They help in reducing pollution in the lake
(iii) They are renewable
(iv) They require large set-up for their production.

(e) State a way to prevent accumulation of harmful chemicals in our bodies.

Ans. (a) (i) A considerable increase in plant life in the lake was noticed after the farming activity intensified. The most likely reason for this could be chemical fertilizers leached into the lake from the field.

(b) (i) Aquatic plants beings at the first trophic level will show minimum amount of pesticide concentration in them after considerable time.

(c) Yes. Biological magnification increases at each trophic level.

(d) (iv) Biofertilisers do not require large set-up for their production.

(e) Minimize the use of chemicals/pesticides in agriculture. **(Any four) 1+1+1+1**

Q. 11. Study the passage and answer any four questions from (a) to (e).

The activities of man had adverse effects on all forms of living organisms in the biosphere.

Unlimited exploitation of nature by man disturbed the delicate ecological balance between the living and non-living components of the biosphere. The unfavourable conditions created by man himself threatened the survival not only of him but also of the entire living organisms on the mother earth. One of your classmates is an active member of 'Eco club' of your school which is creating environmental awareness amongst the school students, spreading the same in the society and also working hard for preventing environmental degradation of the surroundings.

(a) Why is it necessary to conserve our environment?

(b) The green dustbin signifies:
(i) Non- biodegradable waste
(ii) Biodegradable waste
(iii) Plastic waste
(iv) Garbage

(c) State the importance of green and blue dustbins in the safe disposal of the household waste.

(d) In the following groups of materials, which group(s) contains only non-biodegradable items?
(I) Wood, paper, leather
(II) Polythene, detergent, PVC
(III) Plastic, detergent, grass
(IV) Plastic, bakelite, DDT
(i) (III)
(ii) (IV)
(iii) (I) and (III)
(iv) (II) and (IV)

(e) Disposable plastic plates should not be used because
(i) they are made of materials with light weight
(ii) they are made of toxic materials
(iii) they are made of biodegradable materials
(iv) they are made of non-biodegradable materials

@PROCBSE JOIN NOW

Ans. (a) (i) To save water, air and soil from pollution.

(b) Green dustbins are for biodegradable wastes while blue dustbins are for non-biodegradable wastes.

(c) Importance of two types of dustbins: The segregation of biodegradable and non-biodegradable wastes occurs without wasting time and energy.

(d) (iv) Substances which are not broken down by the bacteria or saprophytes are called non-biodegradable substances. Under certain conditions, the non-biodegradable substances can persist for longer time and can also harm the various components of our ecosystem.

(e) (iv) Disposable plastic plates should not be used because they are made of non-biodegradable materials **(Any four) 1 + 1 + 1 + 1**

Know the Terms

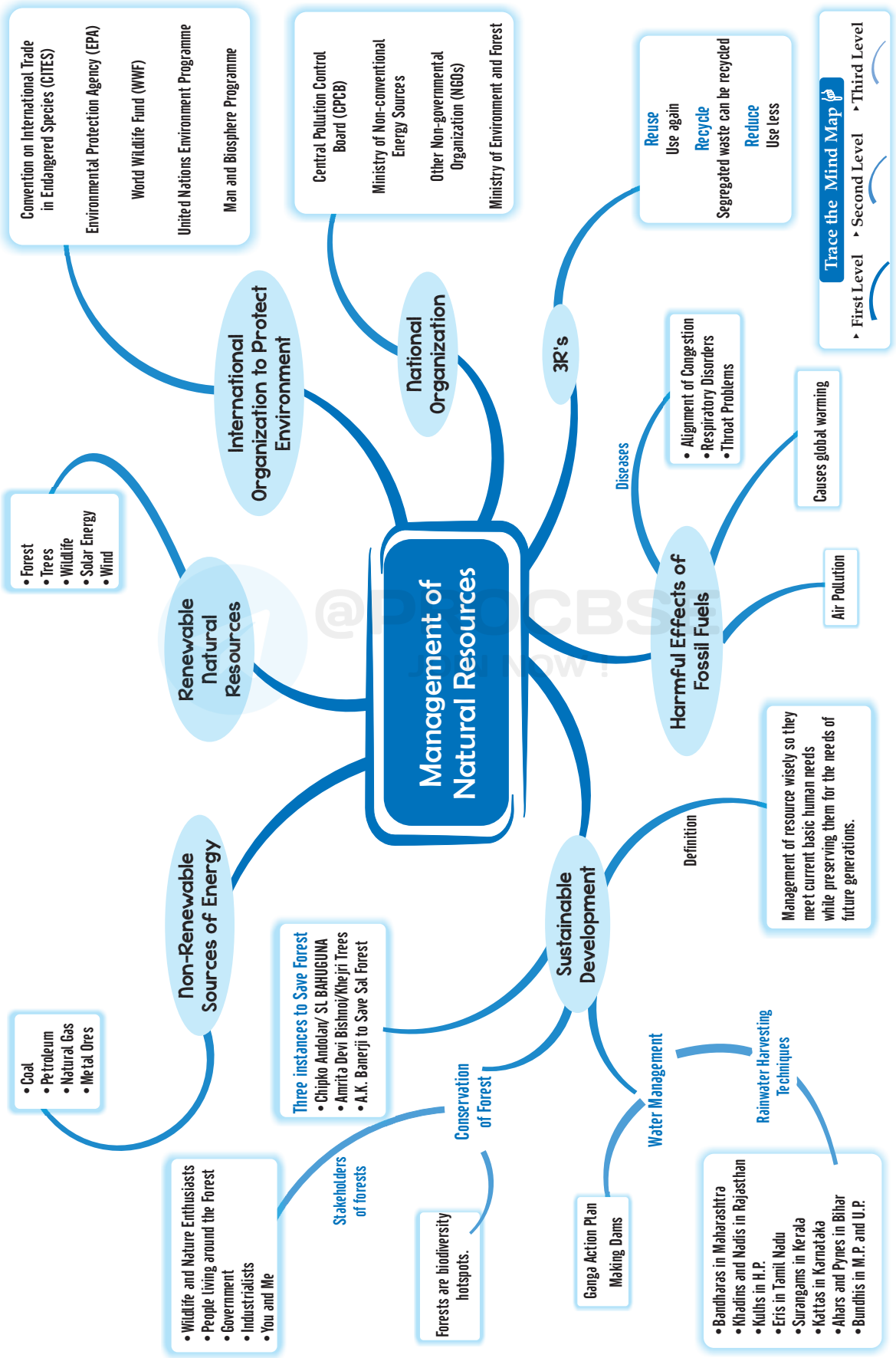
- **Environment:** It is the sum total of all biotic and abiotic components occurring naturally.
- **Biodegradable substances:** Substances which are broken down into simpler, harmless substances in nature in due course of time by the biological processes such as action of micro-organisms.
- **Non–biodegradable substances:** Substances which cannot be broken down into simpler, harmless substances in nature. These substances may be in solid, liquid or gaseous form and may be inert and accumulate in the environment or may concentrate in the food chain and harm the organisms.

OSWAAL LEARNING TOOL
To learn from Oswaal Concept Video
Visit: http:qrgo.page.link OR Scan this code

❑❑❑

@PROCBSE
JOIN NOW !

@PROCBSE


Management of Natural Resources
Renewable Natural Resources
• Forest
• Trees
• Wildlife
• Solar Energy
• Wind
Non-Renewable Sources of Energy
• Coal
• Petroleum
• Natural Gas
• Metal Ores
International Organization to Protect Environment
Convention on International Trade in Endangered Species (CITES)
Environmental Protection Agency (EPA)
World Wildlife Fund (WWF)
United Nations Environment Programme
Man and Biosphere Programme
National Organization
Central Pollution Control Board (CPCB)
Ministry of Non-conventional Energy Sources
Other Non-governmental Organization (NGOs)
Ministry of Environment and Forest
3R's
Reuse
Use again
Recycle
Segregated waste can be recycled
Reduce
Use less
Harmful Effects of Fossil Fuels
Diseases
• Alignment of Congestion
• Respiratory Disorders
• Throat Problems
Causes global warming
Air Pollution
Sustainable Development
Definition
Management of resource wisely so they meet current basic human needs while preserving them for the needs of future generations.
Water Management
Rainwater Harvesting Techniques
• Bandharas in Maharashtra
• Khadins and Nadis in Rajasthan
• Kulhs in H.P.
• Eris in Tamil Nadu
• Surangams in Kerala
• Kattas in Karnataka
• Ahars and Pynes in Bihar
• Bundhis in M.P. and U.P.
Ganga Action Plan
Making Dams
Conservation of Forest
Forests are biodiversity hotspots.
Three instances to Save Forest
• Chipko Andolan/ SL BAHUGUNA
• Amrita Devi Bishnoi/Kherjri Trees
• A.K. Banerji to Save Sal Forest
Stakeholders of forests
• Wildlife and Nature Enthusiasts
• People living around the Forest
• Government
• Industrialists
• You and Me
Trace the Mind Map
First Level
Second Level
Third Level

@PROCBSE

CHAPTER 16

MANAGEMENT OF NATURAL RESOURCES

Syllabus

Conservation and judicious use of natural resources, Forest and wild life; Coal and Petroleum conservation, Examples of people's participation for conservation of natural resources, Big dams: advantages and limitations; alternatives, if any. Water harvesting, Sustainability of natural resources.

Trend Analysis

List of Concepts	2018	2019	2020
	OD	OD/D	OD
Natural resources, Sustainable development and biodiversity		1 Q (1 M)	Or 1 Q (1 M)
Water conservation, Water harvesting, fossil fuels	1 Q (3 M)		1 Q (1 M)

@PROCBSE JOIN NOW !

TOPIC - 1
Natural Resources, Sustainable Development and Biodiversity

Revision Notes

- **Natural Resources:** Anything in the environment which is useful to man or can be transformed into a useful product or can be used to produce a useful thing is called *natural resource*. *e.g.*, soil, air, water, forests, wildlife, coal and petroleum.
-

Types of Resources

Exhaustible	Inexhaustible
These are present in limited quantity. *E.g.*, Coal and petroleum of cannot be reproduced	These are present in unlimited quantity. *E.g.*, Air and water can never get exhausted

- Coliform is a group of gram-negative, rod-shaped bacteria that are found in human intestine. Their presence in water is an indicator of contamination by disease-causing micro-organisms indicating faecal pollution. It includes *Klebsiella* and *Escherichia coli*.

TOPIC - 1
Natural Resources, Sustainable Development and Biodiversity
Page No. 403

TOPIC - 2
Water Conservation and Fossil Fuels
Page No. 411

@PROCBSE

- Largely untreated sewage such as garbage and excreta are dumped into Ganga. Pollution is also caused by human activities such as bathing, washing and immersion of ashes or unburnt corpses.
- Industries also contribute in Ganga's pollution by discharging chemical effluents which are responsible for making the water toxic and killing aquatic organisms.
- Ganga Action Plan is a massive multi-core project launched in 1985, which has been undertaken to clean the excess pollution from river Ganga.
- **Management of Natural resources:** The principle of reducing waste, reusing and recycling resources is often called the *3R's principle*.
- **Sustainable Management:** Management of resources wisely so they meet current basic human needs while preserving them for the needs of future generations.
- **The management of natural resources requires :**
  - **(a)** Long term perspective so that these will last for generations to come.
  - **(b)** Ensure equitable distribution of resources so that all economic sections benefit from these resources.
  - **(c)** Safe disposal of waste.
- The objective of sustainable development is to provide the economic well being to the present and the future generations and to maintain a healthy environment and life support system.
- Forest is a 'biodiversity hotspot' because it is an area where number of species or range of different life form exists.
- **We need to manage natural resources because :**
  - **(i)** They are limited.
  - **(ii)** Utilisation of natural resources is increasing at an exponential rate due to increase in human population.
- Management of natural resource should ensure equitable distribution to all in order to get benefit from the development of these resources.
- Sustainable natural resource management should ensure the safe disposal of wastes produced while using or extracting the resources.
- Forests are 'biodiversity hot spots' where a number of species are found.
- Conserving forest will preserve the bio-diversity which ensure the ecological stability.
- Management of forest resources has to take into account the interests of various stakeholders.
- **Four stakeholders of forests are :**
  - **(i)** Local people who live in and around the forest and are dependent on the forest produce for their livelihood.
  - **(ii)** The Forest Department of the Government which owns the forest and controls the resources from forests.
  - **(iii)** Industrialists who use various forests produce for their factories.
  - **(iv)** Forest and wildlife activists who want to conserve the nature in its original form.

Scan to know more about this topic

Stakeholders of forest

- Industries would consider the forest as merely a source of raw material for its factories.
- Wildlife enthusiasts are in no way dependent on the forests. However they take a great part in conserving the forest and wildlife.
- Amrita Devi Bishnoi, in 1731 sacrificed her life along with 363 others for the protection of 'khejri' trees in Khejrali village near Jodhpur in Rajasthan.
- The Government of India has recently instituted an 'Amrita Devi Bishnoi National Award for Wildlife Conservation' in the memory of Amrita Devi Bishnoi.
- The Chipko movement was a forest conservation movement in India where rural people embraced the trees to prevent them from being cut down.
- **Deforestation affects the :**
  - **(i)** Availability of forest products.
  - **(ii)** Quality of soil and the sources of water.

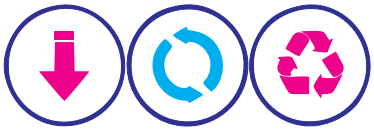
@PROCBSE JOIN NOW !

@PROCBSE

- Participation of the local people is important for efficient management of forests.
- Within a period of 10 years the previously worthless forests called sal forest in West Bengal became valuable by involving the local people in managing the resources.
- Forest resources should be managed in a manner such that they are both environmentally and developmentally viable.
- **Sustainable Management:** It is the management of resources wisely to make them available for future generations.

Mnemonics

Concept: 3R's of conservation



Reduce Reuse Recycle

Interpretation:
Reduce, **R**euse and **R**ecycle

How is it done on the GREENBOARD?

Q. What is 'Sustainable Management of Natural Resources'? Why is it necessary ? What one out of reuse and recycle, would you practise in your daily life and why ? 3

Solution:

Step I: Managing resources to meet current basic human needs, while preserving the resources for the needs of future generations and maintaining the quality of the environment is known as sustainable management of natural resources'.

Its importance is:

Step II: To maintain the quality of the environment.

Step III: To ensure the continuity of the resources

Step IV: I would practice reuse in my daily life.

Step V: It is because process of recycling uses some energy and takes some time.

Objective Type Questions — 1 mark each

A Multiple Choice Questions

Q. 1. It was found that water from a river was contaminated with Coliform bacteria. Which one of the following pollutant might have got mixed with the water?
(a) Fertilizer run off
(b) Industrial waste
(c) Pesticides
(d) Human faecal matter. [CBSE SQP, 2020]

Ans. Correct option: (d)
Explanation: It is a group of bacteria found in human intestine whose presence in water indicates contamination by disease causing micro-organisms. 1

Q. 2. Which one of the following stakeholders of forests causes the maximum damage to forest?
(a) People who live in or around the forest.
(b) The forest department of the government.

@PROCBSE

(c) The wildlife and native enthusiasts.
(d) The industrialists. [CBSE SQP, 2020]

Ans. Correct option: (d)
Explanation: Industrialists who use various forests produce for their factories causes the maximum damage to forest. **1**

Q. 3. Soil fertility is determined by its ability to:
(a) Decay organic matter
(b) Hold organic matter
(c) Hold water
(d) Support life [CBSE Delhi- Set-II, 2020]

Ans. Correct option: (d)
Explanation: Soil fertility is the ability of the soil to supply essential plant nutrients and soil water in adequate amounts for plant growth and reproduction, thereby support life. **1**

Q. 4. The most appropriate definition of a natural resource is that it is a substance/commodity that is :
(a) present only on land.
(b) a gift of nature which is very useful to mankind.
(c) a man-made substance placed in nature.
(d) available only in the forest. [NCERT Exemp.]

Ans. Correct option : (b)
Explanation : Natural resource is a gift of nature which is very useful to mankind. Option (c) can be easily ruled out because natural resources are not man-made. Option (a) can be ruled out, because natural resources are present everywhere. **1**

B Assertions and Reasons Type Questions

Direction: In the following questions, a statement of assertion (A) is followed by a statement of reason (R). Mark the correct choice as :
(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).
(b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).
(c) Assertion (A) is true but reason (R) is false.
(d) Assertion (A) is false but reason (R) is true.

Q. 1. Assertion (A): We need to conserve natural resources.
Reason (R): Natural resources are limited.

Ans. Correct option : (a)
Explanation: We need to manage natural resources because natural resources are limited. Human population is increasing at a tremendous rate and utilization of natural resources is increasing at an exponential rate. Therefore, we need to conserve resources for future generations.

Q. 2. Assertion (A): Reuse is better than recycle.
Reason (R): Recycle prevents environmental pollution.

Ans. Correct option : (c)
Explanation: Reuse is better than recycle because it saves energy by using material again without any changes and also, it prevents environmental pollution.

Q. 3. Assertion (A): The development which can be maintained for a long time without undue damage to the environment is called sustainable development.
Reason (R): It provide the economic well being to the present and future generation.

Ans. Correct option : (b)
Explanation: Sustainable development is the development which can be maintained for a longtime without undue damage to the environment. It has two main objectives: To provide economic well being to the present and future generations and to maintain a healthy environment and life support system.

Q. 4. Assertion (A): Chipko Andolan was done by women of Reni village.
Reason (R): Chipko Andolan was done to protect wild life.

Ans. Correct option : (c)
Explanation: Chipko movement was started in early 1970s in village Reni in Garhwal by the women of Uttarakhand to stop cutting of forest trees of their area.

Q. 5. Assertion (A): Wildlife should be conserved.
Reason (R): Human activities cause several plants and animals to extinct.

Ans. Correct option : (a)
Explanation: Wild life is found in forests. Over a period of time, wildlife has become extinct because of certain human activities like deforestation, hunting, poaching etc.

Q. 6. Assertion (A): Coliform is a group of bacteria found in human stomach.
Reason (R): Presence of coliform in water indicates contamination by disease causing microorganisms.

Ans. Correct option: (d)
Explanation: Coliform is a group of bacteria found in human intestine whose presence in water indicates contamination by disease causing micro-organisms.

C Very Short Answer Type Questions

AI **Q. 1. Name two industries based on forest produce.** A [CBSE Board Outside Delhi, 2019]

Ans. Timber / Bidi / Paper / Medicine.
(Any two) ½ + ½ [CBSE Marking Scheme, 2019]

AI **Q. 2. The presence of a particular group of bacteria in water bodies indicates contamination. Identify the group.** R [CBSE, SQP, 2019]

Ans. Coliform bacteria [CBSE Marking Scheme, 2019] **1**

AI **Q. 3. Name the tree for which Amrita Devi Bishnoi and others sacrificed their lives.** R

@PROCBSE

Ans. Khejri trees. **1**

Q. 4. List two items which can be easily recycled, but we generally throw them in the dustbins.

Ans. Steel cans and paper can be easily recycled, but we generally throw them in dustbins. ½+½

Q. 5. Write one negative effect of affluent lifestyle of few persons on the environment. R

Ans. Due to exploitation and consumption of natural resources, our future generation will suffer by the lack of these resources.

AI **Q. 6. Give one example each from your daily life where the domestic waste can be effectively reused and recycled.** R

Ans. Reuse: We can reuse the empty bottles of jam, pickles, etc. for the storage purposes.

Recycle: We can recycle old newspapers, aluminium cans, etc. ½+½

COMMONLY MADE ERROR

- Students often give incorrect or vague examples.

ANSWERING TIP

- Carefully learn the concept of 3R's of conservation. Lay emphasis on its example from your daily life.

AI **Q. 7. 'We need to manage our resources'. List two reasons to justify this statement.** AE

Ans. We need to manage natural resources because :

(i) A majority of natural resources is limited.

(ii) Utilisation of natural resources is increasing at an exponential rate.

(iii) Need to conserve resources for future generations.

(Any two) ½+½

Short Answer Type Questions-I — 2 marks each

AI **Q. 1. What is sustainable management? Why is reuse considered better in comparison to recycle?** U **[Delhi 31/1/1 2017]**

Ans. Since natural resources are limited, if they are over exploited for short term gains, future generation will suffer heavily.

Reuse does not consume energy. **1+1**

[CBSE Marking Scheme, 2017]

Detailed Answer:

Sustainable management is a resource management technique which aims to conserve the resources, use them efficiently and avoid their misuse for individual purpose such that they are conserved for future.

Reuse is better than recycle because:

(i) Reuse saves energy by using material again without any changes

(ii) Reuse prevents environmental pollution.

(iii) Reuse saves time as same material is used again.

(Any two) 2

Q. 2. How do advantages of exploiting natural resources with short term gains in mind differ from the advantages of managing our resources with a long-term perspective? U **[Delhi 31/1/1 2017]**

Ans. Former leads to huge immediate profits/selfish gains while latter leads to sustainable approach so that the resource may last for future generations too. **1+1**

[CBSE Marking Scheme, 2017]

Detailed Answer:

Exploitation of natural resources with short term gains aims at providing all the benefits to the current generation for their growth and development without any consideration for the future.

In case of long term perspective, the resources are utilised in a more judicious manner so that they are also conserved for the future generations. It ensures uniform distribution among the people. **1 + 1**

COMMONLY MADE ERROR

- Students often get confused between the terms short term gains and long term gains. The terms long term prospective is generally mistaken as the use of resources for a long time.

ANSWERING TIP

- Remember that long term prospective refers to the use of resources in such a way that they can be preserved for future generation.

Q. 3. Explain how would the involvement of local people be useful for successful management of forests. U **[Delhi 31/1/1 2017]**

Ans. The involvement of local people is useful for successful management of forests in the following ways :

(i) People should be aware of the fact that diminishing forest cover would disturb the ecological balance.

(ii) Phenomena like forest fires must be reported

@PROCBSE

immediately to the forest officers. The sooner the action taken more will be the area which can be protected. Forest fires purposely caused by local people must not be practiced. **1 + 1**

COMMONLY MADE ERROR

- Many students fail to write the correct explanation. They get confused and could not relate the answer.

ANSWERING TIP

- Lay stress on understanding the terms/ concepts instead of rote learning.

Q. 4. Management of forest and wild life resources is a very challenging task. Why? Give any two reasons. U **[Delhi 31/1/1 2017]**

Ans. Local people are dependent on forest produce for various aspects of their life, therefore they develop practices to ensure that the resources are used in sustainable manner. **1+1**

[CBSE Marking Scheme, 2017]

Detailed Answer:

Management of forest and wildlife resources are considered as a challenging task because :

(i) There are many stakeholders of forest. Management of forest and wildlife has to take into account the interests of all these stakeholders which become a challenging task.

(ii) Industries would consider the forest as merely a source of raw material for its factories and huge interest groups lobby the government for access to these raw materials. **2**

Q. 5. What is sustainable development? State its two main objectives. U **[Board Term II, Foreign I, 2016]**

Ans. The development which can be maintained for a long time without undue damage to the environment. **1**

Two objectives:

(i) To provide the economic well being to the present and future generation. ½

(ii) To maintain a healthy environment and life support system. **[CBSE Marking Scheme, 2016]** ½

AI **Q. 6. List four stakeholders of forests.**

R **[Board Term II, O.D. Set III, 2016]**

OR

List four stakeholders which may be helpful in the conservation of forests.

R **[Board Term II, O.D. Set III, 2016]**

Ans. (i) The people living in or around the forests who are directly dependent on forest product.

(ii) The Forest Department of the government which owns the land and controls the resources from forests.

(iii) The industrialists who use the forest produce, but are not dependent on the forest of a particular area.

(iv) The wildlife and nature enthusiasts who want to conserve nature in its present form. **4×½=2**

[CBSE Marking Scheme, 2016]

AI **Q. 7. How did 'Chipko Andolan' ultimately benefit the local people? Explain briefly.**

U **[Board Term II, Foreign II, 2016, O.D. Set I, 2016]**

Ans. The Government had to rethink their priorities in the use of forest produce and change their forest policies, this ensured a stable availability of the forest produce to the villagers. **1**

It led to efficient management of forest and also resulted in conservation of soil and water which ultimately benefitted the local people. **1**

[CBSE Marking Scheme, 2016]

AI **Q. 8. Explain giving example where active involvement of local people lead to efficient management of forest.**

U **[Board Term II, Delhi Set I, 2016]**

Ans. (i) In West Bengal the Sal forests had been very badly degraded. ½

(ii) A forest officer involved villagers in protection of Sal forest and gave them employment in silviculture and harvesting operations. ½

(iii) Villagers were allowed to collect firewood and fodder on a nominal payment. ½

(iv) Within a period of 10 years the previously worthless forests became valuable. ½

[CBSE Marking Scheme, 2016]

Q. 9. What is meant by biodiversity? List two advantages of conserving forests and wildlife.

U **[CBSE O.D. Set II, 2015]**

Ans. Biodiversity is the existence of a variety of species of plants, animals and micro-organisms in a natural habitat within a particular environment.

Two reasons each for conserving

(a) Forest: (i) It helps in retaining the sub-soil water, (ii) It checks flood.

(b) Wildlife: (i) To maintain ecological equilibrium, (ii) To protect the nature. **1+1**

AI **Q. 10. What is meant by three types of 'R' (3-R's) to save the environment? Explain with example how would you follow the 3-R's in your School to save the environment.**

A **[Board Term II, Foreign Set I, 2015]**

Ans. Reduce, Reuse, Recycle **(for all the three) 1 (only mark if two are mentioned)** ½

Examples:

(i) Switch off the fans and bulbs when not in use,

(ii) Reuse of paper, polythene bags, etc.,

@PROCBSE

(iii) Reduce the wastage of water / paper or any other item

(Or any other relevant example) (Any two) ½ × 2

[CBSE Marking Scheme, 2015]

Q. 11. Write two advantages of sustainable management of natural resources. Out of the two—reuse and recycle—Which is better and why?

A [CBSE Foreign Set III, 2015]

Ans. Two advantages:

(i) Provides the resources for the present generation. ½

(ii) Preserve the resources for the future generation as well. ½

Reuse is better than recycling because it does not involve use of energy. ½ + ½

[CBSE Marking Scheme, 2015]

Q. 12. Why are forest considered "biodiversity hot spots"? List two ways in which an individual can contribute effectively to the management of forests and wildlife? A [CBSE Delhi Set II, 2015]

Ans. Biodiversity is measured by the number of different life forms found in an area. In a forest, various species are available which include bacteria, fungi, ferns, plants, nematodes, insects, birds, reptiles and mammals. Forests are therefore, called biodiversity hot spots.

An individual can contribute in management of forest and wildlife by :

(i) Avoiding cutting of forest and killing of wildlife.

(ii) Educating people about the importance of forest and wildlife in our life. **1+1**

[CBSE Marking Scheme, 2015]

Q. 13. What damage is caused to forests by the following:

(i) Building rest houses for tourist in national parks.

(ii) Grazing domestic animals in national parks.

A [CBSE, 2015]

Ans. (i) Disturbance in natural habitat. Waste disposal, restriction in movement, poaching / hunting.

(ii) Ecological imbalance less food for herbivores, overgrazing might result in loss of habitat. **1+1**

[CBSE Marking Scheme, 2015]

Q. 14. List four measures that can be taken to conserve forests. A [CBSE Delhi Set I, 2015]

Ans. Four measures taken to conserve forest are:

(i) Deforestation should be banned.

(ii) Forest resources should be used in an environmentally and developmentally sound manner.

(iii) We should use natural resources cautiously.

(iv) Afforestation should be done. ½+½+½+½

[CBSE Marking Scheme, 2015]

Q 15. Everyone of us can do something to reduce our personal consumption of various natural resources. List four such activities based on 3–R approach.

A [CBSE Delhi Set III, 2015]

Ans. (i) By switching off unnecessary light and fans to save electricity.

(ii) By repairing leaky taps to save water.

(iii) Not to dump the materials that can be recycled like paper.

(iv) Plastic bottles of food items can be used to store things. ½+½+½+½

[CBSE Marking Scheme, 2015]

Q. 16. List two problems that may arise by planting trees of single variety over vast tracts of a forest.

A [Board Term II, Foreign Set II, 2015]

Ans. (i) Loss of biodiversity.

(ii) Varied needs of the local people can no longer be met.

(iii) Degradation of soil. **(Any two) 1 + 1**

[CBSE Marking Scheme, 2015]

Short Answer Type Questions-II — 3 marks each

AI **Q. 1. List three advantages each of:**

(i) exploiting resources with short term aims, and

(ii) using a long term perspective in managing our natural resources.

A [CBSE Board, Delhi Set-III, 2019]

Ans. Three advantages of exploiting resources with short term aims:

(i) Immediate benefit to few people.

(ii) Progress in science and technology for development in a country.

(iii) Urbanisation and Industrialisation of an area. ½ × 3

Three advantages of using a long time perspective:

(i) Resources will be made available for sustainable development.

(ii) Provides valuable contribution to the socio-economic development.

(iii) Quality of environment will be conserved.

[CBSE Marking Scheme, 2019] ½ × 3

Q. 2. What is 'Sustainable Management of Natural Resources'? Why is it necessary? What one out of reuse and recycle, would you practise in your daily life and why? C [CBSE Comptt. Set 1, 2, 3, 2018]

Ans. Managing resources to meet current basic human needs, while preserving the resources for the needs of future generations and maintaining the quality of the environment. **1**

Importance :

To maintain the quality of the environment.

To ensure the continuity of the resources **1**

@PROCBSE

Reuse :
Because process of recycling uses some energy and takes some time. **1**

[CBSE, Comptt. Marking Scheme, 2018]

Q. 3. What changes can you make in your habits to become more environment-friendly? R [NCERT]

Ans. (i) By minimising the water usage and avoiding its wastage. ½

(ii) Saving power by switching off unnecessary lights and fans. ½

(iii) Avoiding wastage of food by consuming it rationally as per our needs. ½

(iv) Walking or use bicycle for going to nearby market instead of using vehicle. ½

(v) By segregating wastes into recyclable and non-recyclable. ½

(vi) Reuse carry bags, packing materials, plastic containers and other reusable material. ½

Long Answer Type Questions — 5 marks each

Q. 1. Prepare a list of five activities that you perform daily in which natural resources can be conserved or energy utilisation can be minimised. C [NCERT Exemp.]

Ans. (i) Unused water in the water bottle may be used for watering plant. **1**

(ii) Close all the taps before you go to sleep. **1**

(iii) Use fan and light only when required. **1**

(iv) Use solar water heating devices. **1**

(v) Use LEDs in place of conventional bulbs/tubes **1**

Q. 2. What is the importance of forest as a resource? U [NCERT Exemp.]

Ans. Forests are renewable resources which provide :

(i) Habitat, food and shelter to wildlife.

(ii) Help in balancing CO_2 and O_2 of atmosphere.

(iii) Improves water holding capacity of soil.

(iv) Regulates water cycle.

(v) They provide materials like fuel wood, timber pulp and paper, etc., which are essential for human beings.

(vi) They provides useful products like fruits, resins, gums, essential oils, bidi wrapper, etc., and other livelihood for the local people. **(Any five) 5**

Q. 3. Can you suggest some changes in your school which would make it environment-friendly? U [NCERT Ex.]

Ans. (i) Grow trees along the boundary wall. **1**

(ii) Grow shrubs and small plants on the sides of internal road and around the playground. **1**

(iii) Harvest water from rooftop to be utilised for watering the plants. **1**

(iv) Arrange awareness programmes among students through poster exhibition and seminars. **1**

(v) Avoid wastage of water and ensure recycling of used paper. **1**

Q. 4. How can you as an individual contribute or make a difference to the management of

(a) forests and wildlife,

(b) water resources and

(c) coal and petroleum? A [NCERT Ex.]

Ans. (a) Forests and Wildlife :

1. Take part in community activities with focus on conserving forests and wildlife.

2. As a tourist follow all principles of conservation.

3. Help organisations engaged in conservation of forests and wildlife.

(b) Water Resources

1. Save water in domestic use.

2. Install a system for rainwater harvesting and ground water recharge.

(c) Coal and Petroleum

1. Save electricity whenever required.

2. Install electric gadgets that use less power. **5**

Q. 5. List five things you have done over the last one week to :

(a) conserve our natural resources.

(b) increase the pressure on our natural resources. A [NCERT Ex.]

Ans. (a) Five things done to conserve natural resources are :

1. Use energy efficient electrical appliances.

2. Use only as much of electricity as required.

3. Keep the water tap closed while brushing the teeth.

4. Convince mother to cook the food in a solar cooker.

5. Use public transport for school instead of parent's car. **2½**

(b) Five things done to increase the pressure on natural resources :

1. Went to school on a bike instead of cycle.

2. Forgot to switch off fan while going out.

3. Wasted food.

4. Used more paper than required for printing on computer.

5. Wasted water resource. **2½**

@PROCBSE

TOPIC - 2
Water Conservation and Fossil Fuels

Revision Notes

Fossil fuels

- Coal and petroleum are non-renewable natural resources.
- Coal was formed from the remains of trees buried deep inside the earth some 500 million years ago.
- Petroleum is formed by the bacterial decomposition of dead marine plants and animals, buried at the bottom of the seas.
- This decomposition takes place under high pressure and temperature and formation of petroleum take millions of years of time.
- **Necessity of judicious use of coal and petroleum:** The fossil fuels, coal and petroleum will get exhausted and their combustion pollutes our environment, so a judicious use of these resources is necessary.
- **Harmful effects of using fossil fuels are:**
  - **(i)** Combustion of coal and hydrocarbons release a large amount of carbon monoxide, carbon dioxide, sulphur dioxide, oxides of nitrogen, etc. These cause air pollution and cause various diseases like respiratory and throat problems, congestion etc.
  - **(ii)** Excessive emission of greenhouse gases like carbon dioxide causes a rise in atmospheric temperature (Global warming).
- The oxides of sulphur, nitrogen and carbon monoxide are poisonous at high concentrations.
- Carbon dioxide is a greenhouse gas which leads to global warming.
- **Water for all**
  - **(a)** Water is one of the most important and renewable natural resources and is the basic necessity for all forms of life. Therefore, its conservation is very necessary.
  - **(b)** Rain is an important source of water.
  - **(c)** Irrigation methods like tanks and canals have been used in various parts of India.
- **Dams:** Dams ensure the storage of adequate water for irrigation and are also used for generating electricity. Various dams have been built on rivers to regulate the flow of water.
  e.g., (a) Tehri Dam— On river Ganga
  (b) Sardar Sarovar Dam — On river Narmada
  (c) Bhakra Nangal Dam — On river Satluj
- **Advantages of Dams**
  - **(a)** Ensures adequate water for irrigation.
  - **(b)** To generate electricity.
  - **(c)** Continuous supply of drinking water to cities and towns.
- **Disadvantages of Dams**
  - **(a) Social problems :**
    - **(i)** Many tribals and peasants are displaced and rendered homeless.
    - **(ii)** They do not get adequate compensation or rehabilitation.
  - **(a) Environmental problems :**
    - **(i)** Deforestation
    - **(ii)** Loss of biodiversity
    - **(iii)** Disturbed ecological balance
  - **(c) Economic problems :**
    - **(i)** Huge amount of public money is used.
    - **(ii)** No proportionate benefit to people.
    - **(iii)** No equitable distribution of water.
- **Rain Water Harvesting:** Rain water harvesting is to make rain water percolate under the ground so as to recharge 'groundwater'.
- Watershed management work on scientific soil and water conservation.
- The aim is to develop primary resources of land and water to produce secondary resources of plant and animal for use in a way that will not cause biological imbalance.
- **Advantages of storing water in the ground:**
  - (i) It does not evaporate.
  - **(ii)** It spreads out to recharge wells.
  - **(iii)** It provides moisture for vegetation over a wide area.
  - **(iv)** It does not provide breeding grounds for mosquitoes.
  - **(v)** It is protected from contamination by human and animal wastes.

Scan to know more about this topic

Water

@PROCBSE

How is it done on the GREENBOARD?

Q. What is a dam? Why do we seek to build large dams? While building large dams, which three main problems should particularly be addressed to maintain peace among local people? Mention them. 5

Solution:

Step I: Dams are massive barriers built across rivers and streams to arrest and utilise the flow of water for irrigation and generation of hydro-electricity.

We build large dams in order to :

Step II: Store large quantity of water for irrigation and electricity generation.

Step III: Transport water to distant locations through canals to use it for irrigation and drinking purposes.

Construction of large dams causes :

Step IV: Social problems as it involves displacement of large number of people from their original settlement to other locations.

Step V: Economic problems arising due to huge inputs without proportionate benefits distribution.

Step V: Environmental instability due to deforestation and loss of floral and faunal biodiversity.

@PROCBSE JOIN NOW !

Objective Type Questions — 1 mark each

A Multiple Choice Questions

Q. 1. Which one of the following is responsible for the sustenance of underground water?
(a) Loss of vegetation cover
(b) Diversion for high water demanding crops
(c) Pollution from urban wastes
(d) Afforestation [Delhi, Set-I, 2020]

Ans. Correct option: (d)

Explanation: Afforestation (plantation of trees) will save ground water from getting depleted. **1**

Q. 2. Incomplete combustion of coal and petroleum:
(a) increases air pollution.
(b) increases efficiency of machines.
(c) reduces global warming.
(d) produce poisonous gases.
The correct option is:
(a) (a) and (b) **(b) (a) and (d)**
(c) (b) and (c) **(d) (c) and (d)**
[Delhi, set-I, 2020]

Ans. Correct option: (b)

Explanation: Incomplete combustion of coal and petroleum increases air pollution and produce poisonous gases.

Q.3. Several factories were pouring their wastes in rivers A and B. Water samples were collected from these two rivers. It was observed that sample collected from river A was acidic while that of river B was basic. The factories located near A and B are:
(a) Soaps and detergents factories near A and alcohol distillery near B.
(b) Soaps and detergents factories near B and alcohol distillery near A.
(c) Lead storage battery manufacturing factories near A and soaps and detergents factories near B.
(d) Lead storage battery manufacturing factories near B and soaps and detergents factories near B.
[Outside Delhi, Set- I, 2020]

Ans. Correct option: (d)

Explanation: Lead storage battery manufacturing factories near A and soaps and detergents factories near B led to the given observation.

Q. 4. Opposition to the construction of large dams is due to
(a) social reasons. **(b) economic reasons.**
(c) environmental reasons. **(d) all the above.**
[NCERT Exemp.]

Ans. Correct option : (d)

Explanation : Dam construction adversely affects local flora and fauna by raising social, economic and environmental problems. **1**

Q. 5. Pick the right combination of terms which has no fossil fuel.

@PROCBSE

(a) **Wind, ocean and coal**
(b) **Kerosene, wind and tide**
(c) **Wind, wood, sun**
(d) **Petroleum, wood, sun** [NCERT Exemp.]

Ans. Correct option : (c)
Explanation : Wind, sun and wood are natural resources. **1**

Q. 6. It is important to make small check dams across the flooded gullies because they
(i) hold water for irrigation.
(ii) hold water and prevent soil erosion.
(iii) recharge ground water.
(iv) hold water permanently.
(a) **(i) and (iv)** (b) **(ii) and (iii)**
(c) **(iii) and (iv)** (d) **(ii) and (iv)**
[NCERT Exemp.]

Ans. Correct option : (b)
Explanation : Small check dams or temporary dams across the flooded gullies helps to prevent adverse effects of flooding on nearby areas and land. **1**

B Assertions and Reasons Type Questions

Directions: In the following questions, a statement of assertion (A) is followed by a statement of reason (R). Mark the correct choice as:
(a) **Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).**
(b) **Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).**
(c) **Assertion (A) is true but reason (R) is false.**
(d) **Assertion (A) is false but reason (R) is true.**

Q. 1. Assertion (A): Water is a valuable resource.
Reason (R): Turn off the taps when not in use.

Ans. Correct option : (b)
Explanation: Water is a valuable resource. So, we need to conserve it by turning off the taps when not in use.

Q. 2. Assertion (A): Coal and petroleum are categorised as natural resources, so should be used judiciously.
Reason (R): They are formed from the degradation of biomass subjected to various biological and geological processes over a million of years.

Ans. Correct option : (a)
Explanation: Coal and petroleum are formed from the degradation of biomass subjected to various biological and geological processes over a million of years. Thus, cannot be manufactured by humans. Therefore, coal and petroleum are categorised as natural resource.

Q. 3. Assertion (A): Water harvesting is the method to capture every trickle of water that falls on the land.
Reason (R): Water harvesting recharges wells and ground water.

Ans. Correct option : (b)
Explanation: Water harvesting is a technique of capturing rain water when it falls and taking measure to keep the water clean. It recharges wells/ ground water and provides moisture for vegetation over a wide area.

C Very Short Answer Type Questions

Q. 1. Write two advantages associated with water harvesting at the community level.
R **[Board Outside Delhi, Set- II, 2019]**

Ans. (i) Recharged the ground water level ½
(ii) Brought rivers back to life ½
[CBSE Marking Scheme, 2019]

Q. 2. Name two indigenous water saving methods.
R **[CBSE, 2015]**

Ans. Digging small pits and lakes. **1**
[CBSE Marking Scheme, 2015]

Q. 3. Water is a valuable resource. List two ways, that you would suggest every family member to save this resource. A **[CBSE Delhi Set I, 2015]**

Ans. (i) Turning-off the taps when not in use.
(ii) Checking the leaking water pipelines and getting them repaired. ½+½

AI **Q. 4. List two measures that you would suggest for the better management of water resources.**
AE **[CBSE Delhi Set II, 2014]**

Ans. Two measures for the better management of water resources are :
(i) Rainwater harvesting.
(ii) Construction of dams. ½+½

Q. 5. Mention one reason of discontentment among the people who have been displaced by building dams. A

Ans. It displaces large number of local people without adequate compensation and rehabilitation. **1**

AI **Q. 6. List two causes of pollution of river Ganga.** U

Ans. Major causes of pollution of river Ganga :
(i) Release of industrial waste into the river.
(ii) People use river water for domestic purposes and add pollutants like surf, detergents, soap to the river.
(iii) People flow food items, images of gods and goddesses into the river due to ritualistic reasons.
(Any two) ½+½

@PROCBSE JOIN NOW

Short Answer Type Questions-I — 2 marks each

AI **Q. 1. Explain two main advantages associated with water harvesting at the community level.**

U [CBSE O.D. Set, I- 2018, OD 31/1 2017]

Ans. Two main advantages associated with water harvesting at the community level are:

(i) Water does not evaporate instead it percolates into the ground. Therefore, results in the recharging of wells.

(ii) The stored water provides moisture to the vegetation in and around the area. **1+1**

Q. 2. You being an environmentalist are interested in contribution towards the conservation natural resources. List four activities that you can do on your own. A [OD 31/3 2017]

Ans. The four activities that we can do on our own are:

(i) Reduce the use of water.

(ii) Recycle the waste materials like paper.

(iii) Avoid the use of non-renewable sources of energy.

(iv) Planting trees. **2**

Q. 3. Why is an equitable distribution of resources essential in a Society? List two forces which are against such distribution. A [OD 31/2 2017]

Ans. Equitable distribution of resources is essential in a society because there will be continuous flow of sufficient resources to, every section of the society. Also, the resources will not be exploited at the hands of a few persons. **1**

Two forces which are against such distribution are :

(i) Limited amount of resources in nature.

(ii) Excessive consumption by the rich. **1**

Q. 4. Why are coal and petroleum categorised as natural resources? Give a reason as to why they should be used judiciously. R [OD 31/3 2017]

Ans. Coal and petroleum are formed from the degradation of bio-mass subjected to various biological and geological processes over a million of years. Thus, cannot be manufactured by humans. Therefore, coal and petroleum are categorised as natural resource. **1**

They should be used judiciously as they cannot be manufactured by humans and naturally it takes million of years to form. **1**

Q. 5. ''Burning of fossil fuels results in global warming''. Give reasons to justify this statement.

A [CBSE O.D. Set I, 2016, Foreign 2017]

Ans. Burning of fossil fuels produces green house gases (CO, CO_2, water vapour, oxides of nitrogen, sulphur). High concentration of CO_2 causes global warming. [CBSE Marking scheme, 2016] 1 + 1

Q. 6. What is water harvesting? How can this technique help in the conservation of water?

U [CBSE O.D. Set II,2016]

Ans. (i) Water harvesting is a technique of capturing rain water when it falls and taking measure to keep the water clean. **1**

(ii) Water is stored underground that remains unpolluted, it recharges wells and provides moisture for vegetation over a wide area.

[CBSE Marking Scheme, 2016] **1**

AI **Q. 7. The construction of large dams leads to social and environment problems. List two problems of each category.** A [CBSE O.D. Set III, 2016]

Ans. Social problems:

(i) Many people are rendered homeless.

(ii) Displacement of large number of tribals without due compensation.

(iii) Migration into the cities for settlements.

[2 × ½ = 1]

Environmental problems:

(i) Deforestation / loss of biodiversity

(ii) soil erosion / ecological imbalance **[2 × ½ = 1]**

[CBSE Marking Scheme, 2016]

AI **Q. 8. List four advantages of properly managed watershed management.**

A [CBSE Delhi Set I, 2016]

Ans. Advantages of watershed management:

(i) Mitigates drought and floods.

(ii) Increase the life of the dams and reservoirs downstream.

(iii) Increases the biomass production and thereby the income of the watershed community.

(iv) Helps in maintaining ecological balance by scientific conservation of soil and water. (Or any other)

[CBSE Marking scheme, 2016] **4 × ½ = 2**

Q. 9. Building of big dams gives rise to some problems. List three main problems that may arise. Suggest a solution to any one of these problems.

A [CBSE Foreign Set II, 2015]

Ans. (i) Social problems

(ii) Economic problems

(iii) Environmental problems.

Solution: (i) Adequate rehabilitation.

(ii) Compensation to the displaced persons.

(iii) Afforestation

[CBSE Marking scheme, 2015] **1 + 1**

COMMONLY MADE ERROR

- Students often forget to answer the second part of the question.

@PROCBSE

ANSWERING TIP

- Read the question properly. Do not overlook any part of a question and avoid being in a hurry to conclude the answer.

Q. 10. Burning of fossil fuel is causing great environmental concern. Mention the consequences of combustion of fossil fuels. A [CBSE, 2015]

Ans. Combustion of fossil fuels release oxides of carbon, nitrogen and sulphur.

[CBSE Marking scheme, 2015] **2**

Detailed Answer:

Combustion of fossil fuel leads to harmful effects on the environment. It releases a large amount of CO_2 along with a number of air pollutants into the atmosphere and CO_2 is a greenhouse gas, which is responsible for global warming.

AI **Q. 11. List four advantages of conserving water in the form of ground water.** A [CBSE Delhi I, 2015, O.D. Set II, 2015]

Ans. Advantages of ground water:

(i) It does not evaporate.
(ii) Spreads out to recharge wells.
(iii) Provides moisture for vegetation over a large area.
(iv) Does not provide breeding ground for mosquitoes.

[CBSE Marking scheme, 2015] ½×4

COMMONLY MADE ERROR

- Students often write advantages in essay form rather than points and lose marks.

ANSWERING TIP

- Write answers point-wise rather than in the form of an essay.

Short Answer Type Questions-II — 3 marks each

Q. 1. What is water harvesting? List two main advantages associated with water harvesting at the community level. Write two causes for the failure of sustained availability of groundwater. R [CBSE Delhi Set- I, 2019]

Ans. Water harvesting: A technique used to collect and store water for future use.

Advantages: (a) Available resource in time of need.
(b) Recharging the ground water level.

Causes: (a) Overuse of ground water
(b) Deforestation

[CBSE Marking Scheme, 2019] **1 + 1 + 1**

Q. 2. Why should there be equitable distribution of resources? List three forces that would be working against an equitable distribution of our resources. A [CBSE Board Delhi, Set- II, 2019]

Ans. Need for equitable distribution of resources :

So that all and not just a handful of rich and powerful people benefit from the development of these resources / all living beings have a birthright to the available resources.

Forces against equitable distribution of resources : **1**

(1) Industrialists who work for their own benefit / profit.
(2) When environmental laws / rules are not implemented properly.
(3) Mismanagement in the distribution of natural resources or any other relevant answer.

(Or any other relevant point)
(Any two points) 1 + 1

[CBSE Marking Scheme, 2019]

Q. 3. (a) Water is an elixir of life, a very important natural resource. Your Science teacher wants you to prepare a plan for a formative assessment activity, "How to save water, the vital natural resource". Write any two ways that you will suggest to bring awareness in your neighbourhood, on 'how to save water'.

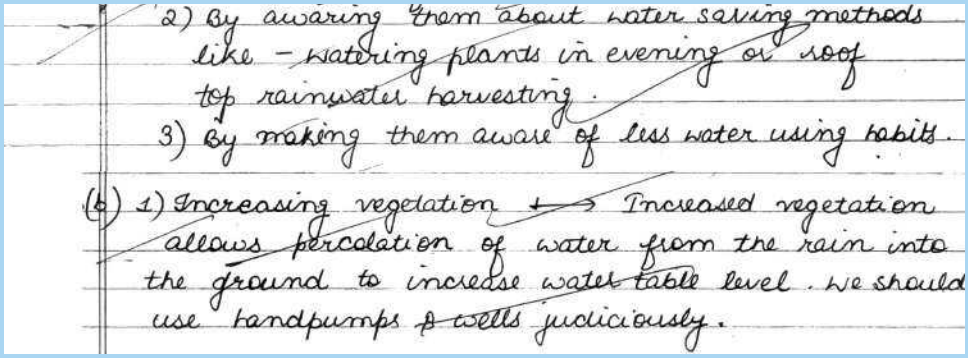
(b) Name and explain any one way by which the underground water table does not go down further.

U [CBSE O.D. Set I, 2017]

Topper Answer, 2017

Ans. (a) 1) By making them understand the need and important of water.

@PROCBSE


2) By awaring them about water saving methods like - watering plants in evening or roof top rainwater harvesting.
3) By making them aware of less water using habits.
(b) 1) Increasing vegetation → Increased vegetation allows percolation of water from the rain into the ground to increase water table level. We should use handpumps & wells judiciously.

AI **Q. 4. (i) Name any two fossil fuels. Why are they so-called?**

(ii) Mention the role of forests in conserving environment. How do the forest get depleted? R

Ans. (i) Coal and Petroleum. ½
Formed from the degradation of biomass millions of years ago. ½

(ii) (a) Preservation of biodiversity. ½
(b) Forest products ½
Reasons for depletion :
(a) Indiscriminate felling of trees. ½
(b) Destroying biodiversity to produce one particular kind of trees. ½

Q. 5. (i) Although coal and petroleum are produced by degradation of biomass, yet we need to conserve them. Why?

(ii) List any two causes for the failure of sustained availability of ground water. A

Ans. (i) As their formation is extremely slow, hence these resources may get exhausted. **1**

(ii) Two causes are :
(a) Loss of vegetation cover and dumping of urban waste. **1**
(b) Diversion for high water demanding crops and pollution from industrial effluents. **1**

Long Answer Type Questions — 5 marks each

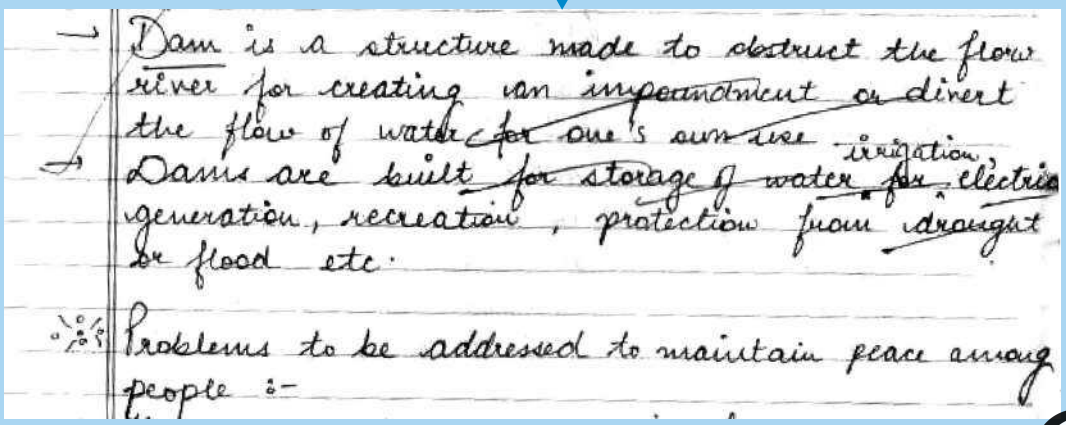
Q. 1. What is a dam? Why do we seek to build large dams? While building large dams, which three main problems should particularly be addressed to maintain peace among local people? Mention them. R **[CBSE Delhi/O.D., 2018]**

Ans. Dams are massive barriers built across rivers and streams to arrest and utilise the flow of water for irrigation and generation of hydro-electricity. **1**

We build large dams in order to :
(i) Store large quantity of water for irrigation and electricity generation.
(ii) Transport water to distant locations through canals to use it for irrigation and drinking purposes.
(iii) Uniform distribution of water over a large geographical track to enhance intensive cropping.
(iv) Flood control by storing water and regulating the flow of water during the rainy season **2**

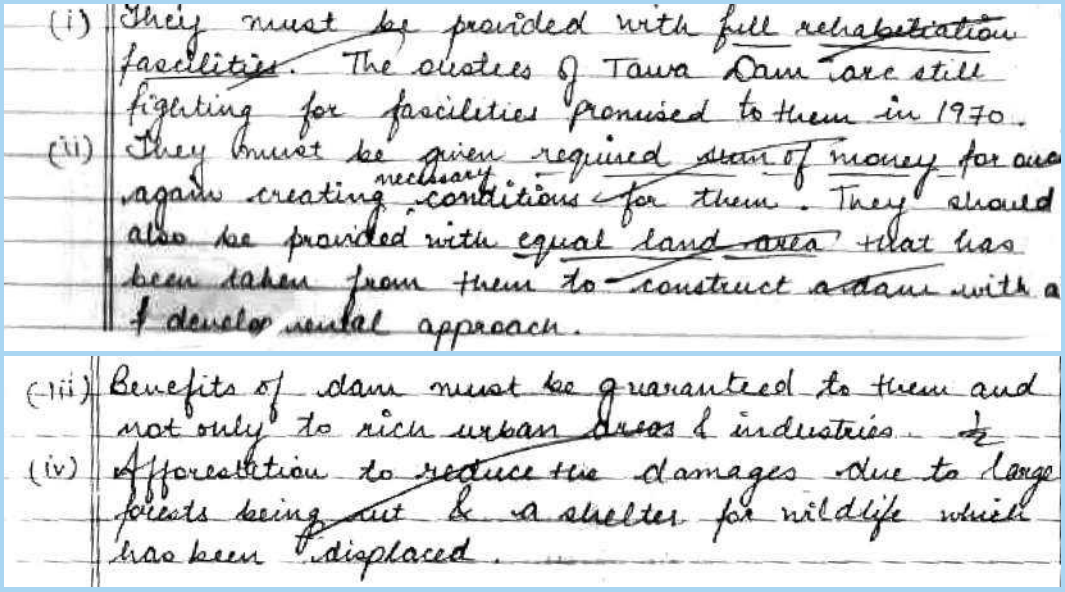
Construction of large dams causes :
(i) Social problems as it involves displacement of large number of people from their original settlement to other locations.
(ii) Economic problems arising due to huge inputs without proportionate benefits distribution.
(iii) Environmental instability due to deforestation and loss of floral and faunal biodiversity. **2**

Topper Answer, 2018


Dam is a structure made to obstruct the flow river for creating an impoundment or divert the flow of water for one's own use irrigation. Dams are built for storage of water for electric generation, recreation, protection from drought or flood etc.

Problems to be addressed to maintain peace among people :-

@PROCBSE JOIN NOW !


(i) They must be provided with full rehabilitation facilities. The ahotees of Tawa Dam are still fighting for facilities promised to them in 1970.
(ii) They must be given required sum of money for one again creating necessary conditions for them. They should also be provided with equal land area that has been taken from them to construct a dam with a f develop ental approach.
(iii) Benefits of dam must be guaranteed to them and not only to rich urban areas & industries. ½
(iv) Afforestation to reduce the damages due to large forests being cut & a shelter for wildlife which has been displaced.

Q. 2. (a) What is sustainable development? Why is it necessary?

(b) What is water harvesting? List its four benefits.

U [Delhi Comptt. 31/1/1 2017]

Ans. (a) Sustainable development: Development which meets the current basic human needs, while preserving the resources for the needs of future generation. **1**

It is necessary for environment conservation. **1**

(b) Water harvesting: It is a method to capture every trickle of water that falls on the land. **1**

(i) Recharges wells/ Ground water

(ii) Provides moisture for vegetation

(iii) It is not lost by evaporation

(iv) It does not provide a breeding place for mosquitoes

(v) Prevents ground water from contamination due to human and animal wastes. **(Any four)** ¼×4

[CBSE Marking Scheme, 2017]

COMMONLY MADE ERROR

- Students often write repeated points and irrelevant stories.

ANSWERING TIP

- Always write the answer pointwise and each point must reflect a separate idea. Do not repeat the same point in different words.

Q. 3. (a) In the context of conservation of natural resources, explain the terms reduce, recycle and reuse.

(b) Why is conservation of water necessary? State any four reasons. U [OD 31/ 1 Comptt. 2017]

Ans. (a) (i) Reduce: Less use of natural resources/ avoid wastage of food, water, electricity etc. **1**

(ii) Recycle: Collection of materials like plastic, glass, metals, paper, etc. and recycle these materials to make required items instead of synthesizing fresh ones. This would save natural resources. **1**

(iii) Reuse: Still better than recycling as no energy is required here and the already used things/ items are used again and again. **1**

(b) (i) Essential for living organisms.

(ii) It has limited availability.

(iii) Conservation of water allows its equitable distribution.

(iv) Essential for sustainable development.

(Any other relevant point) [½×4]

[CBSE Marking Scheme, 2017]

COMMONLY MADE ERROR

- Students often write incorrect examples of 3Rs. It seems they are confused about the term.

ANSWERING TIP

- Learn the concepts of 3Rs of conservation with proper examples.

AI **Q. 4. Eco-club of your school is organising a debate on the topic 'Nature's Fury Unleashed by Human's Greed ' (Uttarakhand Disaster).**

(i) List three arguments that you will use to convince the audience that humans are responsible for this disaster.

(ii) List any three values that will be inculcated with this debate. A [CBSE, 2015]

@PROCBSE JOIN NOW

@PROCBSE

Ans. (i) Mining, unnecessary use of resources, cutting of trees, building concrete jungle. **(Any three)** 3

(ii) To protect and improve the natural environment, social awareness, environmental conservation, eco–friendly approach, value for life. **(Any three)**

[CBSE Marking Scheme, 2015] 2

Visual Case-based Questions — 4 marks each

Q. 1. Observe the following diagram and answer any four questions from (a) to (e):

[CBSE–QB 2021]



(a) Choose the waste management strategy that is matched with correct example.

(i)	Refuse	Choose products that use less packaging
(ii)	Reduce	Give unwanted toys and books to hospitals or schools
(iii)	Reuse	Not using single use plastic
(iv)	Repurpose	Making flower pot from used plastic bottle

(b) Recycling of paper is a good practice but recycled paper should not be used as food packaging because

(i) recycled papers may release color /dyes on food items

(ii) recycled papers are not absorbent

(iii) recycled papers can cause infection due to release of methane

(iv) recycled papers are costly

(c) According to the 'Solid Waste Management Rule 2016', the waste should be segregated into three categories. Observe the table below and select the row that has correct information

	Wet waste	Dry waste	Hazardous waste
(i)	Cooked food, vegetable peels	Used bulbs, fluorescent lamps	Plastic carry bags, bottles, newspaper, cardboard
(ii)	Coffee and tea powder, garden waste	Plastic carry bags, bottles, newspaper, cardboard	Expired medicines, razors, paint cans
(iii)	Leftover food, vegetable peels	Coffee and tea powder, garden waste	Insect repellents, cleaning solutions
(iv)	Uncooked food, tea leaves	Old crockery, frying pans	Coffee and tea powder, garden waste

(d) Effective segregation of wastes at the point of generation is very important. Select the appropriate statements giving the importance of waste segregation.

(i) less waste goes to the landfills

(ii) better for public health and the environment

(iii) help in reducing the waste

(iv) resulting in deterioration of a waste picker's health

(1) both (i) and (ii) **(2)** both (i) and (iii)

(3) both (ii) and (iii) **(4)** both (i) and (iv)

(e) When recycling a plastic water bottle, what should you do with the cap?

(i) The cap goes into a garbage can and the bottle goes in a recycling bin

(ii) Screw the cap back on the bottle, then put the bottle and cap in a recycling bin

(iii) Screw the cap back on the bottle, then put the bottle and cap in the garbage can

(iv) Recycle the cap separately.

Ans. (a) (iv)

(b) (iii)

(c) (ii)

(d) (i)

(e) (i)

Q. 2. Study the passage and answer any of the four questions from (a) to (e).

Management and conservation of natural resources means the scientific utilization of resources. This method yields the greatest sustainable benefit of available resources to the present generations, while maintaining its potential to meet the needs and aspirations of future generations. In recent years, it has been observed that most of our natural resources are being depleted. It is mainly due to the over exploitation of resources as a result of changing lifestyle, over population and

@PROCBSE JOIN NOW !

technological development. Thus the need of the hour is to wisely manage our natural resources and minimize their wastage. For this, we should remember the 3 R's that can save environment.

(a) Which of the following R's is not used to save the environment?

(i) Reduce (ii) Remove

(iii) Recycle (iv) Reuse

(b) Why proper management of natural resources is essential?

(c) If we are using discarded items of paper, plastic and sending them to the respective industries for making useful objects. Then which R to save the environment we are following?

(d) Which of these you would practice in your daily life?

(i) Reuse (ii) Recycle

and Why?

(e) Select the incorrect statement:

(i) Economic development is linked to environmental conservation

(ii) Sustainable development encourages development for current generation and conservation of resources for future generations

(iii) Sustainable development does not consider the view points of stakeholders

(iv) Sustainable development is a long planned and persistent development

Ans. (a) (ii) Remove is not the 3 R's that can save the environment.

(b) Proper management of natural resources is essential for judicial use and conservation of natural resources.

(c) (iii) We are using recycle method to save the environment.

(d) Reuse, because process of recycling uses some energy and takes some time.

(e) (iii) Sustainable developments take into consideration both economic growth and ecological conservation simultaneously besides giving due considerations to the viewpoint any four stakeholders. **1 + 1 + 1 + 1**

Q. 3. Study the given diagrams and answer any of the four questions from (a) to (e).

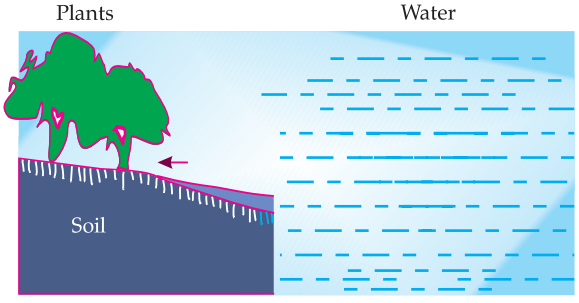


Fig. (1)

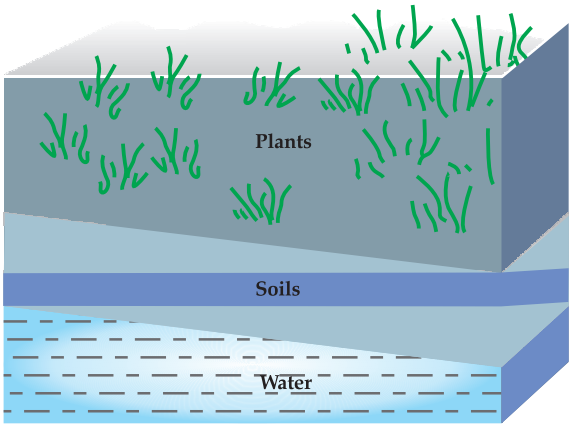


Fig. (2)

(a) Locate and name the water reservoirs in the figures (1) and (2)

(b) Which has an advantage over the other?

(c) A village is suffering from chronic water shortage because most of the water is made available to the surrounding water theme park. Is this a judicious use of water resource?

(d) Ground water will not be depleted due to :

(i) Afforestation

(ii) thermal power plants

(iii) loss of forest, and decreased rainfall

(iv) cropping of high water demanding crops

(e) Khadins, Bundhis, Ahars and Kattas are ancient structures that are examples for

(i) grain storage.

(ii) wood storage.

(iii) water harvesting.

(iv) soil conservation.

Ans. (a) In fig 1, the water reservoir is a pond while in fig (2), it is underground water body.

(b) Fig (2) has more advantage than fig (1). It is because, ground water does not evaporate. It provides moisture for vegetation over a wide area. It is also protected from contamination by animal and human wastes.

(c) No. Authorities should first provide adequate supply of water to people. Requirement of water for theme park should be secondary.

(d) (i) Afforestation (plantation of trees) will save ground water from getting depleted.

(e) (iii) Khadins, Bundhis, Ahars and Kattas are ancient water conservation practices. **5**

@PROCBSE JOIN NOW !

@PROCBSE

Know the Terms

- **Renewable resources:** Those resources which can be regenerated *e.g.*, forest, air and water.
- **Non-renewable resources:** These are available in limited amounts and cannot be reproduced *e.g.*, coal, petroleum, etc.
- **Pollution:** It is defined as the undesirable change in physical, chemical or biological characteristics of our soil, air or water, which affect human lives or the lives of other species.
- **Biodegradable pollutant:** Pollutants which are degraded by decomposers *e.g.* food, kitchen waste, etc.
- **Non-biodegradable pollutant:** Pollutants which are not degraded or decomposed by decomposers.
- **Wildlife:** It means all those naturally occurring animals, plants and their species that are not cultivated, domesticated and tamed.
- **Conservation:** It is the sensible use of the earth's natural resources in order to avoid excessive degradation and betterment of the environment.
- **Fossil fuels:** Fuels that are formed from organic material over the course of millions of years.

OSWAAL LEARNING TOOL
To learn from Oswaal Concept Video
Visit: http:qrgo.page.link OR Scan this code

❑❑❑

@PROCBSE
JOIN NOW !

@PROCBSE

SELF ASSESSMENT TEST - 5

Maximum Time: 1 hour **MM: 35**

Q. 1. Choose the correct alternative from the given options.

(i) Choose the correct statement :

(a) Sun can be taken as an inexhaustible source of energy.

(b) There is infinite storage of fossil fuel inside the Earth.

(c) Hydro energy and wind energy plants are non-polluting sources of energy.

(d) Waste from a nuclear power plant can be easily disposed off. 1

(ii) In the given food chain, suppose the amount of energy at fourth trophic level is 5 kJ, what will be the energy available at the producer level?

Grass → Grasshopper → Frog → Snake → Hawk

(a) 5 kJ **(b)** 50 kJ

(c) 500 kJ **(d)** 5,000 kJ **1**

(iii) The main constituent of biogas is :

(a) methane. **(b)** carbon dioxide.

(c) hydrogen. **(d)** hydrogen sulphide. **1**

Q. 2. Case-Based Question

Read the passage and answer any four of the following questions.

A farmer is growing a crop regularly in his field. He uses chemical fertilizers, pesticides, organic manure as well as bio-fertilizers. Very close to his field is a factory which emits smoke as a byproduct. There is also a huge lake in the nearby area.

(i) A considerable increase in plant life in the lake was noticed after the farming activity intensified. The most likely reason for this could be:

(a) Chemical fertilizers leached into the lake from the field.

(b) Pesticides leached into the lake from the field.

(c) Organic manure leached into the lake from the field.

(d) Smoke particles from the industry got settled in moist surroundings of the lake.

(ii) Consider the following food chain in the same lake.

Aquatic plant → Small fish → Big fish → Birds

Which of the above organisms is likely to show minimum amount of pesticide concentration in them after considerable time?

(a) Aquatic plants. **(b)** Small fish.

(c) Big fish. **(d)** Birds.

(iii) Will the levels of this magnification be different at different levels of the ecosystem?

(iv) An expert agriculturist suggests to the farmer to minimize the use of chemical fertilizers and instead use biofertilizers as they have many advantages over chemical fertilizers.

Which of the following is NOT true for biofertilizers?

(a) They are economical.

(b) They help in reducing pollution in the lake

(c) They are renewable

(d) They require large set-up for their production. **1×4=4**

(v) State a way to prevent accumulation of harmful chemicals in our bodies.

Q. 3. Assertion and Reason

Directions : In the following questions, a statement of assertion (A) is followed by a statement of reason (R). Mark the correct choice as :

(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

(b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).

(c) Assertion (A) is true but reason (R) is false.

(d) Assertion (A) is false but reason (R) is true.

@PROCBSE JOIN NOW !

@PROCBSE

(i) Assertion (A) : Biogas is a boon to the farmers.
Reason (R) : Spent slurry is used as manure and can be used to generate electricity. **1**

(ii) Assertion (A) : Decomposers keep the environment clean.
Reason (R) : They recycle matter by breaking down the organic remains and waste products of plants and animals. **1**

Q. 4. Why is a solar cooker painted black from outside ? **1**

Q. 5. Give one example each from your daily life where the domestic waste can be effectively reused and recycled. **1**

Q. 6. How is ozone both beneficial and damaging? How can we prevent the damaging effect of ozone ? **2**

Q. 7. Explain how would the involvement of local people be useful for successful management of forests. **2**

Q. 8. List three environmental consequences of using fossil fuels. Suggest three steps to minimise the pollution caused by various energy sources. **3**

Q. 9. The flow of energy between various components of the environment has been extensively studied. Give an outline of the findings. **3**

Q. 10. Differentiate between biodegradable and non-biodegradable substances with the help of one example each. List two changes in habit that people must adopt to dispose non-biodegradable waste, for saving the environment. **3**

Q. 11. (a) What is an ecosystem ? List its two main components.
(b) We do not clean natural ponds or lakes, but an aquarium needs to be cleaned regularly. Why is it so ? Explain
(c) Why is forest considered as a natural ecosystem ? **5**

Q. 12. In the context of conservation of natural resources, explain the terms- reduce, recycle and reuse. From among the materials that we use in daily life, identify two materials for each category. **5**



@PROCBSE

WRITING NOTES

1. .....
2. .....
3. .....
4. .....
5. .....
6. .....
7. .....
8. .....
9. .....
10. .....
11. .....
12. .....
13. .....
14. .....
15. .....
16. .....
17. .....
18. .....
19. .....
20. .....
21. .....
22. .....
23. .....
24. .....
25. .....

@PROCBSE
JOIN NOW !

@PROCBSE

Exclusive School Books Suppliers

	TELANGANA
HYDERABAD	Sri Balaji Book Depot , 9676996199, (040) 27613300
	ANDHRA PRADESH
	ASSAM
TEZPUR	Dutta Book Stall, 9402477623, 8729948473
	GUJARAT
JAMNAGAR	Vidyarthi Book Centre (S.S.D.), 9879014367
NAVSARI	College Store. 8141913750 (S.S.D.)
RAJKOT	Royal Stationery, 9824207514
	KARNATAKA
HUBLI	Ajay Agencies , 9342136251, (0836) 2216394
TUMKUR	Palasandra Promoters, 9448214377, (0816) 2273220
	TAMIL NADU
CHENNAI	Kalaimagal Store, (044) 45544072, 9940619404
SALEM	Salem Book House, 9443324584, (0427) 2411315
	HARYANA
PANCHKULA	Raghubar Dass Sat Prakash, 8950055303

	MADHYA PRADESH
INDORE	Raghav Pustak Sadan (S.S.D.), 7772988088
	MAHARASHTRA
PUNE	Sai Shubham, 9975687687, (020) 69498635,
	Goel Mini Market, 9890825884, 9028943031,
	Praveen Sales, 9890683475
JALNA	Anil Paper Mart, 9422722522, (02482) 230733
WARDHA	Unique Traders, (07152) 243617, 8600044411, 9960644752
NAGPUR	Novelty Book Depot, (0712) 2534884
NAVI MUMBAI	Ravechi Book Stationery, 022-27720445
	MANIPUR
IMPHAL	Jain Book Shop, 9856031157
	RAJASTHAN
KARWI	Ramji & Sons, 9026303241
	WEST BENGAL
KOLKATA	Eureka book Emporium, (033) 25934001, 9433089132
SILIGURI	Novelty Books, (0353) 2525445, 7797938077
	UTTAR PRADESH
MIRZAPUR	Pustak Bhawan, 9936500469
AGRA	Maheshwari Pustak Bhandar, 9760602503

OUR DISTRIBUTORS

	ANDHRA PRADESH
GUNTUR	Y Renuka Devi, (0863) 2252308, 9490450750
HYDERABAD	Sri Balaji Book Depot, (040) 27613300, 9866355473
VIJAYAWADA	Sri Kanaka Durga Book Stall, 9603491009, 9849144007
	Akshaya Books Corner, 9666155555
VISAKHAPATNAM	Sri Rajeshwari Book Link, (0891) 6661718, 9848036014
	ASSAM
GUWAHATI	Ashok Publication, 7002846982, Book Emporium, 9675972993, 6000763186
	Kayaan Enterprises, (0361) 2630443, BLJ Publications, 7086099332
TINSUKIA	C. R. Book House, 9957886562
	ANDAMAN
PORT BLAIR	Krishna Book Centre, 9474205570
	BIHAR
MUZAFFARPUR	Pustak Bhandar, 9097046555
JHANJHARPUR	Krishna Book Agency, 9801019292, 9304977755
PATNA	Bokaro Student Friends, (0612) 2300600, 2618400, Gyan Ganga Ltd., 9304826651
	Nova Publisher & Distributors, (0612) 2666404,
	Sharda Pustak Bhandar, 8877279953, Shri Durga Pustak Mandir, 9334477386
	Vikas Book Depot, (0612) 2304753, 7004301983
PURNIA	Chaurasia Book Centre, 9006717044, 7004456102
	CHATTISGARH
RAIPUR	Agarwal Traders & Pub., (0771) 4044423, 7489991679, 8878568055 (W. app)
	Gupta Pustak Mandir, 9329100851
DURG	Bhagwati Bhawani Book Depot, 7882327620, 9827473100
	DELHI
DELHI	Mittal Books, (011) 23288887, 9899037390
	Bokaro,Student Friends Pvt Ltd., 7004074900
	R. D. Chawla & Sons, 9899445522, Zombozone, 9871274082
	Sharda Publication, 9971603248
NOIDA	Prozo (Global Edu4 Share Pvt. Ltd), 9899037390, 8587837835, 9318395520
	Global Islamic Publication, 9873690828
	GUJARAT
AHMEDABAD	Patel Book, 9898184248, 9824386112, 9825900335
	Shalibhadra Stationers, 9904477855
VADODARA	Pooja Book Shop, 7600817198, (0265) 2280464
	Umakant Book Sellers & Stationery, 9824014209, 9624920709
VAPI	Goutam Book Sellers, 9081790813
	JHARKHAND
BOKARO	Bokaro Student Friends, (0654) 2233094, 7360021503
	Sahu Pustak Bhandar, 9431378296, 7979845480
DHANBAD	Bokaro Student Friends, (0326) 3590527
RANCHI	Bokaro Student Friends, 9234628152, Gyan Ganga Ltd., 9117889900
	KARNATAKA
BENGALURU	Sri Sai Ram Book traders, 9738881088
	Sapna Book House, (080) 46551999, 9343366670
BANGLORE	Hema Book Store, 8041485110
GULBARGA	L.E. Bhavikatti, (08472) 261400, 9880737400
HUBLI	Renuka Book Distributor, (0836) 2244124
BELLARY	Chaitanya Exhibition, Bellary - 9886393971
	KERALA
ERNAKULAM	Asad Book Centre, (0484) 2370431, 9447314548, Academic Book House, (0484) 2376613
	Surya Book House, (0484) 2363721, 9847124217, Surya Book Centre, (0484) 2365149
	Orbit Book Centre, 9847770749
KADAVANTHRA	H & C Stores, (0484) 2203683, 2204683, 9446411997
JOMES SRINILAYAM	H & C Store, (0484) 2351233
KOLLAM	H & C Store, (0474) 2765421, 9447574778, H & C Store-2, 9995214104, 9809002519
KOTTAYAM	H & C Store, (0481) 2304351, Book Centre, (0481) 2566992
PALARIVATTOM	H & C Store, (0484) 2344337
TRIVANDRUM	Academic Book House, (0471) 2333349, 9447063349,
	H & C Store, (0471) 2572010, 9446411996
	Engineers Book Centre, (0471) 2596959
KANNUR	Athulya Books, (0497) 2709294
CALICUT	Aman Book Stall, (0495) 2721282,
	MADHYA PRADESH
MORENA	Shri Ram Book Store, 9424603124
GWALIOR	Agarwal Book Depot, 9425116210
INDORE	Student Book Depot, (0731) 2503333, 2535892, 9425322330
	Arun Prakashan, (0731) 2459448, 9424890785
REWA	Siddharth Enterprises, 9425185072
JABALPUR	Sangam General Store, (0761) 2412592, Akash Book Distributor, 7974264828
	GOA
MARGO	Golden Heart Emporium, (0832) 2725208, 9370273479
	HARYANA
ROHTAK	Swami Kitab Ghar, 9255121948
GURGAON	Pahuja & Co., 9999563778
	HIMACHAL PRADESH
SOLAN	Mangla Enterprises, 9882050720
	MANIPUR
IMPHAL	Jain Book Shop, 9856031157
	MAHARASHTRA
JALGAON	Sharma Book Depot, 9421393040

MUMBAI	Shivam Books & Stationery, (022) 28230897, 9892935799
	Student Book Depot, 9821550165
NAVI MUMBAI	Krishna Book Store, (022) 27744962, 9819537938
NASHIK	Rahul Book Centre, (0253) 2599608, 9970849681
NAGPUR	Laxmi Pustakalay Stationers, (0712) 2727354, Novelty Book Depot, 9657690200
	Renuka Book Distributor, 9765986633.
	Karamveer Book Depot, 9923966466, 7172725726
	Vijay Book Depot, 9860122094, (0712) 2520496, 2534217
	Shree Mahalaxmi Pustakalaya, (0712) 2283580, 7507099360
PUNE	Natraj Book Depot., (020) 24485054, 9890054092
	Vikas Book House, 9860286472, (020) 244683737
	Mahesh Book & General Store, 9421036171, Kirti Book Agnecies, 9881190907
YAVATMAL	Dilip Book Agency, (0823) 2245450, 9423131275
SOLAPUR	Jitesh Vastu Bhandar (0217) 2741061, 9960000009
DHULE	Navjeevan Book Stall, 7020525561
BHUSAWAL	Anil Book Depot, 9403942906
	ODISHA
CUTTACK	A. K. Mishra Agencies, 9437025991, 9437081319
BHUBANESHWAR	M/s Pragnya, 8847888616, 9437943777, Bharati Book House, 9438420527
BARIPADA	Trimurthi Book World, (0679) 2253336 9437034735
	PUNJAB
LUDHIANA	Amit Book Depot., 9815807871, Ravi Book Shop, 9815200925
	Bhatia Book Centre, 9815277131, 7901814043
JALANDHAR	Cheap Book Store, 9872223458, 9878258592, Gaurav Book, 9478821183
	Subhash Book Depot, 9876453625
	City Book Shop, 9417440753
PATIALA	Adarsh Enterprises, 9814347613
BARNALA	Navchetan Book Depot, 9779050692
BHATINDA	Bhagwati Book, 9463120564, Agarwal Book, 9417816439
SANGRUR	Jindal Book Depot, 9876141679
	RAJASTHAN
KOTA	Raj Traders, (0744) 2429090, 9309232829, 8005529594, Bhandari Stationers, (0744) 231958, Radhe Traders, 8769802001, Perfect Stationers & Gen. Shoppe, 9829863904
BHILWARA	Nakoda Book Depot, (01482) 243653, 9214983594
JAIPUR	J K Enterprises, 9460983939, 9414782130, Education Point, 9269664791
	Saraswati Book House, (0141) 2610823, 9829811155
	Ravi Entreprises (0141) 2602517, 9828944479
	Manohar Book Distrubutor, 9414072321
	TAMIL NADU
COIMBATORE	Majestic Book House, (0422) 2384333
	CBSE Book Shop, (0422) 2303533, 8056655337
CHENNAI	Arraba Book Traders, (044) 25387868, 9841459105, Mr Book Store (044)
	25364596, Indian Book House, (044) 24327784, 9094129595,
	Kalaimagal Store, (044) 5544072, 9940619404, Vijaya Stores, 9381037417
	Ruby Books, (044) 26425958, 9884519471, Kamal Store. 9840276067
	Bookmark It-Books & Stat. Store, 7305151653,
	Tiger Books Pvt. Ltd., 9710447000, M. K. Store, 9840030099
PUDUCHERRY	Sri Saraswathi Book Stall, (04132) 222283, 9092626287
TRICHY	Trichy Book House, (0431) 2764198, 2766815, 9489764192. 9443238419
OOTY	Bharat & Co., 9095552155
	TRIPURA
AGARTALA	Book Corner, 9856358594, Book Emporium, (0381) 2391509, 9436460399,
	UTTAR PRADESH
AGRA	Ajay Book Depot, (0562) 2254621, 9411205449
	K. S. A. Book Distributor, 9149081912
	Om Pustak Mandir, (0562) 2464014, 9319117771,
	Panchsheel Books, 9412257961, 9412257962,
ALIGARH	Shaligram Agencies (0571) 2421887, 9412317800
ALLAHABAD	Mehrotra, (0532) 2266865, 9415636890
AZAMGARH	Sasta Sahitya Sadan, 9450029674
BALIA	Vidya Kendra, 9415281234
FARRUKHABAD	Anurag Book, (0569) 2226843, 9839933650
GORAKHPUR	Central Book House, 9935454590
JAUNPUR	Thakur Pustak, 9795198974, 5453-222298
LUCKNOW	Rama Book Depot, (0522) 4080133, 9956922433 (Retail), Vyapar Sadan, 7607102462
MEERUT	Ideal Book Depot, (0121) 4059252, 9837066307
	Garg Book Depot, 9927052149
VARANASI	Bokaro Student Friends, (0542) 2401250, 8299344607
	Gupta Books, 9918155500, 8707225564
	Shri Krishna Book & Stationery, 9415020103
	WEST BENGAL
KOLKATA	Eureka Book, (033) 25934001, 9433089132, Oriental Publishers & Distributor
	(033) 40628367, Katha 'O' Kahani, (033) 22196313, 22419071,
	Saha Book House, (033) 22193671, 9333416484,
	New National Book Store, 8697601392,
	United Book House, 9231692641, (033) 22418105
ASANSOL	Book House, 9434747506
SILIGURI	Agarwal Book House, (0353) 2535274, 9832038727, Metro Books, 9832477841

0704

@PROCBSE JOIN NOW

@PROCBSE

Want to face CBSE Exams stress free?

Oswaal360

is the most helpful platform for you to practice & become perfect at any subject!



Get e-Assessments on the latest Typologies of Questions as per Latest CBSE Syllabus With Real-Time Analysis and LIVE Scores

Scan the QR Code below and use Coupon Code – **SECRET100** to get **100% FREE** access
(Don't share this Code with anyone)

Start practicing now!

Scan the QR code to download the app

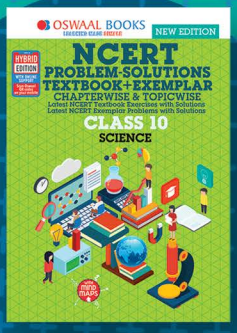
@PROCBSE

We thought of everything

to help you ace your boards

OSWAAL BOOKS®

LEARNING MADE SIMPLE



NCERT PROBLEMS-SOLUTIONS TEXTBOOK+EXEMPLAR

For Classes VI to XII

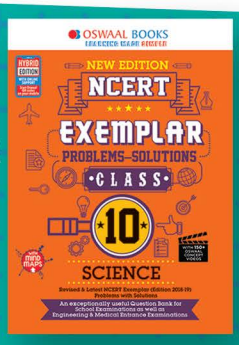
BENEFITS

- Latest NCERT Textbook Exercises with Solutions
- Latest NCERT Exemplar Problems with Solutions
- Hybrid Edition with Print & Online Support • Mind Maps
- 150+ Concept Videos

SUBJECTS AVAILABLE IN THIS SERIES

- Science
- Mathematics

★ Also available in Hindi



NCERT EXEMPLAR PROBLEMS-SOLUTIONS

For Classes IX to XII

BENEFITS

- Latest NCERT Exemplar Problems - Solutions
- Hybrid Edition with Print & Online Support
- Concept Videos • Mind Maps

SUBJECTS AVAILABLE IN THIS SERIES

- Science
- Mathematics

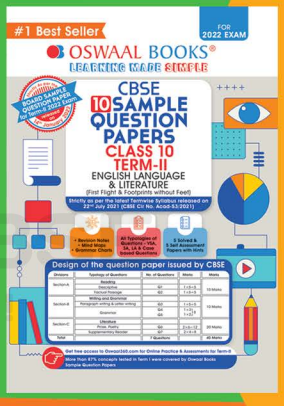
★ Also available in Hindi Medium

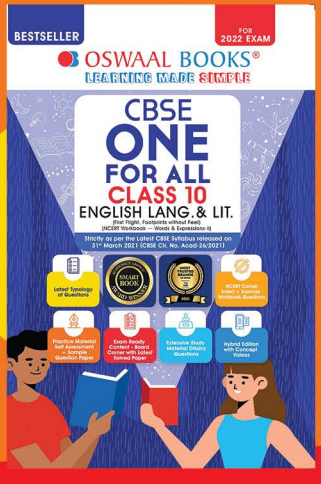
CBSE SAMPLE QUESTION PAPERS

For Classes X & XII

BENEFITS

- Revision Notes for Extensive Study
- Mind Maps
- Grammar Charts
- All Typologies of Questions - VSA, SA, LA & Case based Questions
- 5 Solved & 5 Self Assessment Papers with Hints





CBSE ONE FOR ALL

For Classes IX, X & XII

BENEFITS

- Revision Notes for Extensive Study
- Chapterwise & Topicwise Self Assessment Test for Practice
- Latest NCERT & NCERT Exemplar Questions - Fully Solved for in depth learning of the concepts (in class IX only)
- Previous Year's Board Exam Questions to facilitate exam-oriented preparation
- Board Marking Scheme & Toppers Answers
- Hybrid Edition with Print & Online Support with Concept Videos

OSWAAL RMT CARDS

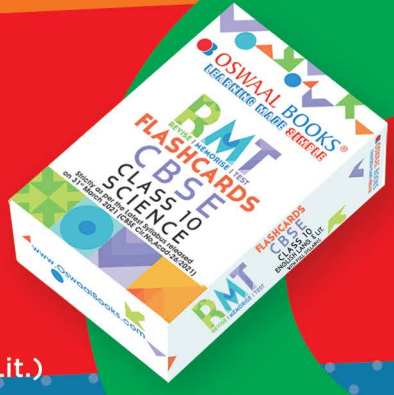
(As per the latest CBSE Syllabus)

BENEFITS

- Easy Revision Tool
- Chapterwise & Topicwise presentation
- Revise & Memorise cards for active recall
- Tests & Practicals cards for self assessment

SUBJECTS AVAILABLE IN THIS SERIES

- Science
- Mathematics
- Social Science
- English (Lang. & Lit.)



@PROCBSE