DIRECTORATE OF EDUCATION
GNCT of Delhi

SUPPORT MATERIAL
(2021-2022)
Class : X

SCIENCE

Under the Guidance of

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Secretary (Education)

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IAS

सत्यमेव जयते

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MESSAGE

I would like to congratulate the members of Core Academic Unit and the subject experts of the Directorate of Education, who inspite of dire situation due to Corona Pandemic, have provided their valuable contributions and support in preparing the Support Material for classes IX to XII.

The Support Material of different subjects, like previous years, have been reviewed/ updated in accordance with the latest changes made by CBSE so that the students of classes IX to XII can update and equip themselves with these changes. I feel that the consistent use of the Support Material will definitely help the students and teachers to enrich their potential and capabilities.

Department of Education has taken initiative to impart education to all its students through online mode, despite the emergency of Corona Pandemic which has led the world to an unprecedented health crises. This initiative has not only helped the students to overcome their stress and anxiety but also assisted them to continue their education in absence of formal education. The support material will ensure an uninterrupted learning while supplementing the Online Classes.

(H. Rajesh Prasad)

UDIT PRAKASH RAI, IAS
Director, Education & Sports

सत्यमेव जयते

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MESSAGE

The main objective of the Directorate of Education is to provide quality education to all its students. Focusing on this objective, the Directorate is continuously in the endeavor to make available the best education material, for enriching and elevating the educational standard of its students. The expert faculty of various subjects undertook this responsibility and after deep discussions and persistent efforts, came up with Support Material to serve the purpose.

Every year the Support Material is revised/ updated to incorporate the latest changes made by CBSE in the syllabus of classes IX to XII. The contents of each lesson/chapter are explained in such a way that the students can easily comprehend the concept and get their doubts solved.

I am sure, that the continuous and conscientious use of this Support Material will lead to enhancement in the educational standard of the students, which would definitely be reflected in their performance.

I would also like to commend the entire team members for their contributions in the preparation of this incomparable material.

I wish all the students a bright future.

(UDIT PRAKASH RAI)

Dr. RITA SHARMA
Additional Director of Education
(School/Exam)

सत्यमेव जयते

Govt. of NCT of Delhi
Directorate of Education
Old Secretariat, Delhi-110054
Ph. : 23890185

D.O. No.

Dated:

MESSAGE

It gives me immense pleasure to present the revised edition of the Support Material. This material is the outcome of the tireless efforts of the subject experts, who have prepared it following profound study and extensive deliberations. It has been prepared keeping in mind the diverse educational level of the students and is in accordance with the most recent changes made by the Central Board of Secondary Education.

Each lesson/chapter, in the support material, has been explained in such a manner that students will not only be able to comprehend it on their own but also be able to find solution to their problems. At the end of each lesson / chapter, ample practice exercises have been given. The proper and consistent use of the support material will enable the students to attempt these exercises effectively and confidently. I am sure that students will take full advantage of this support material.

Before concluding my words, I would like to appreciate all the team members for their valuable contributions in preparing this unmatched material and also wish all the students a bright future.

(Rita Sharma)

DIRECTORATE OF EDUCATION
Govt. of NCT, Delhi

SUPPORT MATERIAL
(2021-2022)

SCIENCE
Class : X
(English Medium)

NOT FOR SALE

PUBLISHED BY : DELHI BUREAU OF TEXTBOOKS

SUPPORT MATERIAL
CLASS X
SCIENCE

List of contributors for preparation of Support Material in Science Class X (2021-22)

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Team who Prepared Support Material of Natural Science:

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भारत का संविधान

भाग 4क

नागरिकों के मूल कर्तव्य

अनुच्छेद 51क

मूल कर्तव्य – भारत के प्रत्येक नागरिक का यह कर्तव्य होगा कि वह –

1. संविधान का पालन करे और उसके आदर्शों, संस्थाओं, राष्ट्र ध्वज और राष्ट्रगान का आदर करें।
2. स्वतंत्रता के लिए हमारे राष्ट्रीय आंदोलन को प्रेरित करने वाले उच्च आदर्शों को हृदय में संजोए रखे और उनका पालन करे।
3. भारत की प्रभुता, एकता और अखंडता की रक्षा करे और उसे अक्षुण्ण रखे।
4. देश की रक्षा करे।
5. भारत के सभी लोगों में समरसता और समान भ्रातृत्व की भावना का निर्माण करे।
6. हमारी सामाजिक संस्कृति की गौरवशाली परंपरा का महत्त्व समझे और उसका निर्माण करे।
7. प्राकृतिक पर्यावरण की रक्षा और उसका संवर्धन करे।
8. वैज्ञानिक दृष्टिकोण और ज्ञानार्जन की भावना का विकास करे।
9. सार्वजनिक संपत्ति को सुरक्षित रखे।
10. व्यक्तिगत एवं सामूहिक गतिविधियों के सभी क्षेत्रों में उत्कर्ष की ओर बढ़ने का सतत् प्रयास करे।
11. माता–पिता या संरक्षक द्वारा 6 से 14 वर्ष के बच्चों हेतु प्राथमिक शिक्षा प्रदान करना (86वां संशोधन)।

CONSTITUTION OF INDIA

Part IV A (Article 51 A)

Fundamental Duties

Fundamental Duties : It shall be the duty of every citizen of India —

1. to abide by the Constitution and respect its ideals and institutions, the National Flag and the National Anthem;
2. to cherish and follow the noble ideals which inspired our national struggle for freedom;
3. to uphold and protect the sovereignty, unity and integrity of India;
4. to defend the country and render national service when called upon to do so;
5. to promote harmony and the spirit of common brotherhood amongst all the people of India transcending religious, linguistic and regional or sectional diversities; to renounce practices derogatory to the dignity of women;
6. to value and preserve the rich heritage of our composite culture;
7. to protect and improve the natural environment including forests, lakes, rivers and wild life, and to have compassion for living creatures.
8. to develop the scientific temper, humanism and the spirit of inquiry and reform;
9. to safeguard public property and to adjure violence;
10. to strive towards excellence in all spheres of individual and collective activity so that the nation constantly rises to higher levels of endeavour and achievement.
11. who is a parent or guardian to provide opportunities for education to his child or, as the case may be, ward between the age of six and fourteen years.

भारत का संविधान

उद्देशिका

हम, भारत के लोग, भारत को एक **(सम्पूर्ण प्रभुत्व–सम्पन्न समाजवादी पंथनिरपेक्ष लोकतंत्रात्मक गणराज्य)** बनाने के लिए, तथा उसके समस्त नागरिकों को :

सामाजिक, आर्थिक और राजनैतिक **न्याय,**

विचार, अभिव्यक्ति, विश्वास, धर्म

और उपासना की **स्वतंत्रता,**

प्रतिष्ठा और अवसर की समता

प्राप्त करने के लिए,

तथा उन **सब में,**

व्यक्ति की गरिमा और **(राष्ट्र की एकता**

और अखंडता) सुनिश्चित करने वाली बंधुता

बढ़ाने के लिए

हम दृढ़संकल्प होकर इस संविधान को आत्मार्पित करते हैं।

THE CONSTITUTION OF INDIA

PREAMBLE

WE, THE PEOPLE OF INDIA, having solemnly resolved to constitute India into a **(SOVEREIGN SOCIALIST SECULAR DEMOCRATIC REPUBLIC)** and to secure to all its citizens :

JUSTICE, social, economic and political,

LIBERTY of thought, expression, belief, faith and worship,

EQUALITY of status and of opportunity; and to promote among them all

FRATERNITY assuring the dignity of the individual and the **(unity an integrity of the Nation)**;

WE DO HEREBY GIVE TO OURSELVES THIS CONSTITUTION.

COURSE STRUCTURE
CLASS X

(EVALUATION SCHEME)		
THEORY		
Units	**Term -1**	**Marks**
I	Chemical Substances-Nature and Behaviour: Chapter 1,2 and 3	16
II	World of Living: Chapter 6	10
III	Natural Phenomena: Chapter 10 and 11	14
Units	**Term - II**	**Marks**
I	Chemical Substances-Nature and Behaviour: Chapter 4 and 5	10
II	World of Living: Chapter 8 and 9	13
III	Effects of Current: Chapter 12 and 13	12
IV	Natural Resources: Chapter 15	05
Total Theory (Term MI)		80
Internal Assessment: Term I		10
Internal Assessment: Term II		10
Grand Total		100

TERM - I

Theme: Materials

Unit I : Chemical Substances - Nature and Behaviour

Chapter - 1 Chemical reactions and equations

Chemical Reactions: 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.

Chapter - 2 Acids, Bases and Salts

Adam, Bases and Salts: 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 everyday life; preparation and uses of Sodium Hydroxide, Bleaching powder, Baking soda, Washing soda and Plaster of Paris.

Chapter - 3 Metals and Non-metals

Metal and Non-metals: Properties of metals and non-metals; Reactivity series; Formation and propertief of ionic compounds

Theme: The World of the Living

Unit II : World of Living

Chapter - 6 Life Processes

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

Theme: How Things Work

Unit III: Natural Phenomena

Chapter - 10 Light, Reflection and Refraction

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.

Chapter - 11 Human Eve and Colourful World

Refraction of light through a prism, dispersion of light, scattering of light, applications in daily life.

TERM - II

Theme: Materials

Unit I : Chemical Substances - Nature and Behaviour

Chapter - 4 Carbon and its Compounds

Carbon Compounds: Covalent bonding in carbon compounds. Versatile nature of carbon.Homologous series.

Chapter - 5 Periodic Classification of Elements

Periodic Classification of Elements: 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.

Theme: The World of the Living

Unit II : World of Living

Chapter - 8 How do Organisms Reproduce?

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.

Chapter - 9 Heredity and Evolution

Heredity: Heredity; Mendel's contribution- Laws for inheritance of traits: Sex determination: brief introduction;

Theme: Natural Phenomena

Unit IV : Effects of Current

Chapter - 12 Electricity

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.

Chapter - 13 Magnetic Effects of Current

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, Electric Motor, Electromagnetic induction. Induced potential difference, Induced current. Fleming's Right Hand Rule.

Theme: Natural Resources

Unit V : Natural Resources

Chapter - 15 Our Environment

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

*****

ONLY FOR INTERNAL ASSESSMENT

Note: Learners are assigned to read the below listed part of Unit V, Thev can be encouraged to prepare a brief write up on any one concept of this Unit in their Portfolio. This may be an assessment for Internal Assessment and credit may be given (Periodic assessment/Portfolio). This portion of the Unit is not to be assessed in the year-end examination.

Chapter - 16 Management of Natural Resources

Conservation and judicious use of natural resources. Forest and wild life; Coal and Petroleum conservation. Examptes of people's participation for conservation of natural resources. Big dams: advantages and limitations; alternatives, if any, water harvesting. Sustainability of natural resources.

PRACTICALS

Practical should be conducted alongside the concepts taught in theory classes.

TERM - I

List of Experiments

1. A. Finding the pH of the following samples by using pH paper/universal indicator:
   (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 (HC1 & NaOH) on the basis of their reaction with:
   (a) Litmus solution (Blue/Red)
   (b) Zinc metal
   (c) Solid sodium carbonate

Unit I : Chapter-2

2. Performing and observing the following reactions and classifying them into:
   A. Combination reaction
   B. Decomposition reaction
   C. Displacement reaction

D. Double displacement reaction

(i) Action of water on quicklime

(ii) Action of heat on ferrous sulphate crystals (Hi) Iron nails kept in copper sulphate solution

(iv) Reaction between sodium sulphate and barium chloride solutions.

Unit I : Chapter - 1

3. A. Observing the action of Zn, Fe, Cu and Al metals on the following salt solutions:

(i) $ZnSO_4$(aq) (ii) $FeSO_4$(aq)

(iii)$CuSO_4$(aq) (iv) Al2 $(SO_4)_3$(aq)

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

Unit I : Chapter - 3

4. Experimentally show that carbon dioxide is given out during respiration.

Unit II : Chapter - 6

5. Determination of the focal length of (t) Concave mirror and (ii) Convex lens by obtaining the image of a distant object.

Unit III : Chapter - 10

6. Tracing the path of a ray of light passing through a rectangular glass slab for different angles of f incidence. Measure the angle of incidence, angle of refraction, angle of emergence and Interpret the result.

Unit III : Chapter-10

7. Tracing the path of the rays of light through a glass prism.

Unit III : Chapter - 11

TERM - II

List of Experiments

1. Studying the dependence of Potential difference (V) across a resistor on the current (I) passing through it and determining its resistance. Also plotting a graph between V and I

Unit IV : Chapter - 12

2. Studying (a) binary fission in Amoeba, and (b) budding in yeast and Hydra with the help of prepared slides.

Unit II : Chapter - 8

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

Assessment Areas (Theory) 2021-22
(Class X)
Science (086)

Theory **Total Maximum Marks: 80**

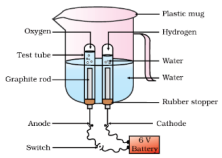
Competencies	Marks
Demonstrate Knowledge and Understanding	46%
Application of Knowledge/Concepts	22%
Analyze, Evaluate and Create	32%

Note: Internal choice would be provided.

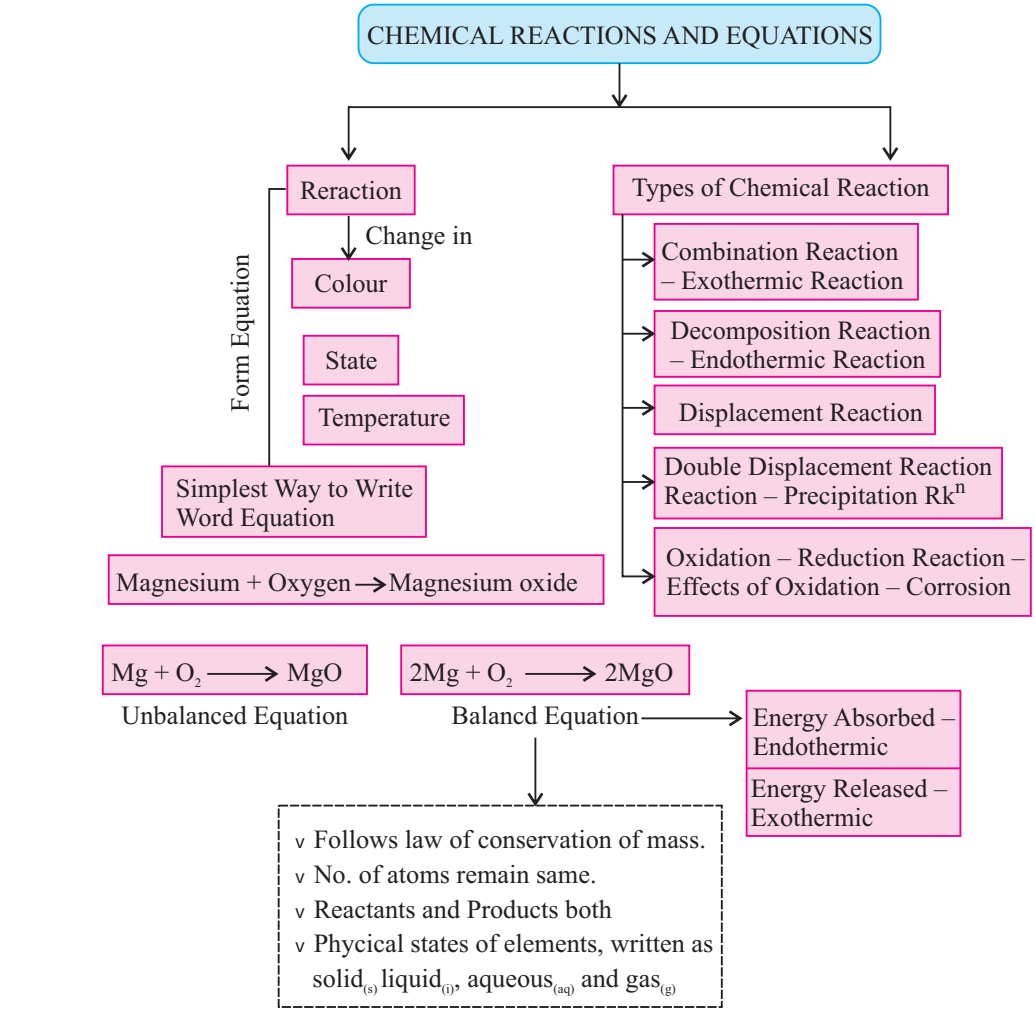
Internal Assessment - Term I and II (10 Marks Each)

- Periodic Assessment - 03 marks
- Multiple Assessment - 02 marks
- Subject Enrichment (Practical Work) - 03 marks
- Portfolio - 02 marks

Content



Chapter - 1 Chemical Reactions And Equations



Note: Skeleton equations are usually unbalanced equation but there are few which need not to be balanced as they are already balanced equations eq.

Skeleton Equation	Balanced Equation
$C_{(s)} + O_{2(g)} \longrightarrow CO_{2(g)}$	$C_{(s)} + O_{2(g)} \longrightarrow CO_{2(g)}$
$Zn_{(s)} + H_2SO_{4(l)} \longrightarrow ZnSO_4 + H_{2(g)}$	$Zn_{(s)} + H_2SO_{4(l)} \longrightarrow ZnSO_4 + H_{2(g)}$
$S_{(s)} + O_{2(g)} \longrightarrow SO_{2(g)}$	$S_{(s)} + O_{2(g)} \longrightarrow SO_{2(g)}$
$NaCl_{(aq)} + AgNO_{3(aq)} \longrightarrow NaNO_{3(aq)}$	$NaCl_{(aq)} + AgNO_3(g) \longrightarrow CO_{2(g)}$

The process in which new substances with new properties are formed from one or more substances is called **Chemical Reaction.**

* The substances which take part in chemical reaction are called **Reactants.**
* The substances which are formed in a chemical reaction are called **Products.**

Examples :

(i) Digestion of food

(ii) Respiration

(iii) Rusting of iron

(iv) Burning of Magnesium ribbon

(v) Formation of curd

Chemical reaction involves :

- Change in state
- Change in colour
- Change in temperature
- Evolution of gas

Ways of Representing a Chemical Reaction

Word Equation

Zinc + Sulphuric Acid → Zinc sulphate + Hydrogen

LHS (Reactant) | RHS (Product)

Chemical Equation

$Zn + H_2SO_4 \rightarrow ZnSO_4 + H_2$

LHS (Reactant) | RHS (Product)

Chemical Equation

* A chemical reaction can be represented by chemical equation. It involves uses of symbol of elements or chemical formula of reactant and product with mention of physical state.
* The necessary conditions such as temperature, pressure or any catalyst should be written on arrow between reactant and products.

e.g., Magnesium is burnt in air to form Magnesium oxide.

$$2\,Mg + O_2 \rightarrow 2\,MgO$$

Balancing Chemical Equation

* Law of conservation of Mass : Matter can neither be created nor be destroyed in a chemical reaction.
* So number of elements involved in chemical reaction should remain same at reactant and product side.

STEPWISE BALANCING (Hit and Trial)

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

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

* Do not change anything inside the box.

Step 2. Count the number of atoms of each element on both the sides of chemical equation.

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. Equalise the number of atoms of element which has maximum number by putting in front of it.

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

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 on arrow above or below.

TYPES OF CHEMICAL REACTIONS

I. COMBINATION REACTION : The reaction in which two or more reactants combine to form a single product.

e.g. (i) Burning of coal

$C\,(s) + O_2\,(g) \rightarrow CO_2\,(g)$

(ii) Formation of water

$2H_2\,(g) + O_2\,(g) \rightarrow 2H_2O\,(l)$

(iii) $CaO\,(s) + H_2O\,(l) \rightarrow Ca(OH)_2\,(aq)$

Quick lime Slaked lime

Exothermic Reactions : Reaction in which heat is released along with formation of products.

e.g., (i) Burning of natural gas

$CH_4\ (g) + O_2\ (g) \rightarrow CO_2\ (g) + 2H_2O\ (g) + Heat$

(ii) Respiration is also an exothermic reaction.

$C_6H_{12}O_6\ (aq) + 6O_2\ (g) \rightarrow 6CO_2\ (g) + 6H_2O\ (l) + energy$

II. DECOMPOSITION REACTION : The reaction in which a compound splits into two or more simple substances is called decomposition reaction.

$$A \rightarrow B + C$$

- **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) $CaCO_3\ (s) \xrightarrow{Heat} CaO\ (s) + CO_2\ (g)$

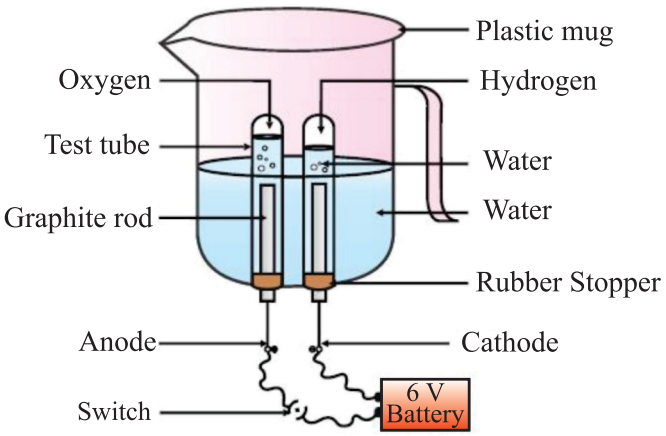
(Lime stone) (Quick lime)

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

(lead nitrate) (lead oxide) (Nitogen dioxide)

- **Electrolytic Decomposition :** When decomposition is carried out by passing electricity.

e.g., $2H_2O(l) \xrightarrow[current]{Electric} 2H_2(g) + O_2(g)$



- **Photolytic Decomposition :** When decomposition is carried out in presence of sunlight.

The decomposition reactions are mostly endothermic in nature. Energy in the form of heat, light or electricity is generally absorbed in these reactions.

e.g., $2AgCl\ (s) \xrightarrow{Sunlight} 2Ag\ (s) + Cl_2\ (g)$

$2AgBr\ (s) \xrightarrow{Sunlight} 2Ag\ (s) + Br_2\ (g)$

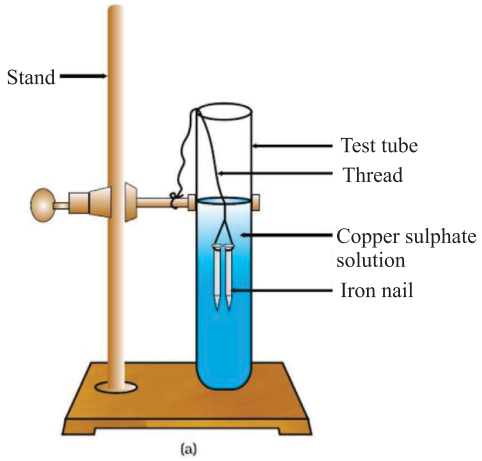
Silver chloride turns grey on exposure to sunlight

* Above reaction is used in black & white photography.

- **Endothermic Reactions :** The reactions which require energy in the form of heat, light or electricity to break reactants are called endothermic reactions.

III. DISPLACEMENT REACTION : The chemical reaction in which more reactive element displaces less reactive element from its salt solution.

(a) **$Fe\ (s) + CuSO_4\ (aq) \longrightarrow FeSO_4\ (aq) + Cu\ (s)$**



The iron nail becomes brownish in colour by deposition of Cu and blue colour of $CuSO_4$ changes to dirty green colour due to formation of $FeSO_4$.

(b) **$Zn + CuSO_4 \rightarrow ZnSO_4 + Cu$**

Zn is more reactive than copper.

IV. DOUBLE DISPLACEMENT REACTION : A reaction in which new compounds are formed by mutual exchange of ions between two compounds.

(i) **$Na_2SO_4\ (aq) + BaCl_2\ (aq) \rightarrow BaSO_4\ (s) + 2NaCl\ (aq)$**

(Sodium sulphate)	(Barium chloride)	(Barium sulphate)	(Sodium chloride)

white precipitate of $BaSO_4$ is formed, so it is also called precipitation reaction.

Note: All bouble displacement reactions are not precipitation reactions.

(ii) $2KI + Pb(NO_3)_2 \rightarrow +PbI_2 + 2KNO_3$

Potassium iodide — Lead nitrate — Lead iodide (Yellow ppt) — Potassium nitrate

(iii) $2KBr + BaI_2 \rightarrow 2KI + BaBr_2$

Potassium bromide — Barium iodide — Potassium iodide — Barium bromide

V. OXIDATION AND REDUCTION :

Oxidation : (i) The addition of oxygen to reactant.

(ii) The removal of hydrogen from a reactant.

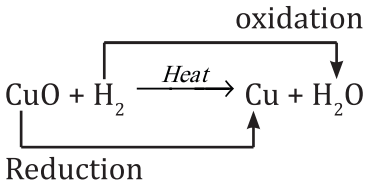
$$C + O_2 \rightarrow CO_2$$

$$2Cu + O_2 \xrightarrow{Heat} 2CuO$$

$$CuO + H_2 \xrightarrow{Heat} Cu + H_2O$$

Reduction : (i) The addition of hydrogen to reactant.

(ii) The removal of oxygen from a reactant.



In this reaction CuO is reduced to Cu and H_2 is oxidized to H_2O. So, oxidation and reduction taking place together is redox reaction.

Effects of Oxidation in Daily Life

1) Corrosion

- When a metal is exposed to moisture, air, acid etc. for some time, a layer of hydrated oxide is formed which weakens the metal and hence metal is said to be corroded.
- Rusting of iron, black coating on silver and green coating on copper are examples of corrosion.
- Corrosion can be prevented by galvanization, electroplating or by putting paints.

2) Rancidity : The oxidation of fats and oils when exposed to air is known as rancidity. It leads to bad smell and bad taste of food.

Methods to Prevent Rancidity

(i) By adding antioxidants

(ii) Keeping food in air tight containers

(iii) Replacing air by nitrogen

(iv) Refrigeration

QUESTIONS

VERY SHORT QUESTIONS (1 Mark)

MULTIPLE CHOICE QUESTIONS

Q. 1 The shiny finish of wall after white wash is because of.

a) Calcium oxide b) Calcium hydroxide

c) Calcium Carbonate d) Calcium phosphate

Q. 2 Electrolysis of water is decomposition reaction. The mole ratio of hydrogen and oxygen gases liberated during electrolysis of water is

a) 1:1 b) 2:1 c) 4:1 d) 1:2

Q. 3 Which the following statements about the given reaction are correct:

$3Fe(s) + 4H_2O(g) \longrightarrow Fe_2O_3(s) + 4H_2(g)$

i) Iron metal is getting oxidized

ii) Water is getting reduced

iii) Water is acting as reducing agent

iv) Water is acting as oxidizine agent

a) (i), (ii) and (iii) b) (iii) and (iv)

c) (i), (ii) and (iv) d) (ii) and (iv)

Q. 4 In order to prevent the spoilage of potato chips, they are packed in plastic bags containing the gas

a) Cl_2 b) O_2 c) N_2 d) H_2

Q. 5 The process of respiration is -

a) an oxidation reaction which is endo thermic

b) a reduction reaction which is exothermic

c) a combination reaction which is endo thermic

d) an oxidation reaction which is exothermic

Q. 6 Burning of Methane is an example of

I. Exothermic recation

II. Combustion reaction

III. Decompostition reaction

a. I only b. II only c. I and II d. I and III

Q. 7 A solution of substance X is used for white washing. The substance X is

a. Calcium oxide b. Calcium hydroxide

c. Calcium carbonate d. Calcium chloride

Q. 8 When iron nails are dipped into Copper Sulphate solution. The colour of Copper Sulphate solution changes from

a. Green to blue b. Blue to green

c. Green to colourless d. Blue to colourless

Q. 9 The given Chemical reaction is an example of

$Zn + CuSO_4 \longrightarrow ZnSO_4 + Cu$

a. Combination reaction b. Displacement reactions

c. Decomposition reaction d. Double displacement reaction

Q. 10 The balanced equation for the given chemical reaction is

Hydrogen + Chlorine $\longrightarrow$ Hydrogen Chloride

a. $H_2 + Cl_2 \rightarrow 2HCl$ b. $H + Cl \rightarrow HCl$

c. $H_2 + Cl_2 \longrightarrow HCl$ d. none of the above

Q. 11 Give an example of double displacement reaction? (CBSE 2010, 2011)

Q. 12 Name the reducing agent in given chemical reaction

$3\,MnO_2 + 4Al \longrightarrow 3\,Mn + 2Al_2O_3$ (CBSE-2016)

Q.13 Name the brown coloured gas evolved when lead nitrate crystal are heated in dry test-tube.

Q. 14 Give reasons-

a) Silver chloride is stored in dark coloured bottles.

b) Copper vessel loses shine when exposed to air

c) Iron displaces copper from copper sulphate solution.

Q. 15 Identify the following reactions as

i) combination ii) decomposition iii) displacement reactions iv) double displacement reaction.

i) $ZnCO_3(s) \longrightarrow ZnO(s) + CO_2(g)$

ii) $Pb(s) + CuCl_2(ag) \longrightarrow PbCl_2(aq) + Cu(s)$

iii) $H_2(g) + Cl_2(g) \longrightarrow 2HCl$

iv) $CaCO_3(s) \longrightarrow CaO(s) + CO_2(g)$

v) $NaCl(aq) + AgNO_3(a) \longrightarrow AgCl + NaNo_3$

vi) $3H_2(g) + N_2(g) \longrightarrow 2NH_3(g)$

vii) $Fe_2O_3 + Al \longrightarrow Al_2O_3 + 2Fe$

16. What changes do you observe in iron nails and colour of copper sulphate solution, if iron nails are dipped in $CuSO_4$ solution for Sometime?

17. Identify the chemical change :

Melting of ice or conversion of milk into curd.

18. Why is respiration considered an exothermic reaction ?

19. Why do copper vessel lose shine when exposed to air ?

20. Potato chips manufacturers fill the packet of chips with nitrogen gas. Why ?

21. Why we store silver chloride in dark coloured bottles in labs?

22. Write a chemical equation of double displacement reaction.

23. $N_2 + 3H_2 \rightarrow 2NH_3$, name the type of reaction.

24. What happens when milk is left open at room temperature during summers ?

25. What happens when quick lime is added to water ?

Practical Based MCQ's

1. When aqueous solution of sodium sulphate and barium chloride are mixed together, we observe-
   a) precipitate red b) white precipitate
   c) yellow precipitate d) colourless solution
2. The colour of ferrous sulphate crystal is-
   a) yellow b) light green c) red d) brown
3. A student took solid quick lime in a china dish and added a small amount of water to it. He would hear-
   a) pop sound b) a crackling sound
   c) hissing sound d) no sound at all
4. When an iron nail is placed in copper sulphate solution the observation are as follow-
   a) The solution turns light green
   b) A brown deposit is formed on the nail
   c) Both 'a' and 'b'
   d) None of the above

Answer

1. (b) 2.(b) 3.(c) 4.(c)

Assertion and Reason type of questions

In the following questions a statement of Assertion is followed by a statement of Reason.
Mark the correct choice as two statements are given one labeled Assertion (A) and the other labeled Reason (R). Select the correct answer to these questions from the cods (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 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 (R):** Chemical reaction changes the physsical and chemical state of substance.
   Reason (R): When electric current is passed through water (liquid), it decomposes to produce hydrogen and oxygen gases.

2. **Assertion (R):** In a balanced chemical equation, total mass of the each element towards reactant side is equal to the total mass of the same element towards product side.
   Reason (R): Mass can neither be created nor destroyed during a chemical change.
3. **Assertion (R):** When calcium carbonate is heated, it decomposes to give calcuim oxide and carbon dioxidde.
   Reason (R): The decomposition reaction takes place on application of heat, therefore its an endothermic reaction.
4. **Assertion (R):** Chips manufactures usually flush bags of chips with gas such as nitrogen to prevent the chips from getting oxidised.
   Reason (R): This increases the taste of the chips and helps in their digestion.
5. **Assertion (R):** Rusting of iron metal is the most common form of corrosion.
   Reason (R): The effect of rusting of iron can be reversed if they are left open in sunlight.

SHORT ANSWER TYPE OF QUESTIONS (2 AND 3 MARKS)

1. Define combination reaction. Give two examples of combination reaction which is exothermic in nature.
2. What is decomposition reaction ? Explain with the help of an example.
3. Name and state the law which is kept in mind when we balance a chemical equation.
4. Give one example of each :
   (a) Chemical reaction showing evolution of gas.
   (b) Change in colour of a substance during a chemical reaction.
   (c) Chemical reaction showing change in temp.
5. What is rancidity ? Write two ways by which it can be prevented.
6. What are two conditions which promote corrosion ?

7. A small amount of Ferrous sulphate is heated in hard glass tube.
   (a) Write the chemical equation.
   (b) What type of reaction is taking place or Name the type of reaction.
8. What happens when Zn strip is dipped in $CuSO_4$ solution ?
   Give equation and identify the type of reaction.
9. What is redox reaction ? Write down a chemical reaction representing it.
10. In electrolysis of water :
   (a) Name the gas collected at cathode and anode respectively.
   (b) Why is volume of one gas collected at one electrode is double of another ?
   (c) Why is it necessary to add few drops of dil. H_2SO_4 to water before electrolysis?
11. In the reaction
   $CuO\ (s) + H_2\ (g) \rightarrow Cu(s) + H_2O\ (g)$
   (a) Name the oxidized substance.
   (b) Name the reduced substance.
   (c) Name the oxidizing agent.
12. Give reasons :
   (a) White Silver chloride turns grey in sunlight.
   (b) Brown coloured copper powder on heating in air turns into black coloured substance.
13. Compound 'X' decomposes to form compound 'Y' and CO_2 gas. Compound Y is used in manufacturing of cement.
   (a) Name the compounds 'X' and 'Y'.
   (b) Write the chemical equation for this reaction.

14. A metal salt MX when exposed to light splits up to form metal M and gas X_2. Metal M is used to make ornaments whereas gas X_2 is used in making bleaching powder. The salt MX is used in black & white photography.

(a) Identify the metal M and gas X_2.

(b) Identify MX.

(c) Write down the chemical reaction when salt MX is exposed to sunlight.

15. A metal strip X is dipped in blue coloured salt solution YSO_4. After some time a layer of metal 'Y' is formed on metal strip X. Metal X is used in galvanization whereas metal Y is used for making electric wires.

(a) What could be metal 'X' and 'Y' ?

(b) Name the metal salt YSO_4.

(c) What type of chemical reaction takes place between X and YSO_4? Write the balanced chemical equation.

Q.16 When potassium Iodide solution is added to a solution of lead nitrate in test tube, a precipitate is formed.

i) State the colour of precipitate

ii) Name the compound which is precipitated

iii) Write balanced equation for chemical reaction (CBSE-2015 Comptt)

Q. 17 Decomposition reactions require energy either in the form of heat or light a electricity for breaking down of reactions. Write one equation for each type of decomposition reaction where heat, light or electricity is used as form of energy.

Q. 18 2 gm of silver chloride is taken in china dish, and china dish is placed in sunlight for sometime. What will be your observation. Write the balanced chemical equation for above reaction and identify the type of reaction. (CBSE-2019)

Q.19 Identify the type of reactions taking place in each of following cases and write the balanced chemical equation for the reactions.

a) Zn reacts with silver nitrate to produce zinc nitrate and silver.

b) Potassium iodide reacts with lead nitrate to produce potassium nitrate and lead iodide (CBSE-2019)

LONG ANSWER TYPE OF QUESTIONS (5 MARKS)

1. White wash was being done at Mukesh's house. Mukesh saw that the painter added quick lime to drum having water. Mukesh touched outer surface of drum, it is unbelievably hot.
   (a) Write the chemical equation for above reaction.
   (b) What type of reaction is it ?
   (c) This reaction is exothermic or endother mic. Justify your answer.
2. Write down the balanced chemical equation for the following :
   (a) Silver chloride is decomposed in presence of sunlight to give silver and chlorine gas.
   (b) Calcium oxide reacts with water to give lime water.
   (c) Sodium hydroxide reacts with hydrochloric acid to give sodium chloride and water.
   (d) Dil hydrochloric acid is added to copper oxide to give green coloured copper chloride and water.
   (e) Solution of barium chloride and sodium sulphate in water reacts to give insoluble Barium sulphate and solution of Sodium chloride.

Case Study/Source Based Question

In most pollution control application lime is used as calcium hydroxide. To manufacture calcium hydroxide the limestone must be converted to calcium oxide then converted to calcium oxide and the calcium oxide then converted to calcium hydroxide. The following is a brief chemical reaction of this process:

Limestone + Heat $\longrightarrow$ Calcium oxide + Carbon dioxide

However, calcium oxide is unstable in the presence of moisture and carbon dioxide. A more stable form of lime is calcium hydroxide.

Calcium oxide + Water $\longrightarrow$ Calcium hydroxide + Heat

The process of adding water to calcium oxide to produce calcium hydroxide is referred to as hydration process or lime slaking. The hydration of Calcium oxide; commercially referred to as quick lime, is an exothermic process releasing a great quantity of heat. The hydration takes place quickly, releasin a lot of heat energy. This heat will boil of the water and genrate steam, which makes the particles burst, exposing the inner surfaces to water for further slaking. This process will continue until hydration is complete.

(i) Lime is used as calcium hydroxide. The formula of lime is calcium hydroxide that absorb CO_2 from air and become white, the compound formed is

(a) CaO (b) $CaCO_3$

(c) $CaCo_3$ (d) $CaO.2H_2O$

(ii) The chemical reaction of the given word equation:

(a) $2CaO + Heat \longrightarrow 2Ca + O_2$

(b) $CaCO_3 + Heat \longrightarrow CaO + CO_2$

(c) $Ca(OH)_2 + Heat \longrightarrow CaO + H_2O$

(d) $2CaCO_3 + Heat \longrightarrow 2CaO + CO_2$

(iii) The stable form of lime is

(a) Calcium hydroxide (b) Calcium oxide

(c) Calcium carbonate (d) Calcium oxide. Dehydrate

(iv) The hydration of Calcium oxide is an

(a) Exothermic reaction

(b) Endothermic reaction

(c) Combination and exothermic reaction

(d) Decomposition and exothermic reaction

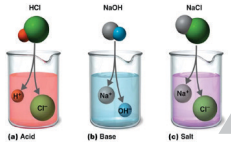
(v) In a beaker take small amount of calcium oxide. When water is added to it. The temperature of the breaker will increase because:

(a) A suspension of calcium hydroxide is formed

(b) The beaker will be hot when touched

(c) Clear solution appears when suspension of calcium hydroxide settles down to the bottom of the beaker.

(d) All of the above



Chapter - 2

Acid, Bases And Salts

- Sour in taste
- Turn blue litmus red
- Give H+ ions in aqueous solution
- Aqueous sol^{n} conduct electricity

- Bitter in taste
- Turn red litmus blue
- Give OH+ ions in aqueous solution
- Does not conduct electricity in aqueous sol^{n}

Physical Properties of Acids

Physical Properties of Bases

Chemical Properties of Acids

Acids, Bases and Salts

Chemical Properties of Bases

- Reacts with metals to liberate hydrogen.
- Reacts with metal carbonates/metal hydrogen carbonate to liberate Co_2
- Reacts with certain metal oxides to form salt and water.

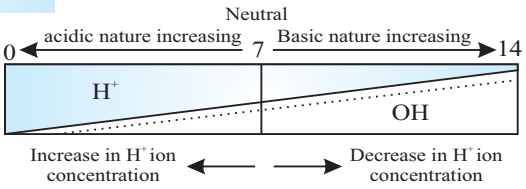
- Alkali reacts with metal to liberate H_2
- Bases reacts with acidic oxides to form water.

Classification of Acid, Bases and Salts on the basis of pH scale.

Salts : When acid and base are combind under the given condition. Salt is formed.

pH scale : H^+ ion concentration of the solution.

Some Common Salts



Some Common Salts

- Common salts : Nacl
- Sodium hydroxide : $NaCl + 2H_2O \longrightarrow NaOH + Cl_2 + H_2$
- Bleaching Powder: $Ca(OH)_2 + Cl_2 \longrightarrow CaOCl_2 + H_2O$
- Baking Soda: $NaCl + H_2O + CO_2 + NH_3 \longrightarrow NH_4Cl + NaHO_3$
- Wasing Soda: $Na_2CO_3 + 10.H_2O \longrightarrow Na_2CO_2.10H_2O$
- Plaster of Paris : $CaSO_4.2H_2O \xrightarrow[\text{heat}]{373\ k} CaSO_4.\ \frac{1}{2}H_2O + 1\frac{1}{2}H_2O$
- Gypsum : $CaSO_4.\frac{1}{2}H_2O + 1\frac{1}{2}H_2O \longrightarrow CaSO.2H_2O$

ACIDS :

- These are the substances which have sour taste.
- They turn blue litmus solution red.
- They give H^+ ions in aqueous solution.
- The term 'acid' has been derived from the Latin word, acidus, which means sour.

Strong Acids : HCl, H_2SO_4, HNO_3

Weak Acids : CH_3COOH, Oxalic acid, Lactic acid

Concentrated Acid : Having more amount of acid + less amount of water

Dilute Acid : Having more amount of water + less amount of acid

BASES :

- These are the substances which are bitter in taste and soapy in touch.
- They turn red litmus solution blue.
- They give OH^- ions in aqueous solution.

Strong Bases : NaOH, KOH, $Ca(OH)_2$

Weak Bases : NH_4OH

Alkalis : These are bases which are soluble in water [NaOH, KOH, $Ca(OH)_2$].

SALTS :

These are the compounds formed from reaction of acid and base.

Example :

NaCl, KCl.

INDICATORS :

These are the substances which change their colour/smell in different types of substances.

TYPES OF INDICATORS

Natural indicators

— Found in nature in plants.

— Litmus, red cabbage leaves extract, flowers of hydrangea plant, turmeric

Synthetic indicators

— These are chemical substances.

— Methyl orange, phenolphthalein

Olfactory indicators

— These substances have different odour in acid and bases.

	S. No.	Indicator	Smell/Colour in acidic solution	Smell/Colour in basic solution
Natural Indicator	1.	Litmus	Red	Blue
	2.	Red cabbage leaf extract	Red	Green
	3.	Flower 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

Reaction of Metals with

Acids	Bases
Acid + Metal → Salt + Hydrogen gas	Base + Metal → Salt + Hydrogen gas
E.g., $2HCl + Zn \rightarrow ZnCl_2 + H_2$	*E.g.,* $2NaOH + Zn \rightarrow Na_2ZnO_2 + H_2\uparrow$ (Sodium zincate)

* Hydrogen gas released can be tested by bringing burning candle near gas bubbles, it burst with pop sound.

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., $2HCl + Na_2CO_3 \rightarrow 2NaCl + CO_2 + H_2O$	
$HCl + NaHCO_3 \rightarrow NaCl + CO_2 + H_2O$	

* CO_2 can be tested by passing it through lime water.

$$Ca(OH)_2 + CO_2 \rightarrow \underset{\text{insoluble}}{CaCO_3} + H_2O \text{ (Lime water turns milky.)}$$

When excess *CO_2 is passed,

$$CaCO_3 + CO_2 + H_2O \rightarrow \underset{\text{(Soluble)}}{Ca(HCO)_3} \text{ (Milkiness disappears.)}$$

Reaction of Acids and Bases With Each Other

Acid + Base → Salt + H_2O

Neutralisation Reaction : Reaction of acid with base to give salt and water is called as **neutralisation** reaction.

E.g., $HCl + NaOH \rightarrow NaCl + H_2O$

IF :

Strong Acid + Weak Base → Acidic salt + H_2O [pH of the Sol^n is less than 7]

Weak Acid + Strong Base → Basic salt + H_2O [pH of the Sol^n is more than 7]

Strong Acid + Strong Base → Neutral salt + H_2O [pH of the Sol^n is = 7]

Weak Acid + Weak Base → Neutral salt + H_2O [pH of the Sol^n is = 7]

Reaction of Metallic Oxides with Acids

Metallic oxides are basic in nature.

E.g., CaO, MgO are basic oxides.

Metallic Oxide + Acid $\rightarrow$ Salt + H_2O

$CaO + 2HCl \rightarrow CaCl_2 + H_2O$

Reaction of Non-metalic Oxides with Bases

Non-metallic oxides are acidic in nature.

Non-mettalic Oxide+Base$\rightarrow$Salt+H_20

$C0_2+Ca(OH)_2 \rightarrow CaCO_3 + H_2O$

Reaction of Acid

- + Metal Carbonate $\rightarrow$ Salt + CO_2+Water
- + Metal $\rightarrow$ Salt+H_2
- + Metal Hydrogen Carbonate $\rightarrow$ Salt+CO_2+H_2O
- + Metal oxide $\rightarrow$ Salt + H_2O
- + Base $\rightarrow$Salt + H_2O

Reaction of Base

- + Metal $\rightarrow$ Salt+H_2
- + Metal Carbonate $\rightarrow$ No Reaction
- + Metal Hydrogen Carbonate $\rightarrow$ No Reaction
- + Acid $\rightarrow$Salt + H_2O
- + Non Metallic oxide $\rightarrow$ Salt + H_2O

What do all Acids and Bases have in common

- All acids have H^+ ions in common.
- Acids produce H^+ ions in solution which are responsible for their acidic properties.
- All bases have OH^- (hydroxyl ions) in common.

All $\rightarrow$ Acids $\rightarrow$ H^+ ions

All $\rightarrow$ Bases $\rightarrow$ OH^- ions

Acid or Base in Water Solution

- Acids produce H^+ ions in presence of water.
- H^+ ions cannot exist alone, they exist as H_3O^+ (hydronium ions).

$$H^+ + H_2O \rightarrow H_3O^+$$

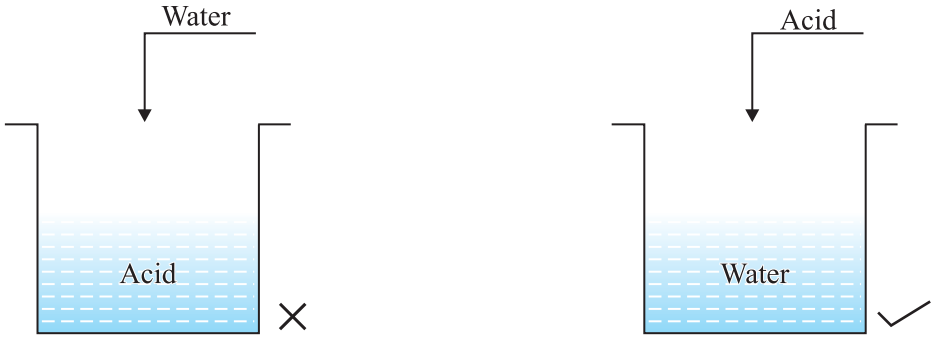
$$HCl + H_2O \rightarrow H_3O^+ + Cl^-$$

Bases when dissolved in water gives OH^- ions.

$$NaOH \xrightarrow{H_2O} Na^+ + OH^-$$

$$Mg(OH)_2 \xrightarrow{H_2O} Mg^{2+} + 2OH^-$$

- Bases soluble in water are called alkali.
- While diluting acids, it is recommended that the acid should be added to water and not water to acid because the process of dissolving an acid or a base in water is highly exothermic.



If water is added to acid, the heat generated may cause the mixture to splash out and cause burns and the glass container may also break due to excessive local heating.

Adding water to acid may

Cause mixture to splash out

Break the glass container

Mixing an acid or a base with H_2O results in decrease of concentration of ions (H_3O^+/OH^-) per unit volume. Such a process is called as dilution.

Strength of Acid and Base

Strength of acid or base can be estimated using universal indicator.

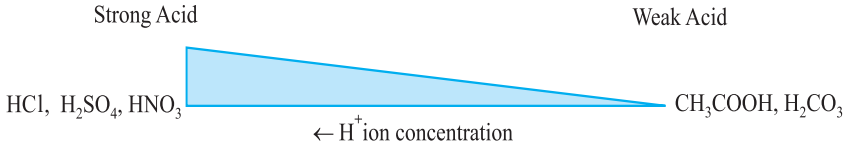
Universal indicator : is a mixture of several indicators. It shows different colours at different concentrations of H^+ ions in the solution.

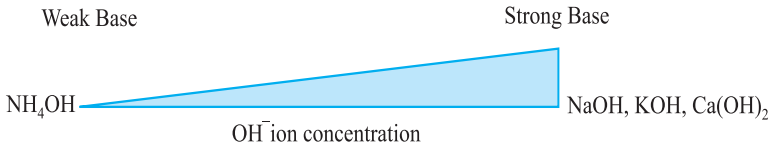
pH Scale : A scale for measuring H^+ ion concentration in a solution . p in pH stands for 'potenz' a German word which means power.

pH = 7 → neutral solution

pH less than 7 → acidic solution

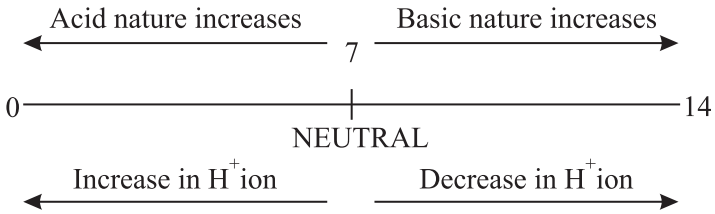
pH more than 7 → basic solution





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.
2. pH of the soil	• Plants require a specific pH range for their healthy growth.

3. pH in our digestive system	• Our stomach produces HCl acid which helps in digestion. • During indigestion, stomach produces more acid and cause pain and irritation. • To get rid of this pain, people uses antacid (mild base) like milk of magnesia [$Mg(OH)_2$] to neutralize excess acid.
4. pH change as cause of tooth decay	• Tooth decay starts when pH of mouth is lower than 5.5. • Tooth enamel made up of calcium phosphate (hardest substance in body) does not dissolve in water but corrodes when pH is lower than 5.5 due to acids produced by degradation of food particles by bacteria. • Using toothpaste (generally basic) tooth decay can be prevented.
5. Self defence by animals and plants through chemical warfare	(a) Bee sting leaves an acid which cause pain and irritation. Use of a mild base like baking soda on stung area gives relief. (b) Stinging hair of nettle leaves inject methanoic acid causing burning Sensation or pain. Rubbing with leaf of dock plant give relief.

pH of Salts :

(i) Strong Acid + Strong Base → Neutral Salt : pH = 7 eg. Nacl

(ii) Salt of strong acid + Weak base → Acidic salt : pH < 7 eg. NH_4cl

(iii) Salt of strong base + Weak acid → Basic salt : pH > 7 eg. CH_3C00na

Chemicals from Common Salt (NaCl)

1.	2.	3.	4.	5.
Sodium Hydroxide (NaOH)	Bleaching Powder ($CaOCl_2$)	Baking Soda ($NaHCO_3$)	Washing Soda ($Na_2CO_3.10H_2O$)	Plaster of Paris ($CaSO_4.½H_2O$)

1. Sodium Hydroxide (NaOH) : When electricity is passed through an aqueous solution of NaCl (brine), it decompose to form NaOH. (Chlor-alkali process)

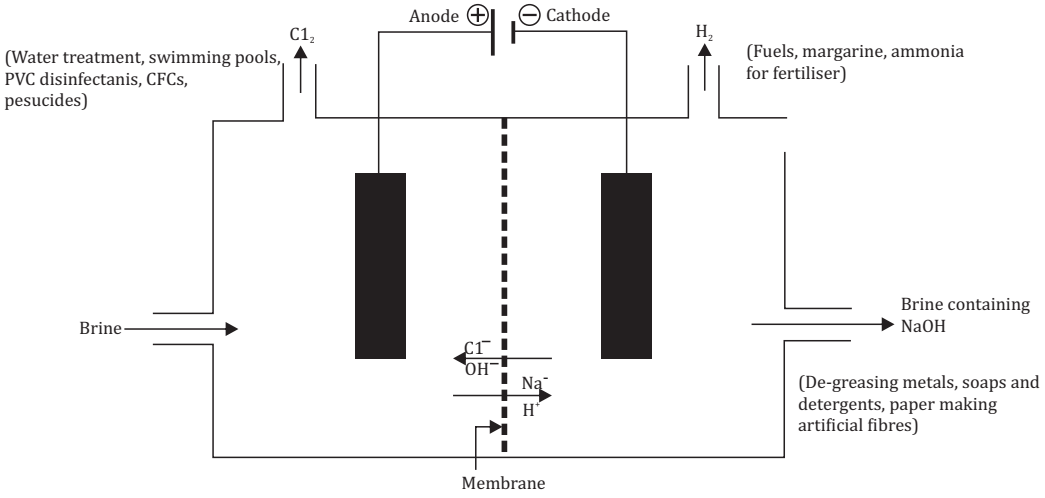


Figure 2.8 Important products from the chlor-alkali process

$$2NaCl + 2H_2O \rightarrow 2NaOH + Cl_2 + H_2$$

At anode : Cl_2 gas

At cathode : H_2 gas

Near cathode : NaOH solution is formed.

Uses :

H_2 : Fuels, margarine

Cl_2 : Water treatment, PVC, CFC's

HCl : Cleaning steels, medicines

NaOH : Degreasing metals, soaps and paper making

Cl_2 + NaOH $\rightarrow$ Bleach : Household bleaches, bleaching fabrics

2. Bleaching Powder ($CaOCl_2$) : It is produced by the action of chlorine on dry slaked lime.

$$Cl_2 + Ca(OH)_2 \rightarrow CaOCl_2 + H_2O$$

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.

3. Baking Soda (Sodium Hydrogen Carbonate) ($NaHCO_3$) :

$$NaCl + H_2O + CO_2 + NH_3 \rightarrow NH_4Cl + \underset{\text{Baking soda}}{NaHCO_3}$$

- 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.

(b) An ingredient in antacid.

(c) Used in soda acids, fire extinguishers.

4. Washing Soda ($Na_2CO_3.10H_2O$) : Recrystallization of sodium carbonate gives washing soda. It is a basic salt.

$$Na_2CO_3 + 10H_2O \rightarrow Na_2CO_3.10H_2O$$

Uses :

(a) In glass, soap and paper industry.

(b) Manufacture of borax.

(c) Cleaning agent for domestic purposes.

(d) For removing permanent hardness of water.

5. Plaster of Paris (Calcium sulphate hemihydrates) ($CaSO_4.½H_2O$) :

On heating gypsum ($CaSO_4.2H_2O$) at 373K, it loses water molecules and becomes Plaster of Paris (POP).

It is a white powder and on mixing with water it changes to gypsum.

$$CaSO_4.½H_2O + 1½H_2O \rightarrow CaSO_4.2H_2O$$

Uses :

(a) Doctors use POP for supporting fractured bones.

(b) For making toys, material for decoration.

(c) For making surfaces smooth.

Water of Crystallization : It is a fixed number of water molecules present in one formula unit of a salt.

E.g., $CuSO_4.5H_2O$ has 5 water molecules.

$Na_2CO_3.10H_2O$ has 10 water molecules.

$CaSO_4.2H_2O$ has 2 water molecules.

VERY SHORT ANSWER TYPE OF QUESTION (1 MARK)

Q. 1 To protect tooth decay we are advised to brush our teeth regularly. The nature of tooth paste used is-

a) acidic b) neutral c) basic d) corrosive

Q. 2 A compound x in aqueous solution turns red litmus solution into blue Identify 'x'

a) Hydrochloric acid b) Ammonium hydroxide sol

c) Sodium chloride solution d) Vinegar

Q. 3 Which one is stronger acid with pH=5 or with pH=2.

Q. 4 What happens when chlorine is passed over dry slaked lime.

(CBSE-2010, 2011)

Q. 5 Dry HCl gas does not change the colour of dry blue litmus paper why?

Q. 6 Fill in the blanks-

a) The chemical formula of plaster of paris is _____.

b) Neutral substances have a pH=_____.

c) Gold can be dissolved in_____.

d) Commonoly used antacid is _____.

Q. 7 Given below are the results of solution tested with universal indicator (pH paper)

(i) Sulphuirc and ..... Red.

(ii) Metal Polish ..... Dark Blue.

(iii) Milk of Mapnesia ..... Light blue.

(iv) Liquid Soop ..... Yellow.

(v) Over cleaner ..... Purple.

(vi) Car battery acid ..... Pink.

Arrange the solutions in increasing order of their pH.

Q. 8 Complete the following reaction-

I) $Na_2C0_3 + HCl \longrightarrow$

ii) $NaOH + HCl \longrightarrow$

iii) $CuO + HCl \longrightarrow$

iv) $Zn + NaOH \longrightarrow$

v) $Ca(OH)_2 + Cl_2 \longrightarrow$

Q.9 Fill the missing data in following table

	Name of salt		**Salt obtained**	
	Formula		**Base**	**Acid**
1	Ammonium chloride	NH_4Cl	NH_4OH	_____
2	Copper sulphate	$CuSO_4$	_____	H_2SO_4
3	Sodium Chlorede	NaCl	NaOH	_____
4	Magnesium Nitrate	$Mg(NO_3)_2$	_____	HNO_3
5	Potassium sulphate	K_2SO_4	_____	_____
6	Calcium nitrate	$Ca(NO_3)_2$	$Ca(OH)_2$	_____

Q. 10 Classify into strong and weak acid-

Hydrochloric acid, Formic acid nitric acid, acetie acid, Sulphuric acid, citric acid (NCERT Exemplar)

Answer

1 c)

2 b)

11. Name the acid present in ant sting.

12. What happens when egg shell is added to nitric acid ?

13. Name a salt which does not contain water of crystallization.

14. Name two constituents of baking powder.

15. What is the pH of gastric juices released during digestion ?

16. Which solution is used to dissolve gold ?

17. How will you test a gas which is liberated when HCl acid reacts with an active metal ?

18. Why does flow of acid rain water into a river make the survival of aquatic life in the river difficult ?

19. When conc. acid is added to water, whether the process is exothermic or endothermic ?

20. Which by-product of chlor-alkali process is used for manufacturing bleaching powder ?

Practical Based MCQ's

1. On putting a drop of liquid on a pH paper a student observes a small patch of blue color on pH paper. The liquid is most probably-

a) H_2O b) HCl c) NaOH d) H_2SO_4

2. The correct method of finding the pH of solution is—

a) Heat the solution in test-tube and expose the pH paper to the vapours formed—

b) Pour solution on pH paper

c) Dip the pH paper in solution

d) Put a drop of solution on pH paper using dropper (CBSE-2011)

3. The colour obtained on pH paper for highly acid basic and neutral solutions are respectively.

a) blue, orange, green

b) yellow, blue, green

c) red, blue, green

d) red, green, blue

4. Four student- 'A', 'B', 'C' and D measured pH value of water, lemon juice and sodium bicarbonate solution. The student who has expressed correct pH values in decreasing order.

a) Water > lemon juice > Sod. bicarbonate solution

b) Lemon juice > Water > Sod. bicarbonate solution

c) Sod. bicarbonate solution > water > lemon juice

d) Water > Sod. bicarbonate solution > lemon juice (CBSE-2010)

5. If we add some sodium carbonate in distilled water, the pH of solution will be-

a) less than 7

b) more than 7

c) exactly 7

d) very close to 7

6. Dil HCl is added to sodium carbonate. It is observed that:-

a) No change takes place

b) A loud sound is produced immediately

c) Immediately a brick effervescence occur

d) The solution turns black.

7. A student added Zn grannules to dil HCl and made following observations:-

I) The surface of Zn become black

ii) A colourless gas evolved which burns with pop/sound

iii) The solution remains colurless

The correct observations are-

a) I and II b) I and III c) II and III d) I, II and III

8. Four students performed reactions of zinc and sodium carbonate with dil Hydrochloric acid sodium hydroxide and present their result as follows.

The (✓) represent evolution of gas and 'x' represent no reaction.

A

	Zn	Na_2CO_3
HCl	✓	✓
NaOH	✓	×

B

	Zn	Na_2CO_3
HCl	✓	×
NaOH	✓	✓

C

	Zn	N_a2C03
HCl	×	×
NaOH	✓	✓

D

	Zn	Na_2CO_3
HCl	✓	✓
NaOH	×	×

The right set of observation is

a) A b) B c) C d) D

9. A colourless and odourless gas is liberated when hydrochloric acid is added to solution of Sod. carbonate. The name of gas is -

a) Carbon dioxide
b) Nitrogen dioxide
c) Sulphur dioxide
d) Sulphur trioxide

10. When did HCl reacts with Zn metal the gas liberaled is -

a) Oxygen b) Nitrogen c) Chlorine d) Hydrogen

Multiple Choice Questions

1. An acid can react with

   (a) AgCl (b) Na2CO_3 (c) $AgNO_3$ (d) None of the above

2. Which of the following statement is correct?

   (a) Both bases and alkalies are soluble in water

   (b) Alkalies are soluble in water but all bases

   (c) Bases are soluble in water but all alkalies are

   (d) C_2H_5OH is a base because it has OH in its formula

3. Solution A,B,C and D have pH 3,4,6 and 8 respectively. the solution with highest acidic strength is

   (a) A (b) B (c) C (d) D

4. A solution blue litmus red the pH of the solution will be

   (a) 8 (b) 10 (c) 12 (d) 6

5. Which of the following is a neutral salt

   (a) NaCl (b) Na_2SO_4 (c) KCl (d) all of the above

6. Which of the following correctly represents the molecular formula of washing sode?

   (a) Na_2CO_3 (b) $Na_2CO_3H_2O$

   (c) $Na_2CO_35H_2O$ (d) $Na_2CO_310H_2O$

7. Gypsum salt is

   (a) $CaSO_42H_2O$ (b) Ca_2SO_4 (c) $CaSO_4.½H_2O$ (d) $CaSO_4.½H_2O$

8. Which of the following is used in making tyos?

   (a) $CaSp_4.2H_2O$ (b) $Na_2SO_4.10H_2O$

   (c) $CaSO_4.½H_2O$ (d) $CaSO_4.½H_2O$

9. The type of medicine used to treat indigestion is hyperacidity is

   (a) antibiotic (b) antacid (c) sulpha drug (d) pain killer

10. Which one of the following is a weak acid

    (a) HCl (b) H_2CO_3 (c) HNO_3 (d) H_2SO_4

Assertion and Reason type of questions

In the following questions a statement of Assertion is followed by a statement are given-one labeled Assertion (A) and the other labeled Reason (R). Selected 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 correct explanation of the assertion.

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

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

1. **Assertion (A):** Salts are the products of the an acid- base reaction.

   Reason (R): Salt may be acidic or basic.

2. **Assertion (A):** NaCl is a basic salt.

   Reason (R): On passing electricity aqueous solution of NaCl forms NaOH.

3. **Assertion (A):** The acid must always be added slowly to water with contant stirring.

   Reason (R): The process of dissolving an acid in water is a highly exothermic.

4. **Assertion (A):** A scale for measuring hydrogen ion concentration in a solution, called pH scale.

   Reason (R): Values less than 7 on the pH scale represent an acidic solution.

5. **Assertion (A):** Ammounium chloride is a basic salt.

   Reason (R): Slats of strong acid and weak base are acidic with pH value less than 7.

SHORT ANSWER TYPE OF QUESTIONS (2 and Marks)

1. Why does bleaching powder smell strongly of chlorine and does not dissolve completely in water ?
2. Hold one moist and one dry strip of blue litmus paper over dry HCl acid gas. Which strip will turn red and why ? show the change in colour.
3. What is Plaster of Paris ? How is it obtained from gypsum ?
4. What is the role of toothpastes in preventing cavities ?
5. Explain why sour substances are effective in cleaning copper vessels ?
6. A white powder is added while baking breads and cakes to make them soft and fluffy. What is the name of the powder ? What are its main ingredients ?
7. How washing soda is prepared from baking soda ?
8. Though the compounds such as glucose and alcohol have hydrogen atoms in their molecule, yet they are not categorized as acids. Why ?
9. What is the reaction called when an acid reacts with base to produce salt and water ? Give example also.
10. Why pickles and curd are not stored in copper and brass utensils ?
11. On passing excess CO_2 through lime water, it first turns milky and then becomes colourless. Explain why ? Write chemical equations.
12. How are bases different from alkalis ? Are all bases alkalis ?
13. While constructing a house, a builder selects marble flooring and marble top for kitchen where vinegar and juices of lemon, tamarind etc. are more often used for cooking. Will you agree to this selection and why ?
14. Indicate with the help of a diagram the variation of pH with change in concentration of H^+ (aq) and OH^- (aq) ions.
15. Write the name and formulae of three hydrated salts.
16. What happens when calcium carbonate is made to react with hydrochloric acid ? Give the equation of reaction.

17. Why metallic oxides are called basic oxides and non-metallic oxides are called acidic oxides ?

18. What is pH scale ? What is pH value of salt formed by a
    (a) weak acid and strong base ?
    (b) strong acid and strong base ?

Q.19 A metal compound 'A' reacts with dil H_2SO_4 to produce a gas which extinguisher a burning candle. Identify compound 'A' and gas produces. Write a balanced chemical equation for the reaction if one of compound formed is sodium sulphate (CBSE-2016)

Q.20 The pH of salt used to make tasty and crispy pakoras is 14. Identify and write the chemical equation for its formation list its two uses. (CBSE-2018)

Q.21 A compound which is prepared by gypsum has the property of hardening when mixed with water identify and write its chemical formulae. Write the chemical equation for preperation and mention any one use of it? (CBSE sample paper-2018)

Q.22 Identify the acid and base which form sodium hydrogen carbonate. Write the chemical equation in support of your answer state whether the compound is acidic, basic or neutral. Also write the pH. (CBSE-2019)

Q. 24 2ml of sodium hydroxide solution is added to few pieces of grannulated Zn metal taken in test-tube. When the contents are warmed, a gas is evolved which is bubbled through soap solution before testing. Write the equation of chemical reaction involved and test to detect gas. Name the gas which will be evolved when same metal reacts with solution of strong acid. (CBSE-2018)

Long Answer Type of Questions (5 Marks)

1. What is water of crystallisation? write the common name and chemical formula of a commercially important compound which has 10 molecules of water how is this compound obtained? Write its chemical equation also. List any two uses of this compound.
2. Identify the compound X on the basis of the reactions given below, Also write the name and chemicals formula of A,B and C.
3. An element P does not react with dil H2SO4. It forms an oxide PO which turns red litmus into blue. Will you call P as a metal or a non-metal? Justify your answer.
4. What is the chemical name and formula of bleaching power. What happens when bleching powder is exposed to air for long time? Give any two important uses of bleaching powder.

Case Study

Read the passage carefully and answer the questions:

There are many substances which show one colour or odour in the acidic medium and a different colour or odour in the basic medium. Such substances are called acid-base indicators. An indicator is a weak acid or base that is added to the analyte solution, and it changes colour when the equivalence point is reached . Let's take the real-life example of our fish tank. Over time, plants, rocks, and the fish themselves will alter the pH of the water. Most fish can adjust to a pH that changes slowly over time, but are very sensitive to sudden changes in pH . So when it's time to clean the tank and add new water, we should add water that is near the pH of what the fish have been swimming in and fish do not get a pH shock. To test a solution that whether it is acidic, basic or neutral, we use indicators.There are 3 types of indicators- Natural, Synthetic and Olfactory.

Indicator	**Colour in the neutral solution**	**Colour in the acidic solution**	**Colour in the basic solution**
Litmus	Purple	Red	Blue
Phenolphthalein	Colourless	Colourless	Pink
Methyl Orange	Orange	Red	Yellow

1. Which of the following will turn Blue litmus red?

   (a) Dry HCI (b) Aqueous HCI

   (c) Solution of HCI in Benzene (d) All the above

2. Phenolphthalein is

   (a) Yellow in acidic and pink in basic medium

   (b) Pink in acidic and colourless in basic medium

   (c) Colourless in acidic and pink in basic medium

   (d) Pink in acidic and yellow in basic medium

3. Methyl Orange is ..... in HCI and ..... in NaOH

   (a) red and yellow (b) red and red

   (c) yellow and red (d) yellow and yellow

4. A solution turns methyl orange yellow, the pH of the solution is probably-

   (a) 6 (b) 12

   (c) 2 (d) 7

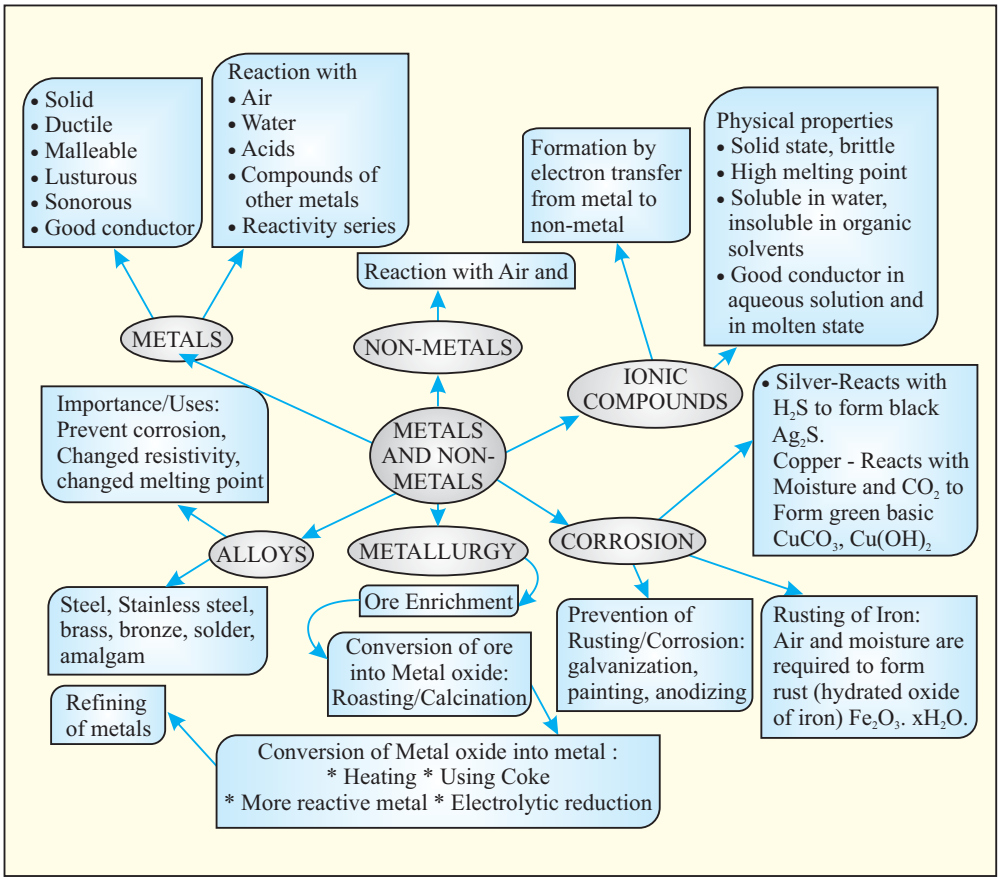
5. If the pH of a solution is 4.5 and you want to change its pH to 8. You will add

   (a) HCI (b) HNO_3

   (c) NaOH (d) H_2O

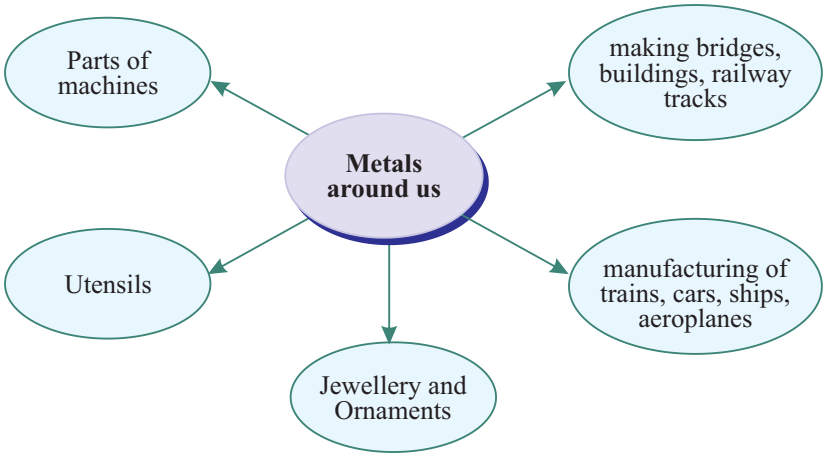
Chapter - 3

Metals And Non-Metals

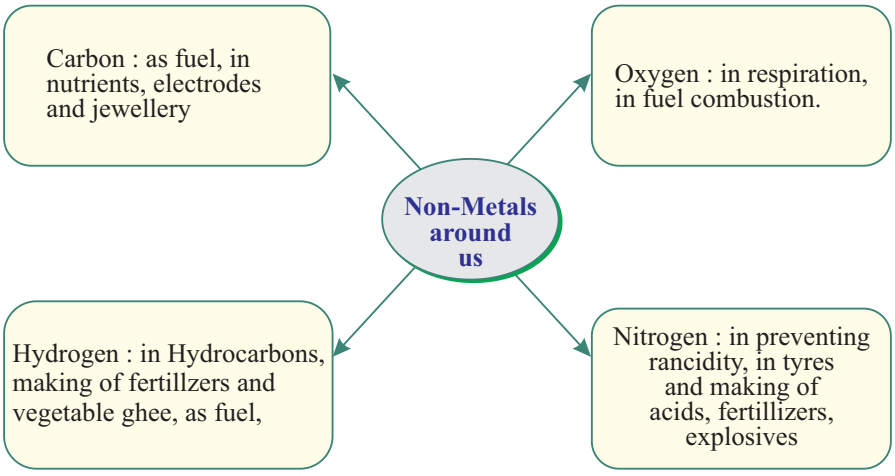


Metals and Non Metals

- About 118 elements are known till date. There are more than 90 metals, 22 non metals and few metalloids.
- Sodium (Na), Potassioum (K), Calcium (Ca), Magnesium (Mg), Iron (Fe), Aluminium (AI) are some metals.



- Oxygen(O), Nitrogen(N), Hydrogen(H), Sulphur(S), Phosphorus(P), Fluorine(F), Bromine(Br) are a few non metals



- Differences between metals and non-metals

Metals	Non-Metals
• Solid at room temperature except mercury	• Exist in all the three states, bromine is liquid
• Ductile and malleable	• Non-ductile and non-malleable
• Sonorous and lustruous	• Non-sonorous and non-lustruous except Iodine and graphite
• Generally have high melting, point, cesium and gallium have low melting point.	• Have low melting, except carbon.
• Generally good conductors of heat and electricity, except lead and mercury.	• Poor conductors, except graphite.
• Have high density, but sodium and potassium have low density.	• Have low density.
• Metal oxides can be basic or amphoteric in nature.	• Oxides of non-metals are acidic generallym in nature.
• Many, metals displace hydrogen from dilute acids and release hydrogen gas.	• Non metals cannot displace hydrogen from dilute acids.
• Metal oxides are ionic in nature.	• Non metal oxides are covalent in nature.

Chemical Properties of Metals

1. Reaction with air

Metals can either burn, react or don't react with air

Metal + Oxygen ⟶ **Metal oxide**

Some metals like Na and K are kept immersed in kerosene as they react vigorously with air. Metals like Mg, AI,Zn and Pb react slowly with air and form a protective layer. Mg can burn in air but combine with oxygen to form oxide Fe and Cu don't burn in air but combine with oxygen to form their oxides. Iron filings burn when sprinkled in the flame of burner. Silver, platinum and gold show no reaction with air.

$$2Na + O_2 \longrightarrow Na_2O$$

$$2Mg + O_2 \longrightarrow MgO$$

$$2Cu + O_2 \quad\quad CuO \text{ (black)}$$

- **Amphoteric oxides:** These are metal oxides which react with both acids as well bases. e.g. ZnO, AL_2O_3

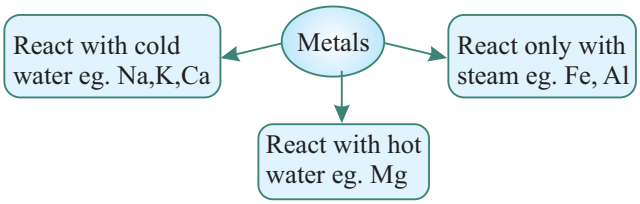
$$AL_2O_3 + 6HCl \longrightarrow 2AlCl_3 + 3H_2O$$

$$AL_2O_3 + 2NaOH \longrightarrow 2NaAlO_2 + H_2O$$

(Sodium aluminate)

- **Anodizing of metals:** In anodizing, aluminium is made anode and graphite as cathode, oxygen gas is released by the electrolysis of sulphuric acid, which reacts with aluminium to form a thick protective oxide layer.

2. **Reaction with water:** Metals react with water differently. Not all metals react with water



$$2K + 2H_2O \longrightarrow 2KOH + H_2$$

$$Ca + 2H_2O \longrightarrow Ca(OH)_2 + H_2$$

$$Mg + 2H_2O \longrightarrow Mg(OH)_2 + H_2$$

- In case, of Ca and Mg, the metal starts floating due to bubbles of hydrogen gas sticking to its surface.

$$2Al + 3H_2O(g) \longrightarrow Al_2O_3 + 3H_2$$

$$3Fe + 4H_2O(g) \longrightarrow Fe_3O_4 + 4H_2$$

3. **Reaction with dilute acids:**

(i) Most metals react with dilute HCl and dilute H_2SO_4 to form salt and hydrogen gas.

$$\text{Metal + dilute acid} \longrightarrow \text{salt + hydrogen gas}$$

$$Mg + 2HCl \longrightarrow MgCl_2 + H_2$$

$$Al + 6HCl \longrightarrow 2AlCl_3 + 3H_2$$

$$Zn + H_2SO_4 \longrightarrow ZnSO_4 + H_2$$

- Copper, mercury and silver don't react with dilute acids.

(ii) With dilute nitric acid: As metals react with dilute nitric acid, hydrogen gas produced is oxidised to water. Mg and Mn are exceptions.

Aqua Regia: It is a mixture of concentrated HCl and concentrated HNO_3 in a 3:1 ratio. It dissolves gold and platinum.

4. Reaction with other metal compounds:

Metal A + Salt solution of metal B ⟶ Salt solution of Metal A + Metal B

More reactive metals can displace less reactive metals from their compounds in solution. This forms the basis of reactivity series of metals.

- **Reactivity series of metals:** It is an arrangement of metals in decreasing order of their reactivity.

$$K > Na > Ca > Mg > Al > Zn > Fe > Pb > H > Cu > Hg > Ag > Au$$

Decreasing reactivity

$$Cu + 2AgNo_3 \longrightarrow Cu(NO_3)_2 + 2Ag$$

Copper being more reactive displace silver.

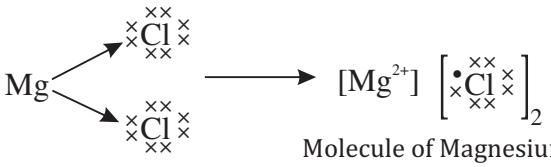
5. Reaction between metals and non-metals:

- Reactivity of elements can be understood as a tendency to attain a completely filled valence shells.
- Atom of metals lose valence electron(s) to form cations (+ve ions)
- Atoms of non-metals can gain electron(s) in valence shell to form anions (–ve ions)
- Oppositely charged ions attract each other forming an ionic compound.

Formation of $MgCl_2$

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

$$Cl + e^- \longrightarrow Cl^-$$



Molecule of Magnesium chloride

- Properties of Ionic compounds: Are solid and mostly brittle
- Have high melting and boiling points. More energy is required to overcome the strong inter-ionic force of attraction.
- Generally soluble in water, but insoluble in inorganic solvents like kerosene, petrol,etc
- Conduct electricity in aqueous solutions and in molten state. In both cases, free ions are formed and conduct electricity.

Occurance of Metals

- **Minerals:** Compounds present in earth's crust can be termed as minerals.
- **Ores:** Mineral from which metal can be economically extracted is called an ore e.g. sulphide ores, carbonate ores, oxide ores. Not all the minerals are ores.
- Metals at the bottom of reactivity series like gold, platinum, silver, copper occur in free state. But copper and silver also occur in sulphide and oxide ores.
- Metals of moderate reactivity (Zn, Fe,Pb) occur mainly as oxide, sulphide or carbonate ores Metals of high reactivity (K,Na,Ca,Mg,AI) are found in combined states.

  Gangue: Ores are found mixed with earthly impurities like soil, sand,etc. known as gangue. The gangue is removed from the ore.

  Metallurgy: It is the step-wise process of obtaining metal from its ore. These steps are

  1. Enrichment of ore.
  2. Obtaining metal from enriched ore.
  3. Refining of impure metal to obtain pure metal

  Obtaining Metals low in the reactivity series: These metals can be obtained by heating the ore in air at high tempertature.

* Mercury from cinnabar:

Sulphide $\xrightarrow{\Delta}$ oxide $\xrightarrow{\Delta}$ metal $\xrightarrow{\Delta}$ refining

HgS $\xrightarrow{\Delta}$ HgO $\xrightarrow{\Delta}$ Hg $\xrightarrow{\Delta}$ Hg(pure)

* Copper from copper sulphide

$$2Cu_2S + 3O_2 \xrightarrow{heat} 2Cu_2O + 2SO_2 \uparrow$$

$$2Cu_2O + Cu_2S \xrightarrow{heat} 6Cu + SO_2 \uparrow$$

EXTRACTING METALS IN THE MIDDLE OF ACTIVITY SERIES:

Metals are easier to obtain from oxide ores, thus, sulphide and carbonate ores are converted into oxides.

Metal ore heated strongly in excess of air (Roasting)

$$2ZnS + 3O_2 \xrightarrow{heat} 2ZnO + 2SO_2$$

Metal ore heated strongly in limited supply of air (Calcination)

$$ZnCO_3 \xrightarrow{heat} ZnO + CO_2$$

Reduction of metal oxide:

1. **Using coke:** Coke as reducing agent.

$$ZnO + C \xrightarrow{heat} Zn + CO$$

2. **Using Displacement Reaction:** highly reactive metal like Na, Ca and Al are used to displace melals of lower reactivity from their compounds.

$$MnO_2 + 4Al \xrightarrow{heat} 3Mn + 2Al_2O_3 + heat$$

$$Fe_2O_3 + 2Al \xrightarrow{heat} 2Fe + Al_2O_3 + heat$$

In the above reaction mclten iron is formed and is used to join railway tracks. This is called thermit reaction.

EXTRACTING METALS AT THE TOP OF ACTIVITY SERIES:

These metals

* Have more affinity for oxygen than carbon

* are obtained by electrolytic reduction. Sodium is obtained by electrolysis of its molten chloride

$$NaCI \longrightarrow Na^{+} + CI$$

As electricity is passed through the solution metal gets deposited at cathode and non-metal at anode.

At cathode:

$$Na^{+} + e^{+} \longrightarrow Na$$

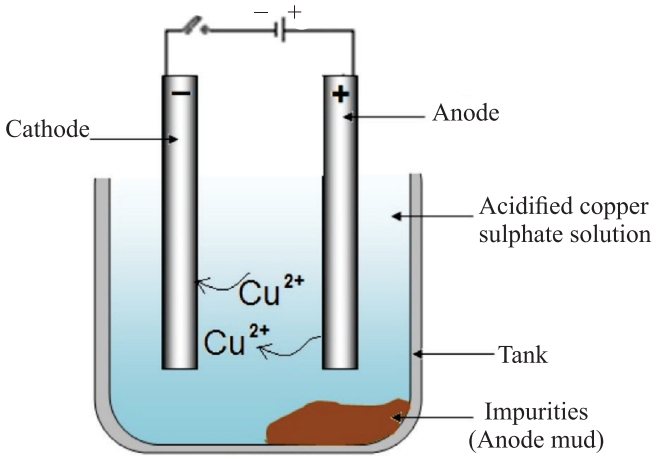
At anode:

$$2Cl^{-} \longrightarrow Cl_2 + 2e$$

REFINING OF METALS:

Impurities present in the obtained metal can be removed by electrolytic refining. Copper is obtained using this method. Following are present inside the electrolytic tank.

- Anode- slab of impure copper
- Cathode- slab of pure copper
- Solution aqueous solution of copper sulphate with some amount of dilute sulphuric acid ,
- From anode copper ions are released in the solution and equivalent amount of copper from solution is deposited at cathode.
- Insoluble impurities containing silver and gold gets deposited at the bottom of anode as anode mud.



CORROSION:

- Metals are attacked by substances in surroundings like moisture, acids, and moist air. Silver- it reacts with H_2S in air to form silver sulphide and articles become black.
- Copper- reacts with moist carbon dioxide in air and gains a green coat of basic copper carbonate
- Iron- acquires a coating of a brown flaky substance called rust. Both air and moisture are necessary for rusting of iron.

Prevention of Corrosion:

- Rusting of iron is prevented by painting, oiling, greasing, galvanizing, chrome plating, anodising and making alloys.
- In galvanization iron or steel is coated with a layer of zinc because zinc is preferably oxidized than iron.
- Alloys: these are mixture of metals with metals or non-metals Adding small amount of carbon makes iron hard and strong.
- Stainless steel is obtained by mixing iron with nickel and chromium. It is hard and doesn't rust. Mercury is added to other metals to make amalgam. Brass: alloy of copper and zinc. Bronze: alloy of copper and tin.
- In brass and bronze, melting point and electrical conductivity is lower than that of pure metal. Solder: alloy of lead and tin has low melting point and is used for welding electrical wires.

MULTIPLE CHOICE QUESTIONS (1 Mark)

1. Which of the following metal is obtained by electrolytic reduction process?

   (a) Cu (b) Ag

   (c) Fe (d) Al

2. Cinnabar is an ore of which metal?

   a. Tin b. Aluminium

   c. Magnesium d. Mercury

3. Which of the following does not conduct electricity?

   a. Solid KCI b. Fused KCI

   c. Aluminium d. Iron

4. Which of the following is not an ionic compound?
   (a) Sodium oxide (b) Carbon tetrachloride
   (c) Magnesium chloride (d) Sodium chloride
5. Which metal is associated with haemoglobin?
   (a) Calcium (b) Aluminium
   (c) Magnesium (d) Iron
6. The liquid non-metal is
   (a) Carbon (b) Hydrogen
   (c) Bromine (d) Chlorine
7. Choose the correct option for brass:
   (a) Cu-Hg (b) Cu-Mg
   (a) Cu-Fe (d) Cu-Zn
8. The colour of Iron(ll) sulphate soultion is
   (a) Blue (b) Yellow
   (c) Green (d) Orange

MCQ Correct Options:

1	2	3	4	5	6	7	8
D	D	A	B	D	C	D	C

1. Define the following terms: ores, gangue, rust, aqua regia, anodizing, amalgam
2. Show the reaction between zinc oxide and sodium hydroxide by a chemical equation.
3. Why food cans are coated with tin and not with zinc?
4. Name any two alloys whose electrical conductivity is less than that of pure metals.
5. Why ionic compounds have high melting point?
6. Which element is displaced by metals from acid?

In the following questions , two statements are given- one labeled Assertion (A) and the other labeled 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:** Metals have high melting point.

   Reason: Metals are found in solid state.

2. **Assertion:** Sulphide ores are roasted.

   Reason: It is easier to obtain metal from their oxides.

3. **Assertion:** Anode mud settles at the bottom of electrolytic tank.

   Reason: Anode mud contain soluble impurities.

4. **Assertion:** Zinc oxide is an amphoteric oxide.

   Reason: It reacts with acid as well as base to produce salt and water.

5. **Assertion:** Silver becomes brown in colour when exposed to air.

   Reason: It reacts with hydrogen sulphide and forms silver sulphide .

Read the following passage and answer the questions:

Elements are pure form of matter, which are divided into metals, non-metals and metalloids. Approximately three-quarters of all known chemical elements are metals. The most abundant varieties in the earth's crust are aluminum, iron, calcium, sodium, potassium, and magnesium. The vast majority of metals are found in their ores, but a few such as copper, gold, platinum, and silver frequently occur in the free state because they do not readily react with other elements.

1. Identify the metalloid:

   (a) Carbon (b) Silicon

   (c) Helium (d) Mercury

2. Choose the correct statement:

   (a) Metals form acidic oxides

   (b) Metal oxides cause acid rain

   (c) All metals react with hot water.

   (d) Metals form ionic chlorides.

3. Which metal is most abundant in earth's crust?
4. Why gold is used for making jewellery?
5. Which metal can be used for making electric wires: Pb or Al?

2 Marks

1. What is an amalgam? Write the constituent elements of solder.
2. Distinguish between :

   (a) Roasting and calcination (b) Mineral and ore
3. Write the chemical equation for heating of Cu and Fe respectively.
4. What is galvanization? How is it beneficial?
5. Why is hydrogen gas generally not evolved when metals react with dilute nitric acid.Name two metals which evolve hydrogen gas with the same acid.
6. Explain thermite process.
7. "Every ore is a mineral, but not every mineral an ore." Explain.
8. Why can highly reactive metals not obtained from their oxides using coke as a reducing agent?
9. Distinguish between metals and non-metals on the basis of chemical properties.

3 Marks

1. Ionic compounds are good conductors of electricity under specific conditions. Write the two conditions and give reason.
2. Why are metal sulphides and carbonates converted to oxides prior to reduction. Write the equation for the chemical reactions occuring during roasting and calcination of zinc ores.
3. What are alloys? How are they prepared? Name the alloy used for welding electric wires together.
4. Write the differences between electrolytic reduction and electrolytic refining.
5. Describe an activity to study conditions necessary for rusting of iron.
6. Show the formation of molecules of Magnesium oxide, aluminium oxide and potassium chloride by electron transfer.
7. Describe an activity to show the reaction between iron and steam.

5 marks

1. (i) Give reasons:
   (a) Platinum is used to make jewellery.
   (b) Lithium is stored under kerosene.
   (c) Aluminium is a highly reactive metal, yet it is used to make utensils for cooking.

   (ii) What is an allotrope? Explain the difference in properties of different allotropes of carbon.
2. Give a detailed account of steps of extracting pure copper from its ore.

HINTS to LA Questions

1. (a) Unreactive metal, donot get corroded by the action of moisture and atmospheric gases. Highly malleable, ductile

   (b)Lithium readily reacts with oxygen gas, formed oxide reacts with moisture producing hydrogen gas, which catches fire.

   (c) Strong and economical metal. Good conductor of heat. On exposure to air it forms aluminium oxide layer all around, which prevents oxidation of the metal inside.

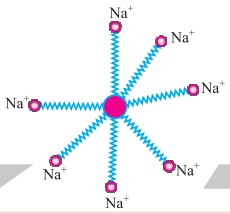
   (ii) Graphite: soft, good conductor of electricity, greyish

   Diamond: hardest natural substance, bad conductor of electricity, transparent.

2. Cu_2S ore. $Cu_2S + O_2 \longrightarrow Cu_2O + SO_2$

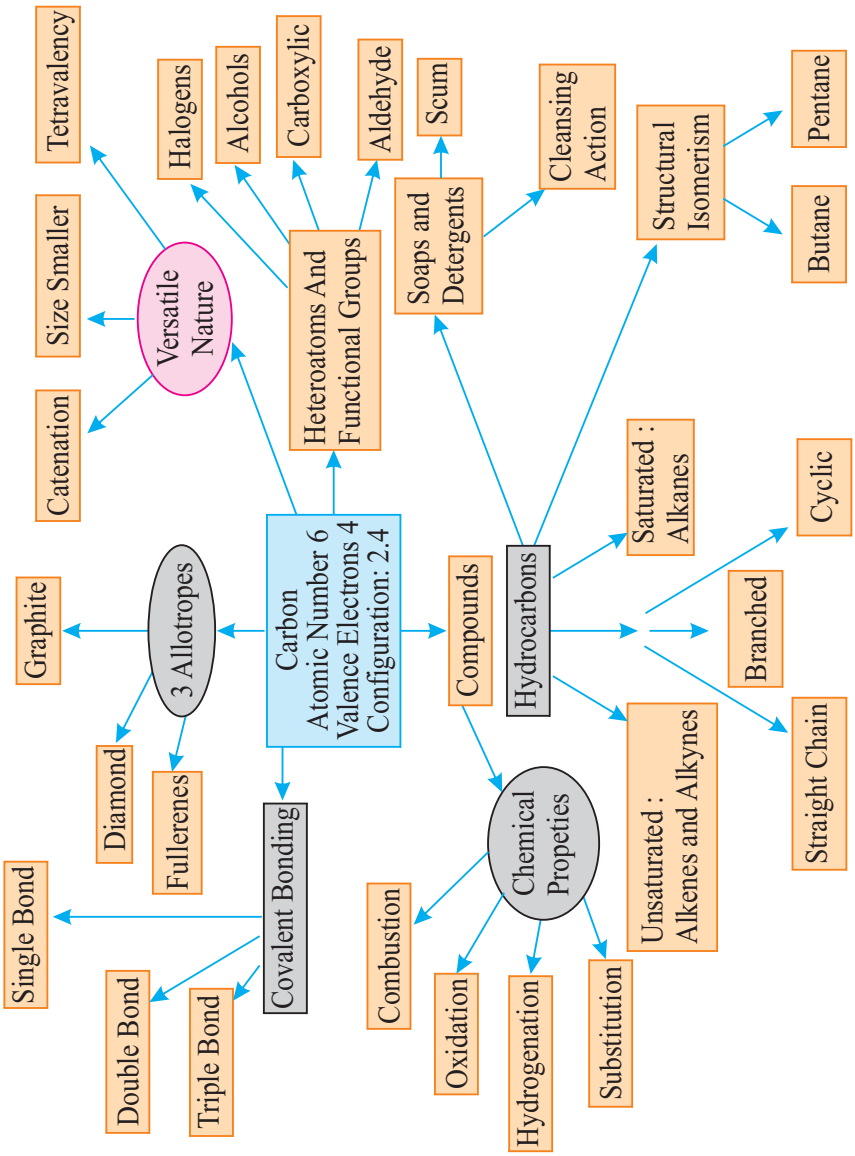
   $Cu_2S + Cu_2O \longrightarrow Cu + SO_2$

   * pure copper is obtained by electrolytic refining of impure copper.
   * Anode-Impure Copper, Cathode- Pure copper, Electrolytic solution- Aq. Solution of Copper sulphate with few drops of sulphuric acid.
   * Pure metal collects over cathode.



Chapter - 4

Carbon and its Compounds



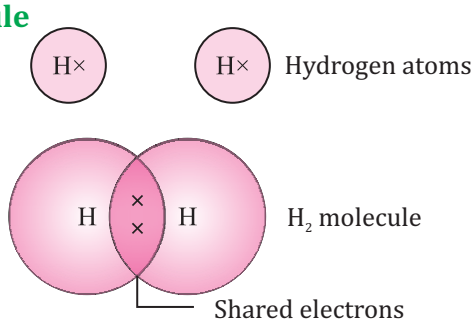
CARBON AND ITS COMPOUNDS

- Carbon is a versatile element.
- In earth's crust, carbon is 0.02% and found in form of minerals.
- Atmosphere has 0.03% of Carbon dioxide.
- All living structures are carbon based.
- Carbon is present in paper, plastic, leather and rubber.

COVALENT BOND IN CARBON

- The atomic number of carbon is 6 and its electronic configuration is 2, 4. To attain a noble gas configuration it can
    1. Gain 4 electrons: But it would be difficult for nucleus to hold 4 extra electrons, and is highly energy requiring process
    2. Lose 4 clectrons: But it would require a large amount of energy to remove 4 electrons.
- It is difficult thus for an atom of carbon to either gain or lose electrons.
- Carbon attains the noble gas configuration by sharing its valence electrons, with other atoms. Atoms of other elements like hydrogen, oxygen, nitrogen, chlorine also show sharing of valence electrons.
- Formation of H_2, O_2 and N_2 is shown as below:

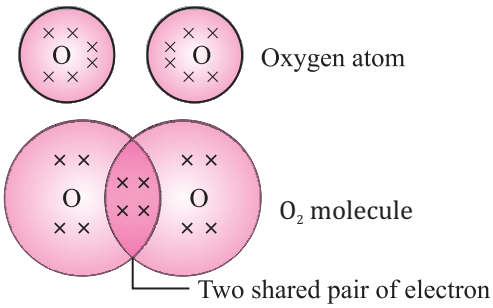
(i) H_2 molecule



A molecule of hydrogen

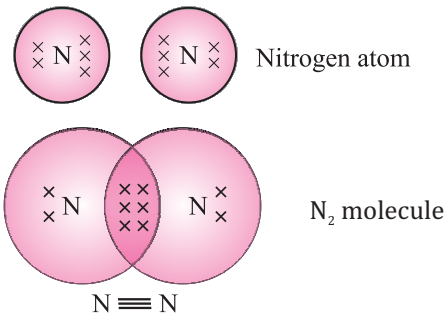
A molecule of hydrogen

(ii) O_2 molecule



Double bond between two oxygen atoms

(iii) N_2 molecule



Triple bond between two nitrogen atoms

- It is evident that the number of shared pair of electrons can be one, two or three. Try making the structures of H_2O and $+CH_4$
- Bond formed by the sharing of an electron pair between two atoms is called covalent bond.
- Covalently bonded molecules have low melting and boiling points because of comparatively weaker intermolecular forces, unlike ionic compounds.
- These molecules are generally poor conductor of electricity since no charged particles are formed.

Allotropes of carbon:

(i) Diamond

(ii) Graphite

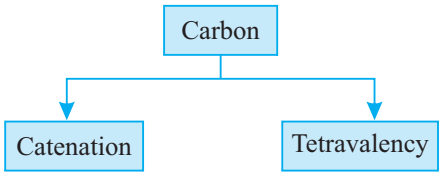
(iii) Fullerenes

These allotropes have same chemical properties. Difference between diamond and graphite

Diamond	Graphite
• It is hardest natural substance • It is bad conductor of electricity but good conductor of heat. • It is transparent	• It is soft. • It is good conductor of both heat and electrcity • It is opaque

VERSATILE NATURE OF CARBON ATOMS:

Two important properties of carbon atom enable carbon to form enormously large number of compounds.

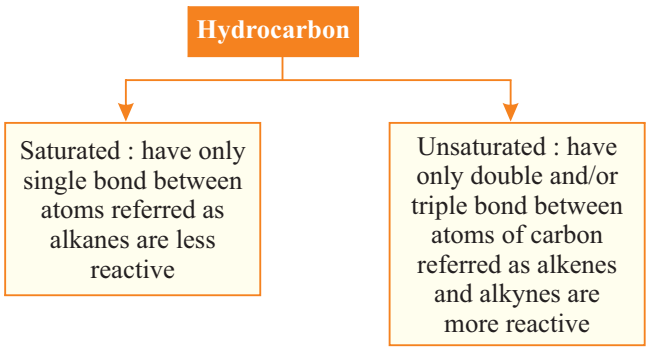


CATENATION: property of carbon atom to form bond with other atoms of carbon is called catenation. Like. carbon, silicon forms compounds with hydrogen upto seven or eight atoms of silicon.

TETRAVALENCY: Having a valency of 4, carbon atom is capable of bonding with atoms of oxygen, hydrogen, nitrogen, sulphur, chlorine and other elements.

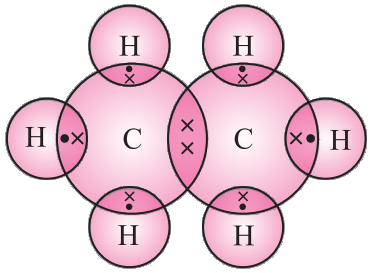
The smaller size of carbon atom enables nucleus to hold the shared pair of electrons strongly, thus carbon compounds are stable in general.

SATURATED AND UNSATURATED CARBON COMPOUNDS

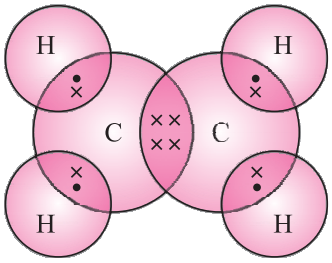


General formula of

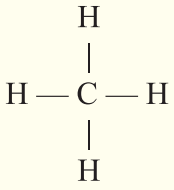
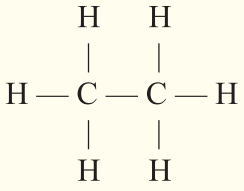
- ALKANE: C_nH_{2n+2} → $CH_4, C_2H_6, C_3H_8, C_4H_{10}, C_5H_{12}$
- C_nH_{2n} → $C_2M_4, C_3H_6, C_4H_8, C_5H_{10}, C_6H_{12}$
- ALKYNE: C_nH_{2n-2} → $C_2H_2, C_3H_4, C_4H_4, C_5H_8, C_6H_{10}$
- Electron dot structure of a saturated carbon compound, ethane (C_2H_6) is as follows:

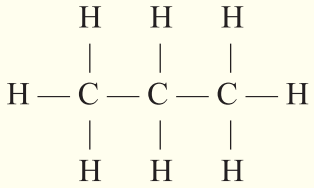
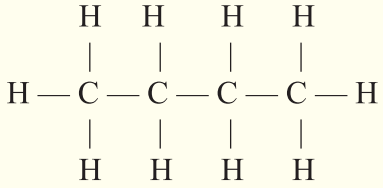
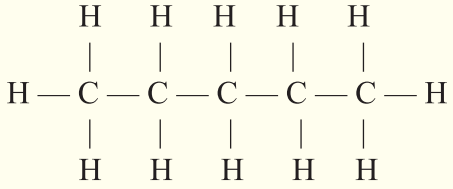


- Electron dot structure of an unsaturated carbon compound, ethene (C_2H_4) is as follows:



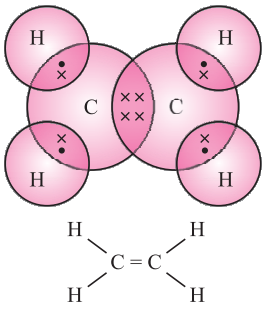
Formulae and structure of saturated compounds of carbon and

No. of carbon atoms	Name	Formula	Structure
1	Methane	CH_4	
2	Elhane	C_2H_6	

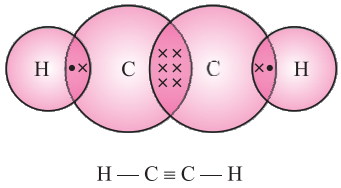
No. of carbon atoms	Name	Formula	Structure
3.	Propane	C_3H_8	
4.	Butane	C_4H_{10}	
5.	Pentane	C_5H_{12}	

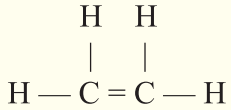
Electron Dot Structure of Unsaturated Hydrocarbons

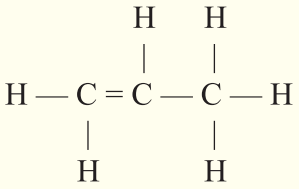
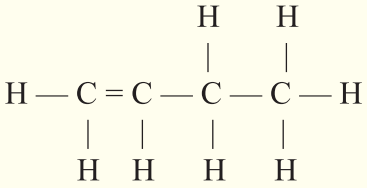
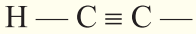
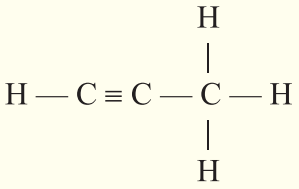
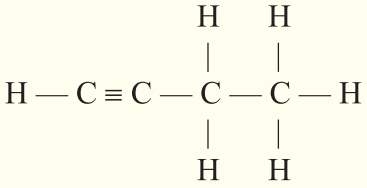
Ethene C_2H_4



Ethyne C_2H_2

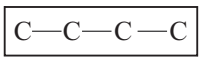


Name of Hydrocarbon	Molecular formula	Structural Formula
Alkenes : 1. Ethene	C_2H_4	

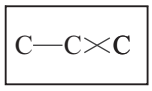
2. Propene	C_3H_6	
3. Butene	C_4H_8	
Alkynes :		
1. Ethyne	C_2H_2	
2. Propyne	C_3H_4	
3. Butyne	C_4H_6	

hydrogen

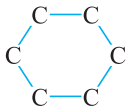
- On the basis of structures the hydrogcarbons can be:



Straight chain

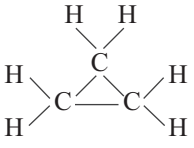


Branched

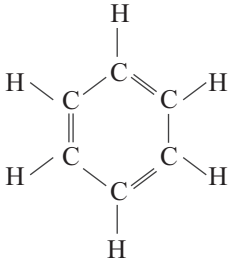


Cyclic Saturated

Cyclic unsaturated

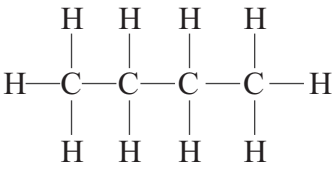


Cyclo-propane

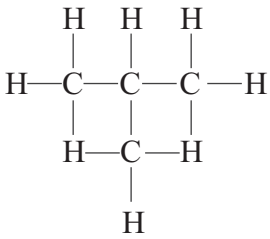


Benzene

- **Structural isomers:** these are the compounds having Identical molecular formula but different structures, for example, isomers of butane.



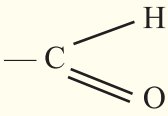
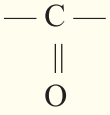
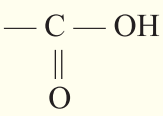
Straight Chain isomer



Branched isomer of butane

HETEROATOM AND FUNCTIONAL GROUP:

- ln hydrocarbon chain, one or more hydrogen atoms can be replaced by other atoms in accordance with their valencies. The element that replaces hydrogen is called a heteroatom.
- These heteroatoms and the group containing them impart chemical properties to the compound and hence are called functional groups.

Heteroatom	Functional Group	Formula
Cl/Br	Halo (Chloro/Bromo)	— Cl, — Br, — I
Oxygen	1. Alcohol	— OH
	2. Aldehyde	
	3. Ketone	
	4. Carboxylic acid	

HOMOLOGOUS SERIES:

- It is a series of compounds in which the same functional group substitutes for hydrogen in a carbon chain.
- For instance, the ALCOHOLSs: CH_3OH, C_2H_5OH, C_3H_7OH, C_4H_9OH.

- The successive member differs by -CH_2 unit and 14 units of mass.
- The chemical properties are imported by the functional group thus all members have similar chemical properties. But the members have different physical properties.
- The physical prcperties vary among the members of homologous series due to difference in their molecular mass.
- Melting point and boiling point increases with increasing molecular mass.

NOMENCLATURE OF CARBON COMPOUNDS:

1. Identify the number of carbon atoms in the compound.
2. Functional group is indicated either by prefix or suffix.

FUNCTIONAL GROUP	SUFFIX	PREFIX
Alkene	-ene	
Alkyne	-yne	
Alcohol	-ol	
Aldehyde	- al	
Ketone	-one	
Carboxylic acid	- oic acid	
chlorine	chloro -	

3. If a suffix is added, then final 'e' is removed from the name.eg. methanol (methane – e = methan + ol).

CHEMICAL PROPERTIES OF CARBON COMPOUNDS

1. COMBUSTION:

* Carbon compounds generally burn (oxidize) in air to produce carbon dioxide and water, and release heat and light energy.

$$CH_4 + 0_2 \longrightarrow CO_2 + H_2O + \text{heat and light}$$

* Saturated hydrocarbon burns generally with a blue flame in good supply of air and with a yellow sooty flame in limited supply of air.
* Sooty flame is seen when unsaturated hydrocarbons are burnt.
* Burning of coal and petroleum emits oxides of sulphur and nitrogen which are responsible for acid rain.

2. OXIDATION:

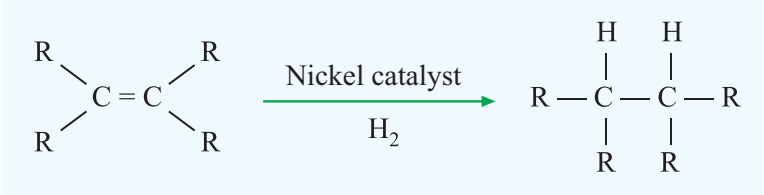
* Alcohols can be converted to caboxylic acids by oxidizing them using alkaline potassium permanganate or acidified poatassium dischromatee (they add oxygen to the reactant, thus are called oxidizing agents)

$$CH_3CH_2OH \xrightarrow[\text{Alkaline } KMnO_4]{\text{Acidified } K_2Cr_2O_7} H_3COOH + H_2O$$

3. ADDITION REACTION:

Hydrogen is added unsaturated hydrocarbon in presence of nickel platinum or palladium as catalyst.

Vegetable oils are converted into vegetable ghee using this process.



Saturated fatty acids are harmful for health and oils with unsaturated fatty acids should be used for cooking.

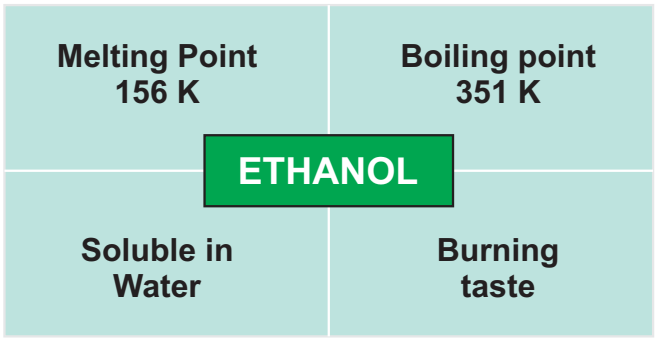
4. SUBSTITUTION REACTION:

In saturated hydrocarbons, the hydrogen attached to carbon can be replaced by another atom or group if atoms in presence of sunlight

$$CH_4 + Cl_2 \longrightarrow CH_3Cl + HCl \text{ (sunlight required)}$$

Important CARBON COMPOUNDS: ETHANOL AND ETHANOIC ACID

Ethanol:



* Consumption of dilute ethanol causes serious health issues and intake of pure alcohol is lethal.

Chemical properties of Ethanol

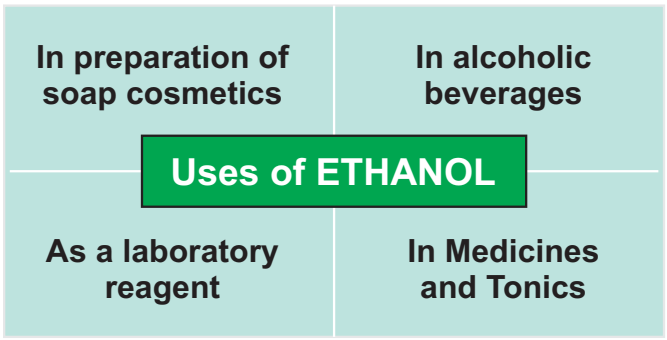
C_2H_5OH Reacts with sodium to form sodium ethoxide and hydrogen	When C_2H_5OH is heated with Concentrated sulphuric acid at 443 K, it is dehydrated to ethene

$$C_2H_5OH \longrightarrow C_2H_5ONa + H_2$$

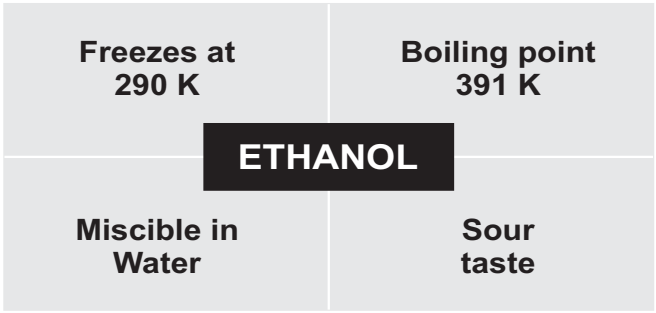
$$\downarrow \text{ conc. } H_2SO_4 \text{ at } 443°K$$

$$C_2H_4 + H_2O$$

(ethene)



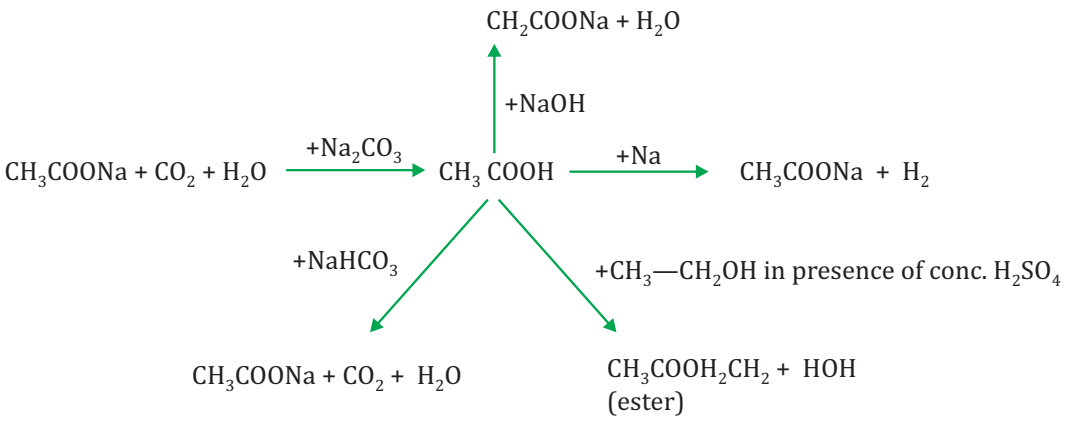
Ethanoic Acid (CH_3COOH)/Acetic Acid



* Pure acetic acid is called glacial acetic acid.

Ethanoic Acid:

	React with	Products
1.	Sodium	Sodium ethanoate and hydrogen
2.	Sodium Carbonate Na_2CO_3 sodium	Sodium ethanoate, carbon dioxide and water
3.	Sodium Bicarbonate $NaHCO_3$ sodium	Sodium ethanoate, carbon dioxide and water
4.	Ethanol (in presence of conc. sulphuric acid) $CH_3 - CH_2OH$	Ester and water



Esterification

Caboxylic acids react with alcohols in presence of few drops of concentrated sulphuric acid as catalyst and form sweet smelling compounds called ester.

HYDROLYSIS

On heating with an acid or a base, the ester forms back the original alcohol and carboxylic acid.

$$CH_3COOCH_2CH_3 + NaOH \longrightarrow CH_3COONa + CH_3—CH_2OH$$

$$CH_3COOCH_2CH_3 \xrightarrow[\text{Heat}]{\text{Dil. } H_2SO_4} CH_3COOH + CH_3—CH_2OH$$

*Alkaline hydrolysis of ester is also called saponification.

SOAPS AND DETERGENTS

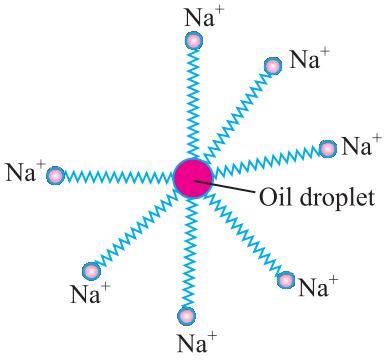
- Soap is sodium and potassium salt of carboxylic acids with long chain. ($C_{15}H_{31}COOH$) ($C_{17}H_{35}COOH$) (Palmitic acid, stearic acid)
- Soaps are effective with soft water only and ineffective with hard water.
- Detergents are ammonium or sulphonate salts of hydrocarbons with long chain, they are effective with both soft as well as hard water.

  An ionic part (hydrophillic) and a long hydrocarbon chain (hydrophobic) part constitutes the soap molecule

STUCTURE OF A SOAP MOLECULE

Cleansing action of Soaps:

- Most dirt is oily in nature and the hydrophobic end attaches itself with dirt, while the ionic end is surrounded with molecules of water. This result information of a radial structure called micelles.



- An emulsion is thus formed by soap molecule, the cloth needs to be mechanically agitated to remove the dirt particles from the cloth.
- Scum: The magnesium and calcium salts present in hard water reacts with soap molecule to form insoluble products called scum, thus obstructing the cleansing action. Use of detergents overcome this

problem as the detergent molecule prevents the formation of insoluble product and thus clothes get cleaned.

- Soaps are completely biodegradable, while detergents are not soaps are environmental friendly but detergents are not.

CARBON AND ITS COMPOUNDS IN BRIEF

- Carbon is a verstile non metal
- Carbon atom, like atoms of other non-metals like oxygen, nitrogen, hydrogen and chlorine shares electrons.
- Carbon forms large number of compounds due to catenation and tetravalency.
- Carbon can form single, double and triple covalent bonds
- The compound of hydrogen and carbon are called hydrocarbons which can be saturated or unsaturated.
- Structurally hydrocarbons can have straight chain, branches or cyclic structure.
- Difference in structual arrangement of same molecule gives the isomers.
- In a hydrocarbon, a hetcroatom can replace the hydrogen atom and impacts its chemical properties. Homologeous series is a series of compounds with same general formula and same chemical properties but different physical properties.
- Carbon based compounds are excellent fuels.
- Ethanol is an important industrial compound. It react with reactive metals and is also dehydrated to ethene.
- Ethanoic acid is another important compound. It combine with ethanol to form sweet smelling esters.
- Soaps and detergents are used as cleansing agents. Detergents efficiently cleanses with soft and hard water.

MULTIPLE CHOICE QUESTIONS

1. Which of the following metal is used as a catalyst in hydrogenation?

   a. Cu b. Ni

   c. Fe d. Na

2. The number of single bonds in hexane molecule are:
   a. 18 b. 19
   c. 20 d. 21
3. It is present in the molecule of N_2:
   a. Single bond b. Ionic bond
   c. double bond d. Triple bond
4. Which substance burns without producing flame?
   a. Candle b. Charcoal
   c. Wood d. LPG
5. It is a product of soap industry,
   a. Glycerol b. Glucose
   c. Ester d. Propanal
6. The third member of homologous series of alkyne is
   a. Hexyne b. Butyne
   c. Propyne d. Ethyne
7. Which of the following is used in cough syrups:
   a. Sugar-methanol b. Methanol
   c. Ethanol-methanol d. Sugar-ethanol
8. –CHO is :
   a. Carboxylic acid b. Ketone
   c. Aldehyde d. Alcohol

MCQ correct options:

1	2	3	4	5	6	7	8
B	B	D	B	A	B	D	C

Read the following passage and answer the questions:

Consumption of alcohol in large quantities slows down the metabolic processes and affects the central nervous system. It results in difficulties such as lack of coordination, mental confusions, drowsiness, lowering of normal inhibitions and finally stupor. Along with these harmful effects, ethanol is an important industrial solvent, it is used in different industries with water and with many organic solvents, including acetic acid,acetone,

benzene, carbon tetrachloride. It is used as fuel in jet engines in countries like Brazil.

1. Identify the heteroatom in ethanol.
   a. Carbon
   b. Hydrogen
   c. Bromine
   d. Oxygen
2. Which acid is constituent of vinegar?
   a. Ethanoic acid
   b. Carbonic acid
   c. Oxalic acid
   d. Lactic acid
3. Complete the following chemical equation.

   $C_2H_5OH + CH_3COOH \xrightarrow{\text{conc. } H_2SO_4}$ _____ + _____
4. Draw the structure of ethanol molecule.
5. Describe the harmful effects of consuming alcohol?

VSA 1 MARK

1. How does an atom of carbon attain noble gas configuration?
2. Draw the electron dot structure of molecule of CCl_4.
3. Define catenation.
4. The kerosene/gas stoves have inlets for air. Give reason.
5. Write only the balanced chemical equation for dehydration of ethanol by hot concentrated sulphuric acid.
6. Draw the structure for propyne.
7. Write the formula of first member of ketone.
8. What is an oxidising agent? Give example.
9. Which energy is used to convert methane into chloromethane?
10. Write a balanced chemical equation for burning of ethanol in oxygen.

In the following questions, two statements are given- one labeled 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: Butane is less reactive than butene.

   REASON: Presence of double bond increases the reactivity of molecule.

2. ASSERTION: Unsaturated hydrocarbons burn in air with blue flame.

   Reason: Incomplete combustion of hydrocarbons causes a yellow flame.

3. ASSERTION: Detergents are not environment-friendly.

   Reason: Detergents are not easily bio-degradable.

4. ASSERTION: Alkanes show addition reaction.

   Reason: Addition reaction is a charateristic property of unsaturated hydrocarbons.

5. ASSERTION: Pentane has three isomers.

   Reason: For structural isomerism hydrocarbons should have 4 or more carbon atoms.

2 Marks

1. Define saponification. Write a chemical equation for it.
2. Covalent compounds generally don't conduct electricity.Why?
3. Specify the condition due to which ethanol undergo oxidation to form ethanoic acid. Write the chemical equation.
4. Define structural isomerism. Draw the structures of two isomers of butane.
5. Identify the functional group in the following compounds, methanoic acid, methanal, bromo ethane and hexanol.
6. Why is ethanoic acid called as glacial acetic acid. Write the chemical equation for esterification.
7. Draw the structure of benzene.
8. Why are carboxylic acids known as weak acids? Name the alcohol which produces methanoic acid on oxidation.
9. A mixture of oxygen and ethyne is burnt for welding. Can you tell why a mixture of air and ethyne is not used?

10. (i) Which property of ethanol makes it suitable for making cough syrups and tincture iodine?

    (ii) What is the function of concentrated sulphuric acid in the formation of ethene from ethanol?

3 Marks

1. What is a homologous series? List any of its four features.
2. State any three charcteristics of structural isomers of any compound.
3. Propanal and propanone are structural isomers. Explain.
4. Explain why carbon atom is unable to form either cation or anion?
5. Describe substitution reaction with the help of an example.
6. Give a test that can be used to differentiate between saturated and unsaturated hydrocarbons.
7. Explain the formation of scum when hard water is treated with soap.
8. Distinguish between soap and detergent.
9. Describe the two properties of carbon which lead to the formation of huge number of compounds.

5 Marks

1. Explain the mechanism of the cleaning action of soaps with the help of diagram.
2. A neutral organic compound X of molecular formula C_2H_6O on oxidation with alkaline $KMnO_4$ gives compound Y. compound X and Y react on warming in presence of concentrated sulphuric acid to produce a sweet smelling substance Z. Identify X,Y and Z. Also write the corresponding chemical equations.

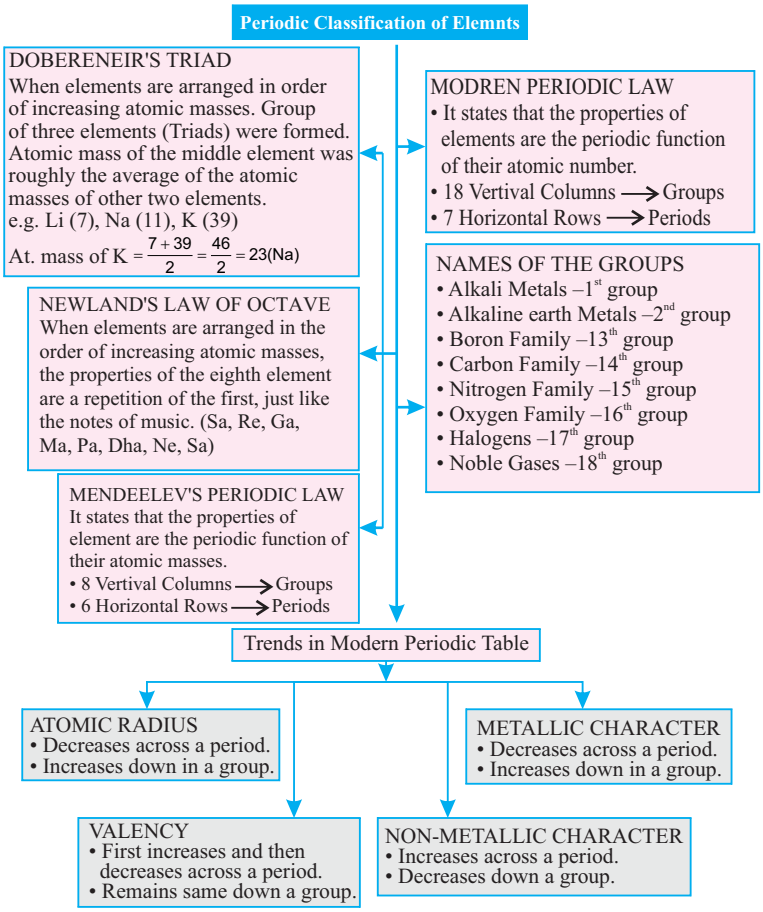
HINT

1. Soap molecule structure, application on wet dirty cloth, micelles formation process, mechanical agitation, suitable diagrams
2. X- ethanol, Y- ethanoic acid, Z- ester ethyl ethanoate, chemical equations.

Chapter - 5

Periodic Classification of Elements

- Matter around us is present in the form of elements, compounds and mixtures.
- Elements are substances containing atoms of only one type. *Eg.*, Na, Mg, Au, etc.
- There are 118 elements known to us. All these have different properties.



Need for Periodic Classification

- To make the study of these elements easy, these 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 Traids :** When elements were arranged in the order of increasing atomic masses, groups of three elements (known as traids), 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.

E.g.,

Elements	Atomic Mass
Ca	40.1
Sr	87.6
Ba	137.3

Limitations : Only three traids were recognized from the elements known at that time.

Li	Ca	Cl
Na	Sr	Br
K	Ba	I

- **Newland's Law of Octaves :**

  Newland arranged the then known elements in the order of increasing atomic masses and found that the properties of every 8th element is similar to that of the 1st element.

He compared this to the octaves found in music and called it the 'Law of Octaves'.

For example, the properties of lithium (Li) and sodium (Na) were found to be the same.

Newland's Octave

Sa	Re	ga	ma	pa	dha	ni
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 :

- It was applicable upto Calcium (for lighter elements only).
- Properties of new discovered elements did not fit into the law of octave.
- To fit elements into his table, Newlands put even two elements together in one slot and that too in the column of unlike elements having very different properties.

Mendeleev's Periodic Table : When elements are arranged in the order of increasing atomic masses, the element with similar properties occur at regular intervals. The properties of elements are a periodic function of their atomic masses.

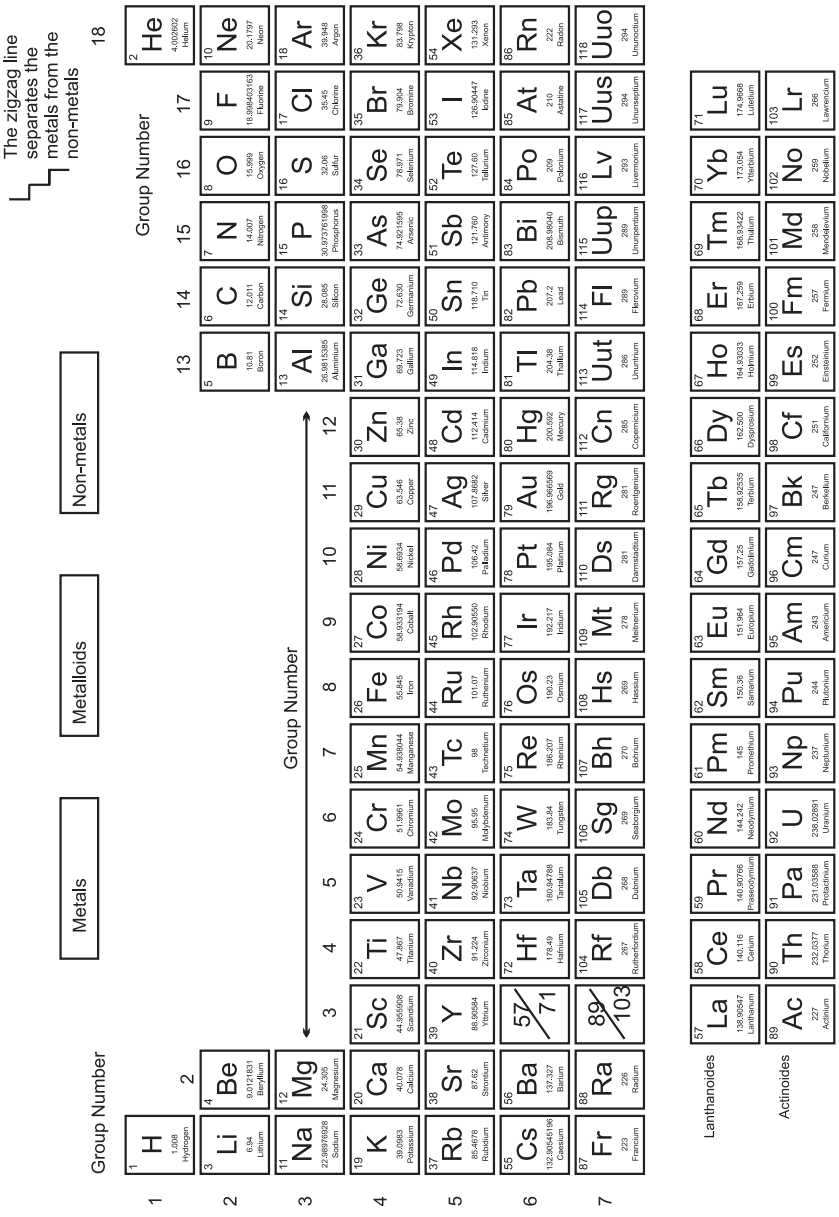
Mendeleev's periodic table is based on the chemical properties of elements. It contains 6 periods (horizontal rows) and 8 groups (vertical columns).

Table. Mendeleev's Periodic Table

Group	I	II	III	IV	V	VI	VII	VIII
Oxide	R_2O	RO	R_2O_3	RO_2	R_2O_5	RO_3	R_2O_7	RO_4
Hydride	RH	RH_2	RH_4	RH_4	RH_3	RH_2	RH	
Periods x	A B	A B	A B	A B	A B	A B	A B	Transition series
1	H 1.008							
2	Li 6.939	Be 9.012	B 10.81	C 12.011	N 14.007	O 15.999	F 18.998	
3	Na 22.99	Mg 24.31	Al 29.98	St 28.09	P 30.974	S 32.06	Cl 35.453	
4 First series :	K 39.102	Ca 40.08	Sc 44.96	Ti 47.90	V 50.94	Cr 50.20	Mn 54.94	Fe 55.85 Ce 58.93 Ni 58.71
Second series :	Cu 63.54	Zn 65.37	Ga 69.72	Ge 72.59	As 74.92	Se 78.96	Br 79.909	
5 First series :	Rb 85.47	Sr 87.62	Y 88.91	Zr 91.22	Nb 92.91	Mo 95.94	Tc 99	Ru 101.07 Rh 102.91 Pd 106.4
Second series :	Ag 107.87	Cd 112.40	In 114.82	Sn 118.69	Sb 121.75	Te 127.60	I 126.90	
6 First series :	Cs 132.90	Ba 137.34	La 138.91	Hf 178.49	Ta 180.95	W 183.85		Os 190.2 Ir 192.2 Pt 195.09
Second series :	Au 196.97	Hg 200.59	Tl 204.37	Pb 207.19	Bi 208.98			

Modern Periodic Table

- Atomic number of an element is a more fundamental property than its atomic mass.
- According to the Modern Periodic law : The properties of elements are a periodic function of their atomic number.
- All the anomalies of Mendeleev's classification disappear.



Modern Periodic Table

Merits of Mendeleev's Periodic Table

(i) Some gaps were left for the undiscovered elements like gallium (Ga), Scandium (Sc) and Germanium (Ge).
(ii) Predict properties of elements on the basis of their positions in the periodic table.
(iii) Accommodate noble gases when they were discovered without disturbing the original arrangement.

Limitations of Mendeleev's Classification

(i) Position of isotopes could not be explained.
(ii) No fixed position for hydrogen.
(iii) Wrong order of atomic masses of some elements could not be explained.

Explanation of the Anomalies :

(i) Explanation for the position of isotopes (Same atomic number put at one place in the same group).
(ii) Cobalt with atomic number 27 came first and nickel (28) should come later.
(iii) Unlike atomic masses, atomic number is always a whole number, so there is no element between hydrogen and helium.

- **Atomic Number** : It is denoted by Z and equal to the number of protons in the nucleus of an atom.
- Modern Periodic table has 18 vertical columns known as 'groups' and 7 horizontal rows known as 'periods'.
- Elements with same number of valence electrons are placed in the same group. For example,
  Li : 2, 1 Na : 2, 8, 1 K : 2, 8, 8, 1

Outermost or valence shell in all the three contains 1 electron. These elements have been placed in the same group.

- Number of shells increases as we go down the group.
- Elements with same number of occupied shells are placed in same period. For example, Li (2, 1); Be (2, 2); B (2, 3), C (2, 4), N(2, 5). These elements have same number of shells (two).
- Each period marks a new electronic shell getting filled.
- Number of elements placed in a particular period depends upon the fact that how electrons are filled into various shell.
- Maximum number of electrons that can be filled in a shell is given by $2n^2$

where n is shell number.

E.g., K shell $n = 1$ or $2n^2 = 2(1)^2 = 2$ First period has 2 elements.

L shell $n = 2$ or $2n^2 = 2(2)^2 = 8$ Second period has 8 elements.

- Position of an element in the periodic table tells us its chemical reactivity.
- Valence electron determine the kind and number of bonds formed by the element.

Trends in the Modern Periodic Table

Valency is the combining power of an element with other atoms when it forms a chemical compound.

Or

Valency is equal to number of electrons gained or lost or shared to complete its octet or doublet. Valency = 8 – No of electrons in valence shell ≥ 4

= No of electrons in valence shell ≤ 4

On moving from left to right in each period, the valency of elements increases from 1 to 4 and then decreases to 0.

Third period elements	Na	Mg	Al	Si	P	S	Cl	Ar
Valency	1	2	3	4	3	2	1	0

Valency remains the same down in a group.

Atomic size : Atomic size refers to the radius of an atom. It may be visualized as the distance between the centre of the nucleus and the outermost shell.

- Atomic size or radius of an atom decreases as we move from left to right in a period because due to large +ve charge on the nucleus, the electrons are pulled in more close to the nucleus and size decreases. *E.g.,*

Third period elements	Na	Mg	Al	Si	P	S	Cl
Atomic radii (Pm)	186	160	143	118	110	104	99

- Atomic size increases as we move down the group because new shells are being added and this increases the distance between nucleus and outermost electron.

Group I	Lithium	Li	152	Atomic radii (pm) ↓
	Sodium	Na	186	
	Potassium	K	231	
	Rubidium	Rb	244	
	Casium	Cs	262	
	Francium	Fr	270	

Metallic Character

- Metallic character means the tendency of an atom to lose electron.
- Metals occupy the left hand side of the periodic table.
- On moving left to right in a period, the metallic character of an element decreases because the effective nuclear charge increases. It means tendency to lose electron decreases.
- Metals are electropositive as they tend to lose electrons while forming bonds.
- Metallic character increases as we go down a group as the effective nuclear charge is decreasing.

Non-metallic Character

- Non-metals are electronegative as they tend to form bonds by gaining electrons.
- Non-metals occupies the right side of the periodic table.
- Non-metallic character increases across a period because due to increase in effective nuclear charge that means tendency to gain electron increase.
- Non-metallic character decreases as we move down a group due to decrease in effective nuclear charge experienced by the valence electron thus the tendency to gain electron decreases.
- In the middle of periodic table we have semi-metals or metalloid because they exhibit some properties of metals and non-metals.
- Oxides of metals are basic in nature while oxides of non-metals are acidic in nature.

	Property	Variation across Periods	Reason	Variation along Groups	Reason
1.	Atomic size	Decrease	Due to increase in nuclear charge, or resulting in stronger force of attraction which causes shrinking.	Increases	Due to addition of new shells, the distance between outermost electron and nucleus increases.

2.	Metallic character	Decreases	Due to increase in effective nuclear charge, tendency to lose valence electrons decreases.	Increases	Decrease in effective nuclear charge experienced by valence electrons. Tendency to lose electrons increases.
3.	Non-metallic character	Increases	Due to increase in effective nuclear charge, tendency to gain electrons increases.	Decreases	Due to decrease in effective nuclear charge experienced by valence electrons (due to addition of new shells) tendency to gain electrons decreases.

QUESTIONS

VERY SHORT ANSWER TYPE OF QUESTIONS (1 Mark)

1. Write the principle of modern periodic table.
2. On which side of periodic table you will find metals.
3. On which side of periodic table you will find-non-metals.
4. Name the elements that separated the metals and non-metals in periodic table .
5. An element 'x' belongs to groups 2. Find its valency.
6. An elements 'y' belongs to group 1. Find formula for its oxide.
7. Name the element that has same number of electrons as that of K^+ and Cl^- have.
8. Write down three elements that show Dobereiner's triad.
9. Write down two drawbacks of Newland's law of octaves
10. What was the need for classification of elements ?

11. Which important property did Mendeleev used to classify the elements in his periodic table ?
12. What do you mean by valency ?
13. How many elements are known till date ?
14. State Modern Periodic law.
15. Name the elements and its valency having electronic configuration 2, 8, 3.
16. How many rows and columns are there in modern Periodie table.
17. Why properties of elements of same period are deffernt.

MULTIPLE CHOICE QUESTIONS

1. Which of the following combination of elements belong to the same period of Mendeleev or Modern Periodic Table.
   a. Li,Mg b. Al, Si
   c. B.Al d. C,S
2. Which of the following remains unchanged on descending a group in the periodic table.
   a. Valence electrons b. Atomic size
   c. Metallic Character d. all of the above
3. The highly metallic element will have the electronic configuration of
   a. 2,8,7 b. 2,8,8,5
   c. 2,8,8.1 d. 2,8,2
4. Element having the smallest size is-
   a. Al b. F
   c. CI d. K
5. Identify the correct statement-
   a. Elements of Group 1 - Alkali metals
   b. Elements of Group IT- Alkaline metals
   c. Elements of Group 17 - Halogens
   d. All of the above
6. Which pair of atomic number represent elements in the same group?
   a. 11,19 b. 6.12
   c. 4, 16 d. 8, 17
7. In Modern Periodic Table the period indicates the value of
   a. atomic number b. atomic mass
   c. number of shells d. none of the above

8. The element with atomic number 16 belongs to
   a. Group 6 b. Group 16
   c. Group 2 d. Group 3
9. Which of the following has correct "law of triads"-
   a. Na,K,Ca b. Na.Sr.Br
   c. CI,Br,I d. Li,Be,Na
10. According to Mendeleeve's Periodic table, the horizontal rows and Vertical columns are known as
   a. Groups and Periods respectively
   b. Periods and Groups respectively
   c. Groups only
   d. Periods only

Assertion and Reason type Of Questions

In the following questions a statement of Assertion is followed by a statement of Reason. Mark the correct choice as two statements are given- one labeled Assertion (A) and the other labeled 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):** Group of three elements having similar properties were called as the Dobereiner triads.
   Reason(R): The atomic mass of the middle element was roughly the average of the atomic masses of the other two elements
2. **Assertion(A):** Lithium shows less metallic nature than Potassium.
   Reason(R): The metallic character of the elements increases downwards in a group.
3. **Assertion(A):** Elements present in group 2 have valency equal to 2 .
   Reason(R): All the elements in group 2 have same valence electrons.
4. **Assertion(A):** Properties of the elements are periodic function of their atomic masses.
   Reason(R): This periodic law was given by Henery Moseley.
5. **Assertion(A):** Elements Lithium, Sodium and Potassium are alkali metals.
   Reason(R): These elements are found in alkaline soil.Z

Case study /Source Based Questions

Read the following passage and answer the given questions:

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 electronegativity increases due to decrease in atomic size.

1. Which of the following correctly represents the decreasing order of metallic character of Alkali metals plotted in the graph?
   a. Cs>Rb>Li>Na>K
   b. K>Rb>Li>Na>Cs
   c. Cs>Rb>K>Na>Li
   d. Cs>K>Rb>Na>Li
2. Hydrogen is placed along with Alkali metals in the modem periodic table though it shows non-metallic character
   a. as Hydrogen has one electron & readily loses electron to form negative ion
   b. as Hydrogen can easily lose one electron like alkali metals to form positive ion
   c. as Hydrogen can gain one electron easily like Halogens to form negative ion
   d. as Hydrogen shows the properties of non-metals.

3. Which of the following has highest electronegativity?
   a. F b. CI
   c. Br d. I
4. Identify the reason for the gradual change in electronegativity in halogens down the group
   a. Electronegativity increases down the group due to decrease in atomic size
   b. Electronegativity decreases down the group due to decrease in tendency to lose electrons
   c. Electronegativity decreases down the group due to increase in atomic radius/ tendency to gain electron decreases
   d. Electronegativity increases down the group due to increase in forces of attractions between nucleus & valence electrons.
5. Which of the following reason correctly justifies that "Fluorine (72pm) has smaller atomic radius than Lithium (152pm)"?
   a. F and Li are in the same group. Atomic size increases down the group
   b. F and Li are in the same period. Atomic size increases across the period due to increase in number of shells
   c. F and Li are in the same group. Atomic size decreases down the group
   d. F and Li are in the same period and across the period atomic size/radius decreases from left to right.

SHORT ANSWER TYPE QUESTIONS (2 & 3 Marks)

1. How does the tendency to lose electrons change in a group and why ?

2. Why He, Ne and Ar are called inert gases ?

3. Write two limitations of Mendeleev's Periodic Table.

4. Why is the position assigning to hydrogen in the periodic table considered anomalous ?

5. What do you mean by metallic character of an element ? How does it vary as we go down a group ? Give reason for this variation.

6. Why metallic oxides are basic in nature whereas non-metallic oxides are acidic in nature ?

7. How does the atomic size vary as we go down a group and move left to right in a period ? Write the reason behind it.

8. Four elements P, Q, R and S have atomic number 12, 13, 14 and 15 respectively. Answer the following :

   (a) What is the valency of Q ?

   (b) Classify these elements as metals and non-metals.

   (c) Which of these elements will form the most basic oxide ?

9. (a) How do we calculate the valency of an element from its electronic configuration ?

   (b) How does the valency vary in a period ?

10. Study the variation in the atomic radii of elements given below and arrange them in increasing order :

Na	Li	Rb	Cs	K
186	152	246	262	231

   (a) Name the element which has the smallest and the largest atomic size.

   (b) How does the atomic size vary as we go down a group ?

11. What are metalloids ? Write two examples.

12. How many gropus and periods are present in Mendeleeve's and Modern Periodic Table?

13. There are two elements X and Y having atomic nubmer 17 and 20 respertively.
   a. What are the position of X and Y in periodic table?
   b. Write the molecular formula of XY.
   c. $_{4}Bc, _{9}F, _{14}Si, _{19}K, _{20}Ca$
   Which are the elements belonging to same group among these elements?
   Give reason for your answer. Which are the two elements belonging to same period. Give reason to your answer. (CBSE 2013)

14. Elements A,B,C,D and E having atomic number : 4, 9, 14, 19, 20.
    a. Name the elements having same valence electrons.
    b. Name the elements of same period . give reason to your answer.
    c. Name the elements of same group . give reason to your answer.
    (CBSE 2015)
15. a. Newland, Mendeleev asnd Dobereiner gave their contribution in building Modern Periodic table. List one merit and one demerit of their contribution.
    b. Write the Modern Peridic law.
16. In refernce to Modern periodic table explain what is meant by periodic function of properties of elements? What is the effect on the po9wer of accepting electrons on moving from left to right in Peroidic table.
17. X and Y are two elements having atomic number 20 and 17. Write the formula of compund formed by X and Y and also draw electron dot structure. Write the nature and bond in XY.
18. Answer by looking at the table:

No. of Periods	Element-I	Element-II
2	Li-3	Be-4
3	Na-11	Mg-12
4	K-19	Ca-20
5	Rb-37	Sr-38

a. Valence electron of Rb	b. Electronic eonfiguration of Ca
c. K is a metal or Non-metal	d. Size is bigger of either Rb of Sr

19. An element belongs to third period and group 13. Fing its valence electrons and valency. Another element Y have 18 neutrons in its nucleus and Massw Number 35, Write the group and period number of element Y.
20. Write the name, symbol and electornic configuration of an element having atomic number 11. Write the group and period nubmer of this element.

21. Can we calssify the given groups of elements as triads of Doereiner?

a. Na, Si, Cl b. Be, Mg, Ca

Mass nubmer of Be-9m Na-23, Mg-24, Si-28, Cl-35, Ca-40

22. How cand we prove that Modern Peroidic table is based on the electronic configuration of various elements.

23. Electronic configuration of an elements is 2, 8, 47.

a. Write the group number of this element in modern periodic table.

b. Write its name and one physical property of this elements.

(CBSE-2019 SET 31/1/3)

LONG ANSWER TYPE QUESTIONS (5 Marks)

1. Write 5 major differences between mendeleev's periodie table and modern periodie table.

2. Element 'A' has atomic number 16

(a) Name of the element

(b) Its physical state

(c) Metal or Non-mental

(d) Nature and formula with oxides

Previous years exams questions

1. How many raw and groups are there in periodic table? (CBSE-2013)

2. $_{4}Be$, $_{9}F$, $_{14}Si$, $_{19}K$, $_{20}Ca$

a) Select the element that has same group and give reason.

b) Select the elements that has same period and give reason.

(CBSE-2013)

3. There are two elements, X atomic no. 17 and Y atomic no. 20

(CBSE-2013)

a) Write the position of X and Y in periodic table

b) Write the molecular formula for compound XY

4. Given that A(4), B(9) C(14), D(19), E(20)

   ie A,B,C,D,E are elements with their atomic numbers

   a) Select the elements that has same valence electrons and write their electronic canfiguration.

   b) Select those, who have same group, Give reason.

   c) Select who belongs to same period, Give reason

5. Modern Periodic table has contribution of Newland, Mendeleeve and Dobereiner. Write one advantage and one limitation of each scientist.

6. State Modern Periodic Law.

7. What is periodicity in properties of elements with respect to modern periodic table? Why do all the element of same group gave similar properties. How does tendency to gain **electron** changes from left to right State reasons for these two changes.

8. (a) Write the electronic configuration of x and y having atomic number 20, 17

   (b) Write molucular formula for XY. Draw electron dot structure of product XY. Find nature and bond in XY.

9. Analyse the Given table

Period No.	Elements I	Elements II
2	Li (3)	Be (4)
3	Na (11)	Mg (12)
4	K (19)	Ca (20)
5	Rb (37)	Sr (38)

   (a) Predict the valence electron of Rb.

   (b) Write electronic configuration of Ca.

   (c) K is metal or non-metal

   (d) Which has the largest atomic size Rb or Sr.

10. An Element X belongs to 3rd Period and 13 Group. Find the Valency and Valence electron. Find molecular formula for compound XY.
(Y = At. No. 8)

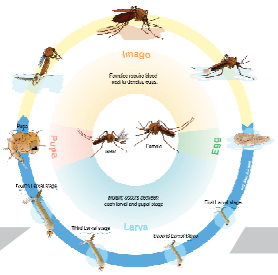
11. An Element X has mass number 35 and neutron 18. Write atomic number and electronic configuration of X. Also write group number and period and find valency of X. (CBSE 2016)

12. Write the name, symbol and electronic configuration of an element X atomic number is 11. (CBSE 2019 Set 31/1/2)

13. Can following groups elements be classified as Doberseiner's triad.
(i) Na, Si, Cl (ii) Be, Mg, Ca
Atomic mass of Be-9, Na-23, Mg-24, Si-28
Cl-35, Ca-40. Justify year answer. CBSE 2019
Set 31/1/2

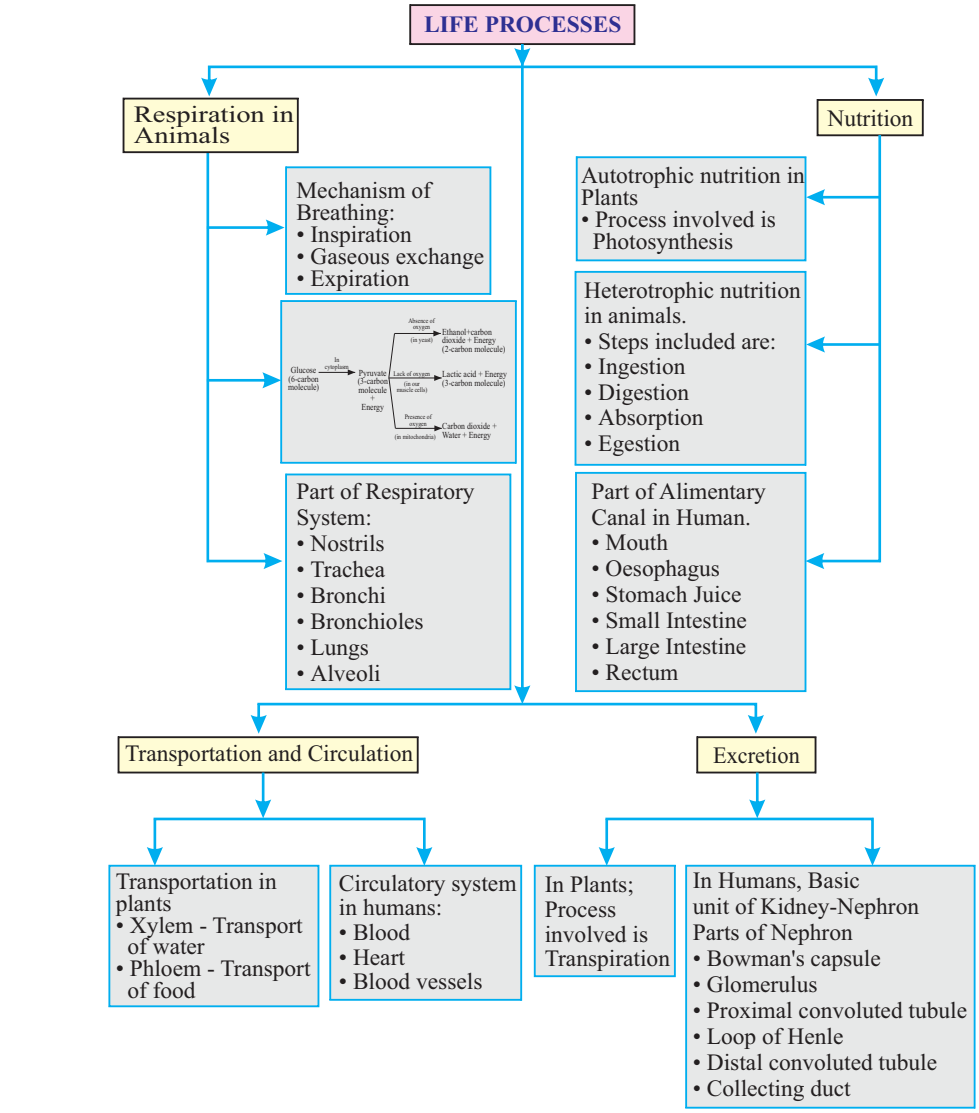
14. How can it proved that the basic structure of Modern periodic Table is based on electronic configuration of atoms of different elements?
(CBSE 2019 Set, 31/1/1)

15. Electronic configuration of an element is 2, 8, 4. State its
(a) Group and period
(b) Name and write its one physical property. (CBSE 2019, Set 31/1/1)



Chapter - 6

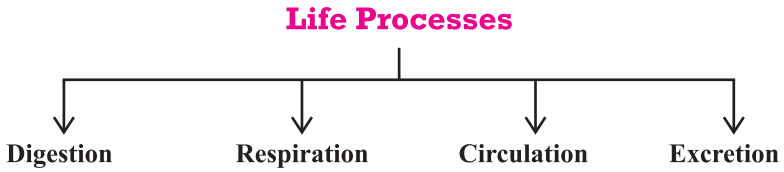
Life Processes



All living things perform certain life processes like growth, excretion, respiration, circulation etc.

All the processes like respiration, digestion, which together keep the living organisms alive and perform the job of body maintenance are called life processes.

Examples :



I. Nutrition

(The whole process by which an organism obtains its food)

Nutrition in Plants

↓

Plants are autotrophs.

↓

Can make their own food.

Nutrition in Animals

↓

Animals are hetrotrophs.

↓

Depends on plants or other animals for their foo

Modes of Nutrition

Autrotrophic	Hetrotrophic
Kind of nutrition in which inorganic materials like CO_2, water etc. are utilized to prepare organic food by the process of photosynthesis. *E.g.,* Green plants.	Kind of nutrition in which organisms do not possess the ability to synthesize their own food. They depend on autotrophs for their food supply directly or indirectly. *E.g.,* Animals, fungi.

Autotrophic Nutrition :

The organisms which carry out autotrophic nutrition are called autotrophs (green plants).

Autotrophs $\xrightarrow{Use}$ Simple inorganic material $\xrightarrow{Convert\ ino}$ Complex high energy molecules (Carbohydrates)

Autotrophic nutrition is the process by which autotrophs take in CO_2 and H_2O and convert these into carbohydrates in the presence of chlorophyll, sunlight is called **Photosynthesis.**

Equations : $6CO_2 + 12H_2O \xrightarrow[Chlorophyll]{Sunlight} C_6H_{12}O_6 + 6O_2 + 6H_2O$

Raw Materials for Photosynthesis :

- Sunlight
- Chlorophyll → Sunlight absorbed by chlorophyll
- CO_2 → Enters through stomata and oxygen (O_2) is released as by-product through stomata on leaf.
- Water → Water + dissolved minerals like nitrogen, phosphorus etc. are taken up by the roots of the soil.

Site of Photosynthesis :

Chloroplast in the leaf, chloroplast contain chlorophyll (green pigment).

Main Events of Photosynthesis :

- Absorption of light energy by chlorophyll

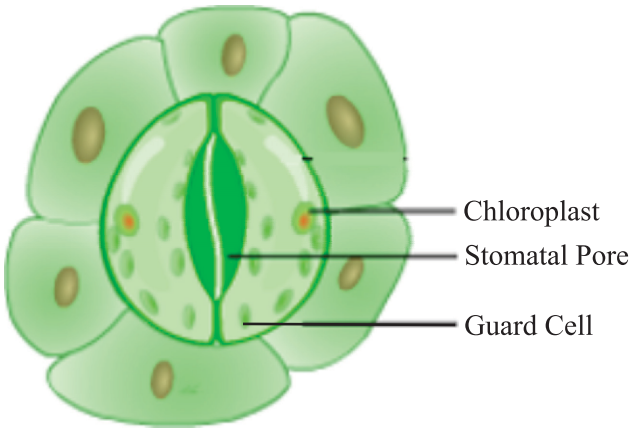
- Conversion of light energy into chemical energy + splitting (breaking) of water into hydrogen and oxygen
- Reduction of CO_2 to carbohydrates

Stomata : Tiny pores present on the surface of the leaves.

Functions :

(a) Exchange of gases O_2/CO_2.

(b) Loses large amount of water (water vapour) during transpiration.



Hetrotrophic Nutrition

Holozoic	Saprophytic	Parasitic
Animals take in solid food and breakdown inside the body. *E.g.,* Amoeba, animals.	Organisms feed on dead, decaying matter. *E.g.,* Fungi.	Parasites live inside or outside other organism (host) and derive nutrition from it. *E.g.,* Cuscuta (plant parasites), Ticks leech etc

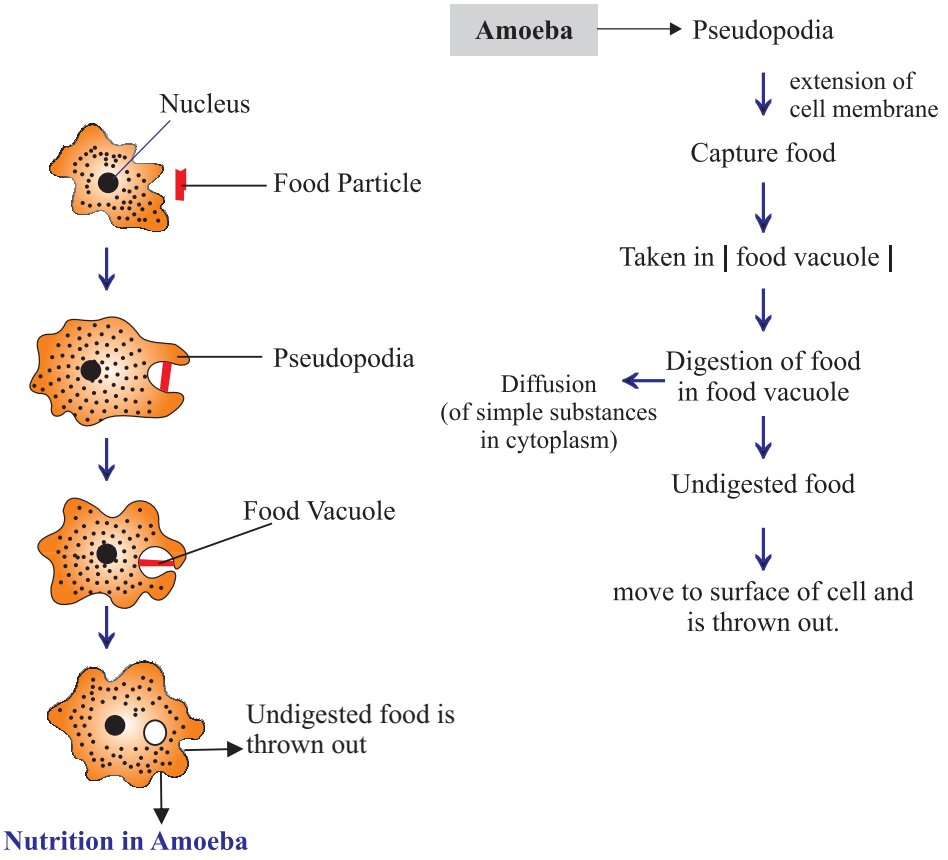
How do organisms obtain their food

Unicellular/Single celled organisms : Food is taken up through entire surface.

Example : (i) Amoeba

(ii) Paramaecium

(i) Amoeba



(ii) Paramaecium : Which is a unicellular organism takes in food at a specific spot which is moved there by cilia (small hairs present all over cell surface)

Steps of Nutrition : (In Heterotrophs)

Ingestion (Intake of food) → **Digestion** (Breakdown of complex material into simple ones) → **Absorption** (Movement of digested food) → **Assimilation** (Utilisation of food) → **Egestion** (Removal of waste products)

1. Mouth → Intake of whole food.

   Teeth → Chewing/grinding of food.

   Tongue → Rolling of food +
   Tasting of food +
   Swallowing/Pushing down of the food.

   Salivary Glands → Secrete saliva + Mucus

   Starch $\xrightarrow[\text{[Saliva]}]{\text{Salivary amylase}}$ Sugar

2. Oesophagus → Taking food from mouth to stomach by **Peristaltic movements.** [Contraction and expansion of muscles of the oesophagus

3. Stomach → Gastric glands $\xrightarrow{\text{Secrete}}$ Gastric juice

   Gastric Juice

PEPSIN	**HCl**	**MUCUS**
(Enzyme that breaks down proteins)	(Makes medium acidic)	(Protects inner lining of the stomach)

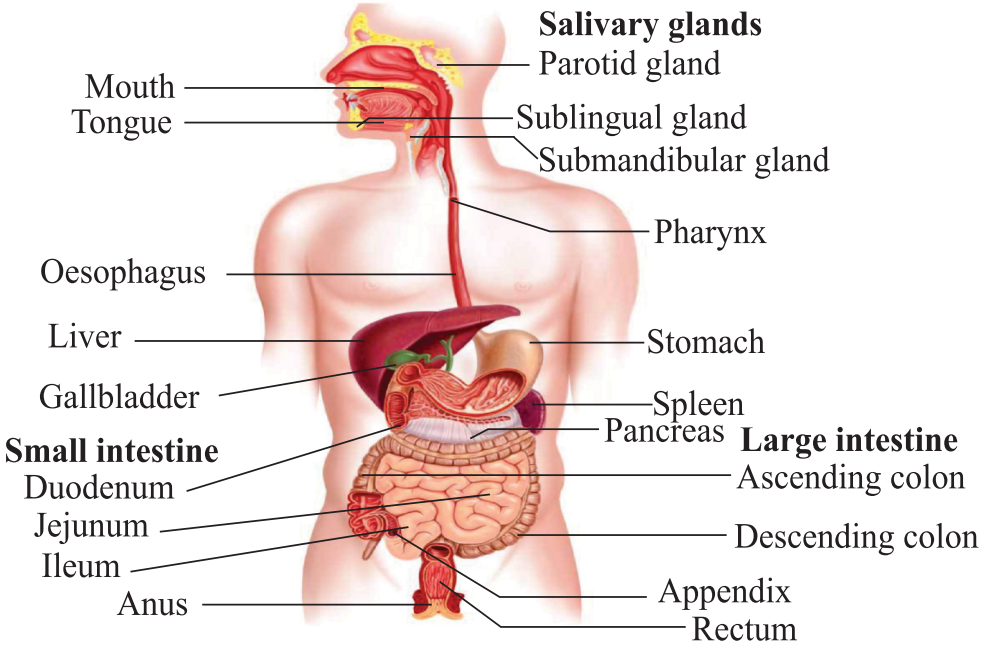
4. Small Intestine → (a) **Intestinal enzyme**
   ↓ convert

Carbohydrate	**Fats**	**Proteins**
↓	↓	↓
Glucose	Fatty acid + Glycerol	Amino acids

5. Small Intestine → (b) Villi (finger like projections) → Helps in absorption of digested food into the blood

Small Intestine → (c) Receives secretion from
- Liver → Bile
- Large fat globules → Emulsify small Fat drop lets
- Pancreas → Pancreatic juice
  - Trypsin → Proteins → Peptones
  - Lipase → Fats → Lipids

6. Large Intestine → Absorb excess of water
→ The rest of the material is removed from the body via the anus.



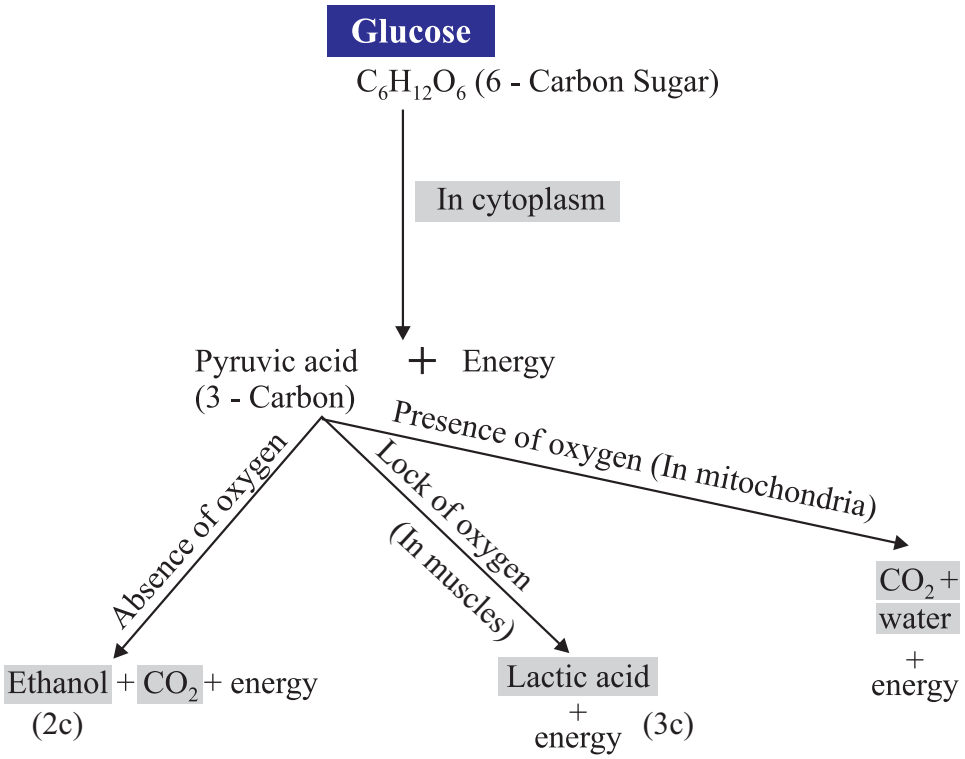
Human Digestive System

RESPIRATION

Respiration 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



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

Human Respiratory System

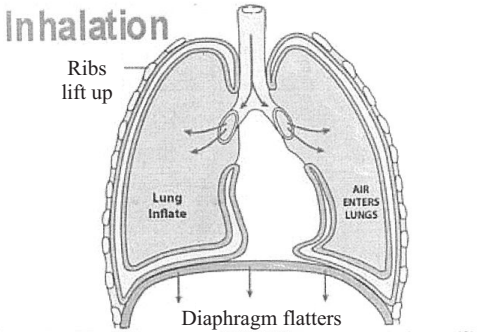
Passage of air through the respiratory system :

Nostril
↓
Nasal Passage
↓
Nasal Cavity
↓
Pharynx
↓
Larynx
↓
Trachea
↓
Bronchi
↓
Bronchioles
↓
Alveoli
↓
Blood capillaries

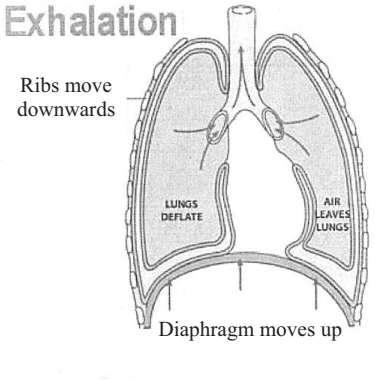
Lungs

Mechanism of Breathing

Inhalation	Exhalation
• During inhalation the thoracic cavity (chest cavity) expands.	• Thoracic cavity contracts.
• Ribs lift up.	• Ribs move downwards.
• Diaphragm become flat in shape.	• Diaphragm becomes dome shaped.
• Volume of lungs increases and air enters the lungs	• Volume of lungs decreases and air exits from the lungs.



(a) Inhalation



(b) Exhalation

Exchange of gases between alveolus, blood and tissues

(i) Air (rich in O_2) → Blood → Binds with haemoglobin in RBC → O_2 is released in (in alveolus) (through blood vessels) tissues

(ii) CO_2 → Released in blood→ Dissolved in blood→ Blood vessels→ Released in alveolar sac → Sent out through nostrils

(from tissue)

Terrestial organisms : Use atmospheric oxygen for respiration

Aquatic organisms : Use dissolved oxygen for respiration

Respiration in plants

Respiration in plants is simpler than the respiration in animals. Gaseous exchange occur through :

(a) Stomata in leaves

(b) Lenticels in stems

(c) General surface of the root

Transportation

Human beings like other multicellular organism need regular supply of food, oxygen etc. This function is performed by circulatory system.

The circulatory system in human beings consists of

Heart	Arteries and Veins	Blood and lymph
(A pumping organ)	(Blood vessels)	(A circulatory medium)

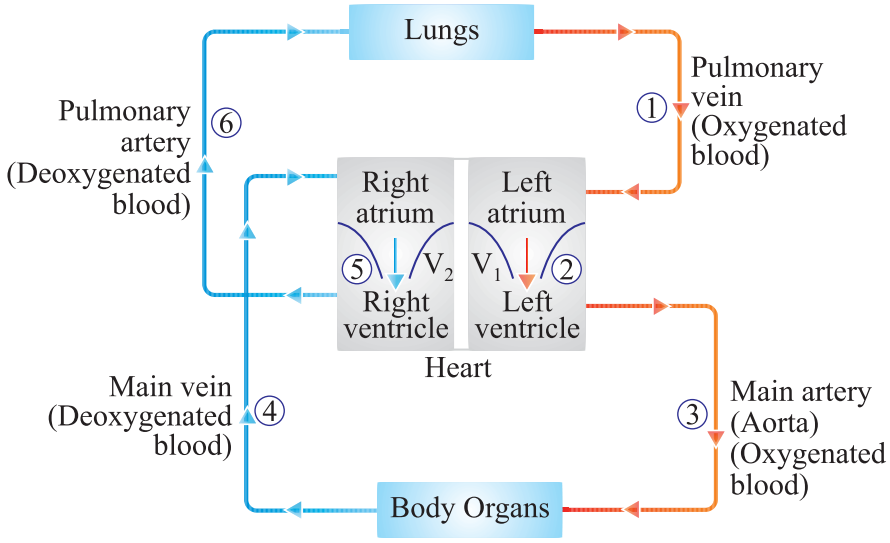
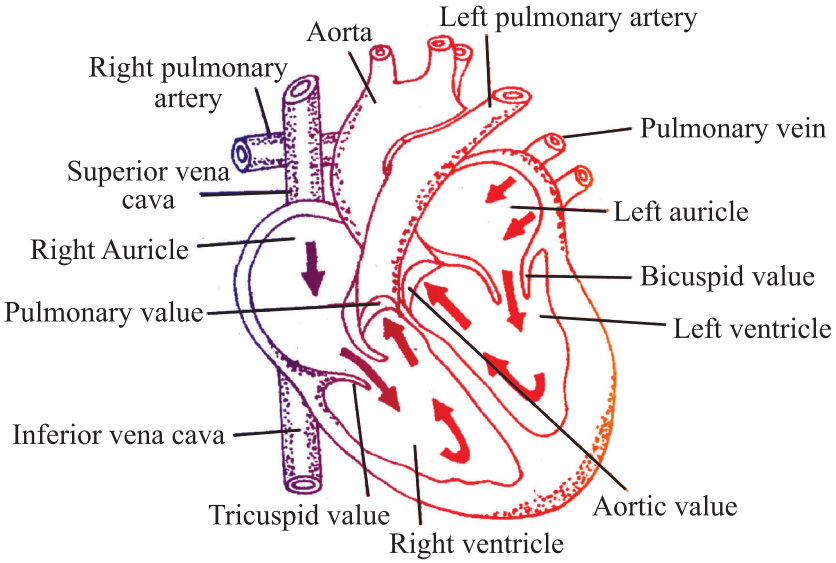


Diagram to show blood circulation in human body

Double circulation

Blood travels twice through the heart in one complete cycle of the body.



Direction of blood flow through human heart

- **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.

Blood

(A fluid connective tissue)

Granular Component — Blood Corpuscles

Liquid Component — Plasma

R. B. C.s	Blood Platelets	W. B. C.	Plasma
• Carries gas, (O_2, CO_2) • Contain Hb, impart red colour to the blood	helps in Blood Clotting	Provide body defence by engulfing the germs & producing antibodies	A yellow colour fluid contain 90% water & 10% organic substances like - plasma, proteins viz. albumin, globulin, inorganic - mineral ions.

Lymph : A yellowish fluid escapes from the blood capillaries into the intercellular spaces contain less proteins than blood. Lymph flows from the tissues to the heart assisting in transportation and destroying germs.

Blood Vessels

Arteries	Veins
1. Carry oxygenated blood from heart to body parts except pulmonary artery.	1. Carry deoxygenated blood from body parts to heart except pulmonary vein.
2. Also called distributing vessel.	2. Also called collecting vessel.
3. Thick and elastic.	3. Thin and less elastic.
4. Deep Seated	4. Superficial as compared to arteries

Transportation in Plants

There are two main conducting pathways in a plant.

Xylem	Phloem
1. Carries water & minerals from the roots to other parts of the plant.	1. Carries product of photosynthesis from leaves to the other parts of the plant.
2. No energy is used.	2. Energy is used from ATP.

Transpiration is the process of loss of water as vapour from aerial parts of the plant.

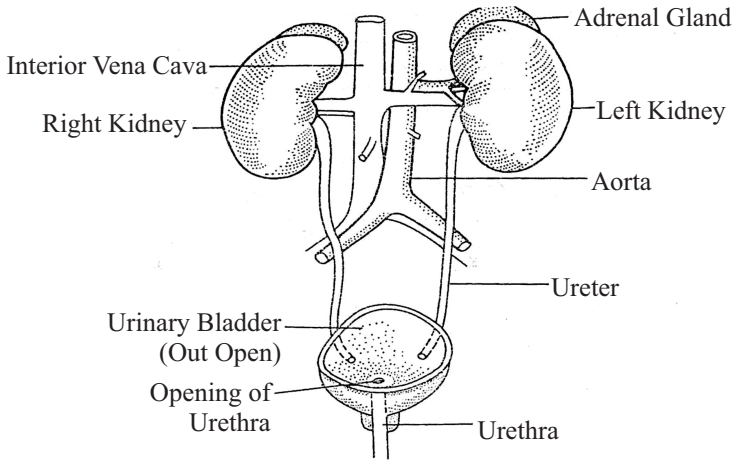
Function :

(a) Absorption and upward movement of water and minerals by creating transpiration pull.
(b) Helps in temperature regulation in plant.
Transport of food from leaves (food factory) to different part of the plant is called **Translocation**.

EXCRETORY SYSTEM IN MAN

Excretory/urinary system consists of :

(1) The kidneys : The excretory organ
(2) The ureters : The ducts which drain out urine from the kidneys
(3) The urinary bladder : The urinary reservoir
(4) The urethra : The channel to the exterior

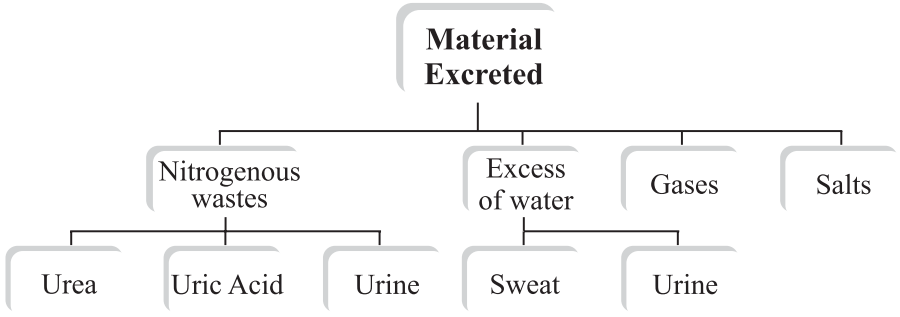


The human excretory system

The human excretory system

EXCRETION

1. The metabolic activities in the body generates many kinds of wastes including nitrogenous wastes which are harmful for the body and hence needed to be removed. Excretion is a process by which these wastes are removed from our body.



2. Unicellular organisms remove these wastes by simple diffusion.

Human Excretory System

1. It maintains water equilibrium, pH equilibrium, ionic equilibrium of the blood and osmotic equilibrium.
2. It helps to excrete out waste product urea in th the dissolved form from the blood.
3. It excretes poisoneous substance like drugs, toxins etc. from the body.
4. It regulates blood pressure by controlling he fluid balance in the body.

Formation of Urine

- 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 these tubules.
- The amount of water reabsorbed depends upon :
  * How much excess of water is there in the body and,
  * How much nitrogenous wastes need to be excreted out.
- So 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.

Functions of Nephron

- Excretion of nitrogenous wastes.
- To maintain the water and ionic balance (osmic regulation).

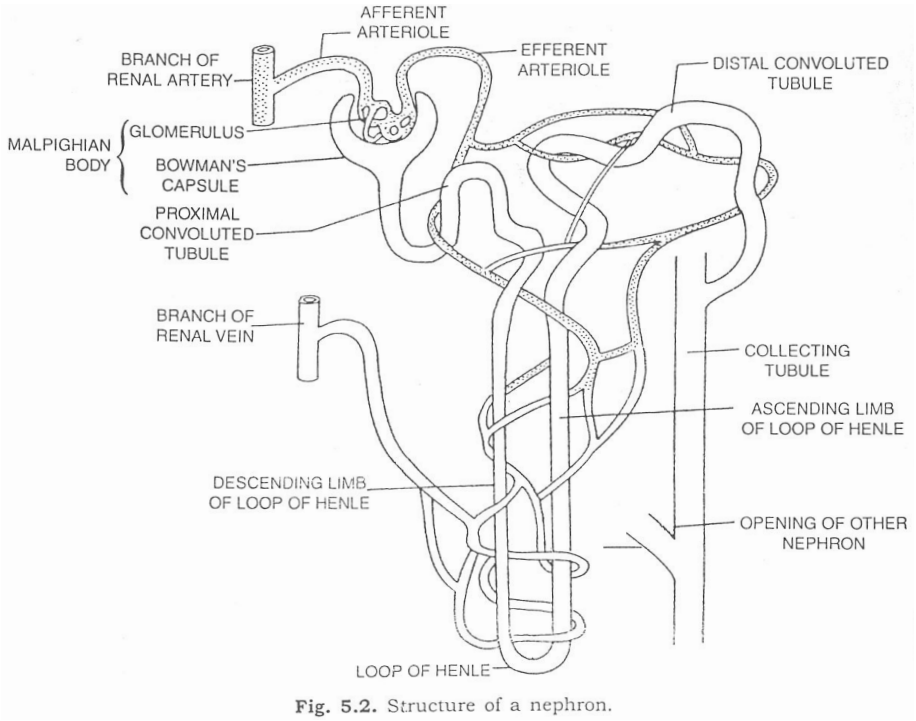


Fig. 5.2. Structure of a nephron.

Structure of a Nephron

The urine formation involves three steps :

1. **Glomerular filtration :** Nitrogenous wastes, glucose water, amino acid filter from the blood into Bowman Capsule of the nephron.
2. **Tubular reabsorption :** Now, useful substances from the filtrate are reabsorbed back by capillaries surrounding the nephron.
3. **Secretion :** Urea, extra water and salts are secreted into the tubule which open up into the collecting duct & then into the ureter.

Artificial Kidney

Haemodialysis : The process of purifying blood by an artificial kidney. It is meant for kidney failure patients.

Excretion in Plants

Plants use different strategies for excretion of different products :

- Oxygen and carbon dioxide is diffused through stomata.
- Excess water is removed by transpiration.
- Plants can even loose some of their old parts like old leaves and bark of tree.
- Other waste products like raisins and gums especially in old xylem cells which can also be lost by plants.
- Plants also secrete some waste substances into the soil around them.

VERY SHORT ANSWER TYPE QUESTIONS (1 MARK)

(A) Multiple Choice Questions (MCQ's)

1. Which is the first enzyme that gets mixed with food in the digestive tract?

   (a) Pepsin (b) Cellulose

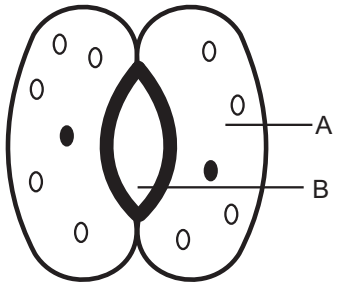
   (c) Trypsin (d) Amylase

2. The opening and closing of the stomatal pore depends upon.

   (a) Temperature (b) Oxygen

   (c) Concentration of CO_2 in stomata (d) Water in guard cells

3. The parts A and B Shown in the given diagram are:



   (a) Guard cell and stomatal pore

   (b) Epidermal cell and stomatal pore

   (c) Epidermal cell and guard cell

   (d) Guard cell and epidermal cell

4. Complete the following reactions:

$$6CO_2 + 12H_2O \xrightarrow[?]{\text{Sunlight}} C_6H_{12}O_6 + 6H_2O + 6O_2$$

(a) Mitochondria (b) Chlorophyll

(c) Iodine (d) Chlorophyll

5. The energy currency of the cell is:

(a) ATP (b) AMP

(c) CO_2 (d) ADP

6. The blood leaving the tissues becomes richer in

(a) Carbon-di-oxide (b) Water

(c) Haemoglobin (d) Oxygen

7. The internal (cellur) energy reserve in autotrophs is

(a) Glycogen (b) Protein

(c) Starch (d) Fatty acid

8. During deficiency of oxygen in tissues of human beings, pyruvic acid is converted into lactic acid in the

(a) Cytoplasm (b) Chloroplast

(c) Mitochondria (d) Golgibody

9. What prevents backflow of blood inside the heart during contraction-

(a) Thin walls of atria

(b) Valves in heart

(c) Thick muscular walls of ventricles

(d) All of the above

10. Which of the following enzymes needs an acidic medium to be active

(a) Trypsin (b) Pepsin

(c) Lipase (d) None of the above

Answers-

1. (d) 2. (d) 3. (a) 4. (b) 5. (a)

6. (a) 7. (c) 8. (a) 9. (b) 10. (b)

11. **Give reasons:**

(i) The number of stomata are more on the lower surface of the leaf as compared to the upper surface.

(ii) Arteries are thick walled.

(iii) Plants have low energy needs.

(iv) Aquatic animals breathe faster than the terrestrial animals.

12. (i) What stops blood from flowing backwards through the heart. (CBSE 2008)

(ii) Name the process used by single-celled organisms for taking in food, exchange of gases or removal of wastes. (CBSE 2016)

13. State one difference between autotrophic and hetrotrophic mode of nutrition.

14. Define peristaltic movement.

15. What is the role of saliva in the digestion of food ?

16. Name the tissue that transports water and minerals in plants.

17. What is the role of acid in our stomach ?

18. What is emulsification ?

19. Name the cell organelle in which photosynthesis occur.

20. Name the largest artery in the human body.

21. Define transpiration.

22. What is the structural and functional unit of kidney called ?

23. In following questions 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.

I. Assertion: Rate of breathing in aquatic organisms is slower than terrestrial organisms.

Reason: The amount of dissolved oxygen is fairly low as compared to amount oxygen in air.

II. **Assertion:** The effect of root pressure in transport of water is more important at night.

Reason: During the day the transpiration pull acts as major driving force in the movement of water in the system.

III. **Assertion:** The openin and closing of the pore of stomata is a function of the guard cell.

Reason: The stomatal pore opens when water comes out of guard cells causing their shrinkage.

IV. **Assertion:** Carnivores have a shorter small intestine.

Reason: Meat is easier to digest.

V. **Assertion:** Plasma of blood transports food, carbondioxide and nitrogenous wastes.

Reason: Red blood corpuscles carry oxygen.

Answer:

1. (d) 2. (a) 3. (c) 4. (a) 5. (b)

24 Read the following and answer questions given below:

There is a progressive change in structure of heat between verterbrates like fishes to birds & mammals. Fish have a simple two chambered heart. Amphibians possess three chambered heart with two atria and a single ventricle. Reptiles have a septum (wall) that partly divides the ventricle. Birds and mammals have the four chambered design.

1. In fishes blood flows from heart to gills to body and back to heart. This is example of
   (a) Single circulation (b) circulation
   (c) circulation (d) circulation
2. Which of the following organisms shows mixing of oxygenated and deoxygenated blood-
   (a) Pigeon (b) Pigeon
   (c) Frog (d) Crocodile
3. Birds and mammals have four-chambered hearts as it leads to serpartion of oxygenated and deoxygenated blood such a separation allows-
   (a) Highly efficient supply of oxygen to the body

(b) Give energy to maintain their body temperature continuously
(c) Double circulation being carried on efficiently
(d) Efficientof collection of blood from tissues of the body\

Now choose the right option-

(a) (i) & (iv) (b) (ii) & (iii)
(c) (i) & (iii) (d) (i), (ii) & (iii)

4. In which of the following verterbrate group/groups heart does not pump oxygenated blood to different parts of the body-
   (a) Pisces and Amphibians (b) Amphibians and reptiles
   (c) Amphibians only (d) Pisces only
5. Which chamber of human heart recieves deoxygenated blood from tissues of the body.
   (a) Left atrium (b) Right atrium
   (c) Left ventricle (d) Right ventricle

Answer:

1. (a) 2. (c) 3. (d) 4. (d) 5. (b)

SHORT ANSWER TYPE QUESTION (2 and 3 MARKS)

1. Name the organ which perform the following functions in human

   i) Absorption of digested food

   ii) Absorption of water

   iii) Secretion of Bile juice.

2. Diagramatically illustrate the process of utilization and digestion of food in Amoeba.
3. Give two examples each of organisms which perform the following types of nutrition.

   a) Saprotrophic b) Parasitic c) Holozoic

4. What will happen if green plants disappear from earth?
5. Mention three major events that occur during photosynathesis?
6. Name the energy currency in the living organisms. When and where it is produced?
7. How do carbohydrates, proteins and fats get digested in human beings?

8. Explain the three pathways of breakdown of glucose in living organisms.
9. How is small intestine designed to absorb digested food.
10. Describe the process of double circulation in human beings.
11. Define the term transpiration. Design an experiment to demonstrate this

LONG ANSWER TYPE QUESTION (5 MARKS)

1. i) Write three types of blood vessels. Give one important feature of each (CBSE, Delhi 2018-19)

   ii) How are CO_2 and O_2 transported in human beings? (CBSE 2018-19)

2. Write the function of the following in the human alimentary canal. (CBSE 2018-19)

   i) Saliva ii) HCl in Stomach iii) Bile juice iv) Villi

3. Write one function of each of the following enymes.

   i) Pepsin ii) Lipase

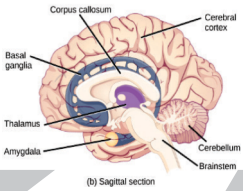
4. Draw a well labelled diagram of Nephron. Explain the process of formation of urine in the human kidney.
5. Why is energy needs in plants is very less as compared to animals? Explain.
6. Draw the diagram showing Human Respiratory System. Label the following parts.

   a) Alveolus

   b) Trachea

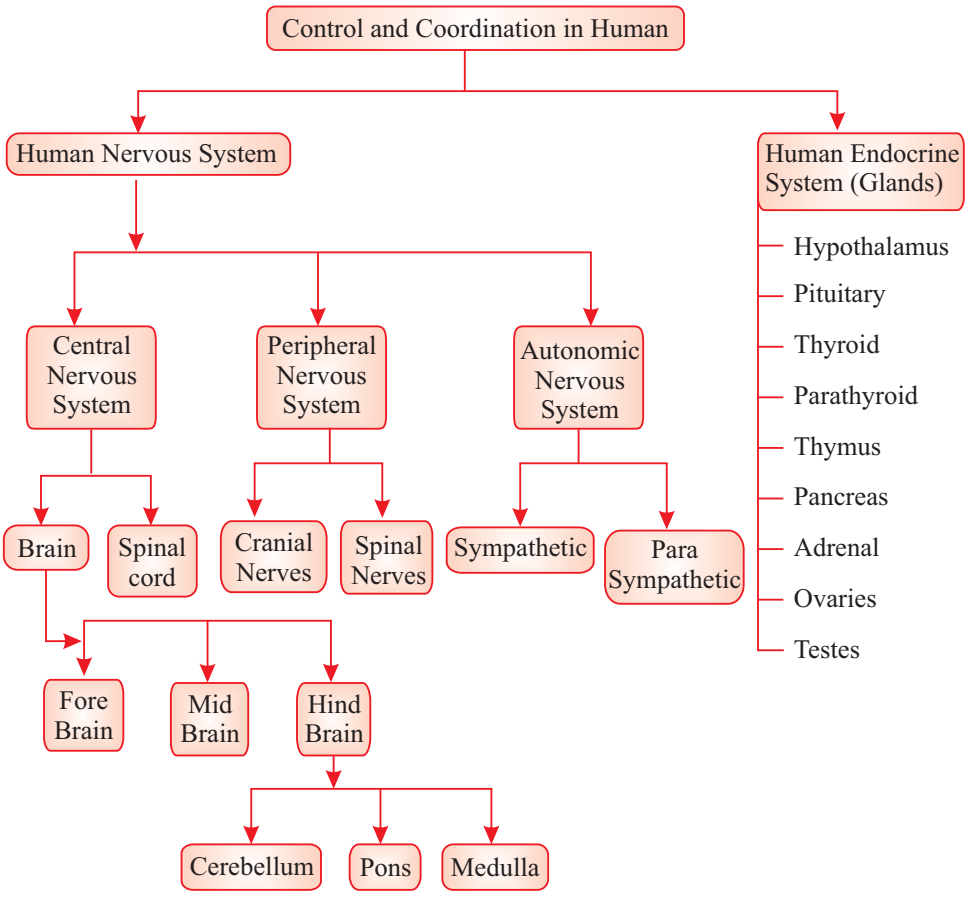
   c) Bronchus

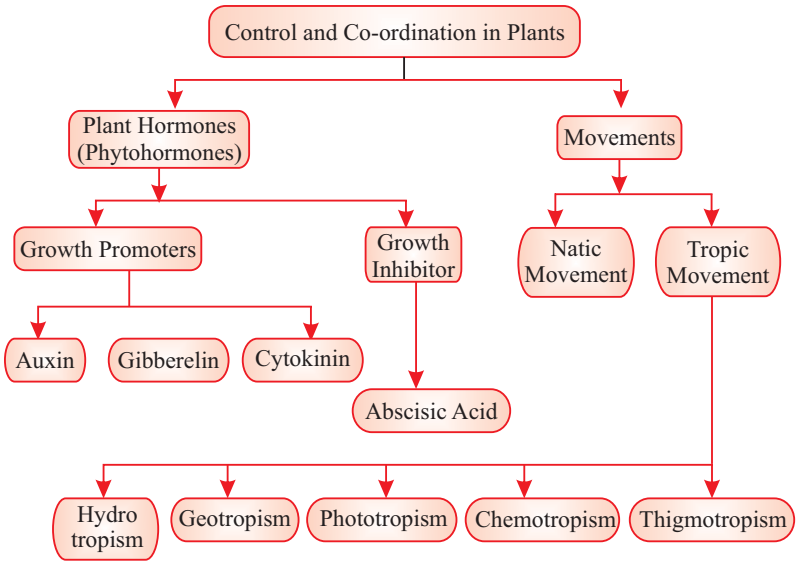
   d) Lungs



Chapter- 7

Control And Coordination





- All the living organisms respond and react to changes 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, sound, smell, touch etc.
- Both plants and animals respond to stimuli but in a different manner.

Control and Coordination in Animals

It is brought about in all animals with the help of two main systems :

(a) Nervous system

(b) Endocrine system

NERVOUS SYSTEM

- Control and coordination are provided by nervous and muscular tissues.
- Nervous tissue is made up of an organized network of nerve cells or neurons, and is specialized for conducting information via electrical impulses from one part of the body to another.

Receptors : Are specialized tips of some nerve cells that detect the information from the environment. These receptors are located in our sense organs.

(a) Ear :
- Phonoreceptors
- Hearing
- Balance of the body

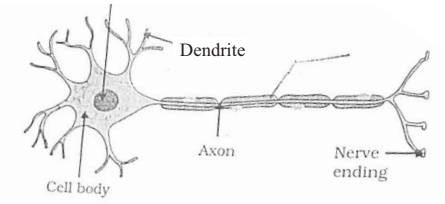
(b) Eyes :
- Photoreceptors
- Seeing

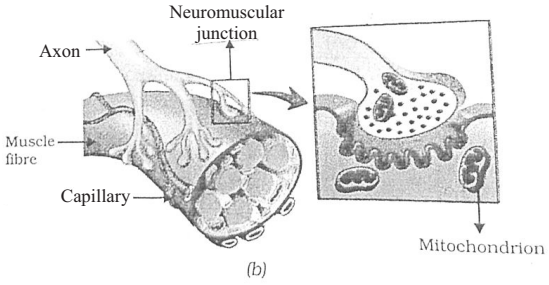
(c) Skin :
- Thigmoreceptors
- Heat or cold
- Touch

(d) Nose :
- Olfactory receptors
- Smell detection

(e) Tongue :
- Gustatory receptors
- Taste detection

Neuron : It is the structural and functional unit of nervous system.





(b)

Parts of Neuron :

(a) Dendrite : Acquires information.

(b) Cell body : Acquired information travels as an electrical impulse.

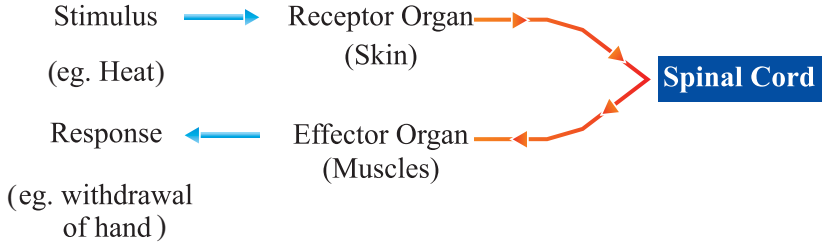
(c) Axon : Longest fibre on the cell body is called axon. It transmits electrical impulse from cell body to dendrite of next neuron.

Synapse : It is the gap between the nerve ending of one neuron and dendrite of the other neuron. Here electrical signal is converted into chemical signal for onward transmission.

REFLEX ACTION

Reflex action 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 impulses pass during reflex action is called reflex arc.



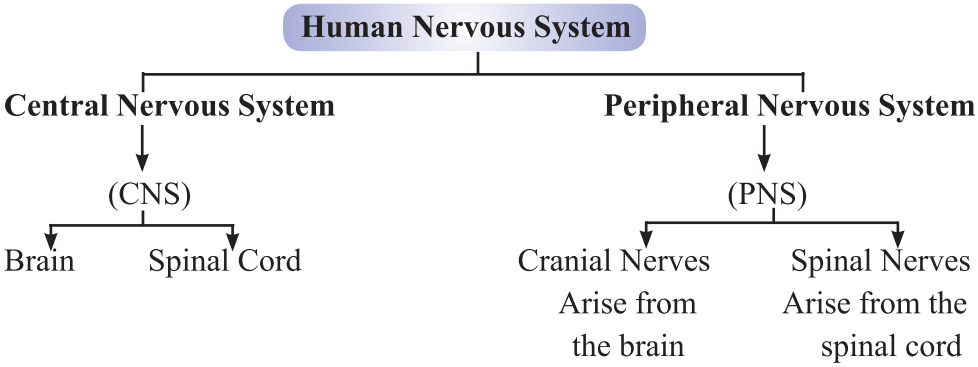
Response : Responses are of three main types :

(a) Voluntary : Controlled by fore brain. *E.g.,* talking, writing.

(b) Involuntary : Controlled by mid and hind brain. *E.g.,* heart beat, 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. Here response is generated from spinal cord instead of brain.



HUMAN BRAIN

Brain is the main coordinating centre of the body. It has three major parts :

(a) Fore-brain (b) Mid-brain (c) Hind-brain

(a) Fore-brain : It is the most complex or specialized part of the brain. It consists of cerebrum.

Functions :

(i) 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) Centre associated with hunger.

(b) Mid-brain :

Controls involuntary actions such as :

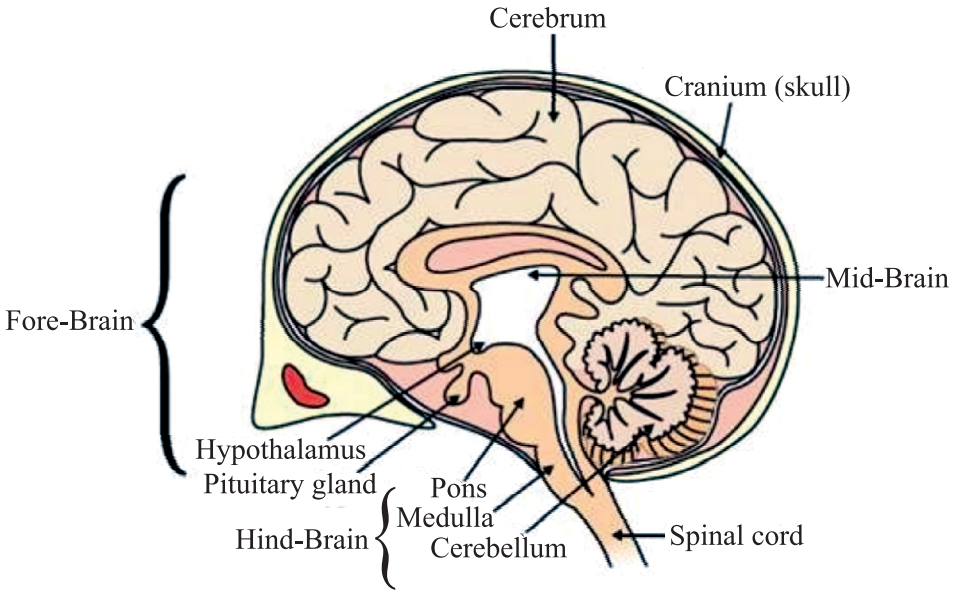
- Change in pupil size.
- Reflex movements of head, neck and trunk.

(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 : Involuntary actions, regulation of respiration.



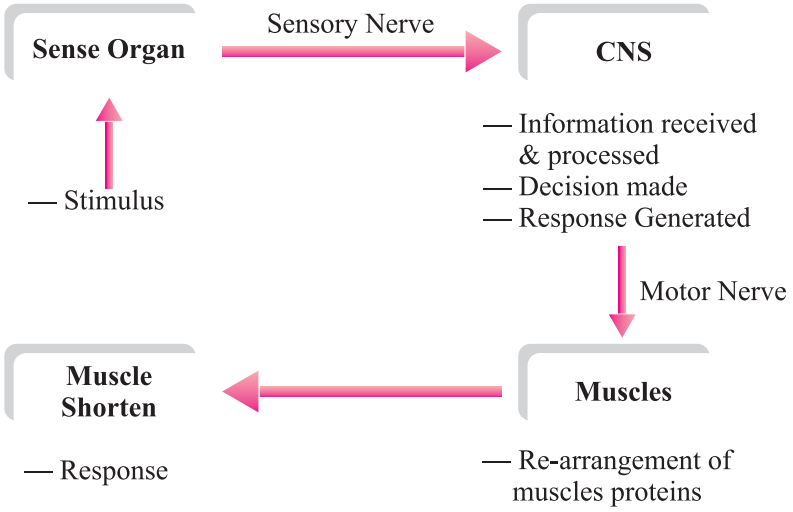
Human Brain

Protection of Brain and Spinal Cord

(a) Brain : Brain is protected by a fluid filled balloon which acts as shock absorber and is enclosed in cranium (skull or brain box).

(b) Spinal Cord : Spinal cord is enclosed in vertebral column.

Coordination between Nervous and Muscular Tissue



Limitations of Electric communication/Nervous system :

(a) Electric impulse will reach only to those cells that are connected by nervous tissue.

(b) After generation and transmission of an electrical impulse, the cell takes some time to reset its mechanism before transmitting another impulse. So cells cannot continually create and transmit impulse.

(c) Plants do not have any nervous system.

Chemical communication : To overcome the limitations of electric communication.

COORDINATION IN PLANTS

Movements in plants :

(i) Independent of growth

(ii) Dependent on growth

(i) Independent of growth : Immediate response to stimulus. (Nastic Movement)

- Plants use electrical-chemical means to convey information from cell to cell.
- For movement to happen, cells change their shape by changing the amount of water in them, resulting in swelling or shrinking of cells.

E.g., Drooping of leaves of 'Touch-me-not' plant on touching it.

(ii) Dependent on growth : These movements are tropic movements i.e., directional movements in response to stimulus.

• **Tendrils :** The part of tendril away from the object grows more rapidly as compared to the part near the object. This causes circulating of tendril around the object.

- **Phototropism :** Movement towards light, e.g. growth of a shoot towards light.
- **Geotropism :** Movement towards/away form gravity, e.g. growth of roots in soil
- **Chemotropism :** Movement to/away Chemicals Growth of pollen tube towards ovule.
- **Hydrotropism :** Movement towards water. e.g. growth of a roots towards water

Plant Hormones : Are chemical compounds which help to coordinate growth, development and responses to the environment.

Main plant hormones are :

(a) Auxin :	• Synthesized at shoot tip
	• Helps the cells to grow longer
	• Involved in phototropism
(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
	• Stress hormone

Hormones in Animals :

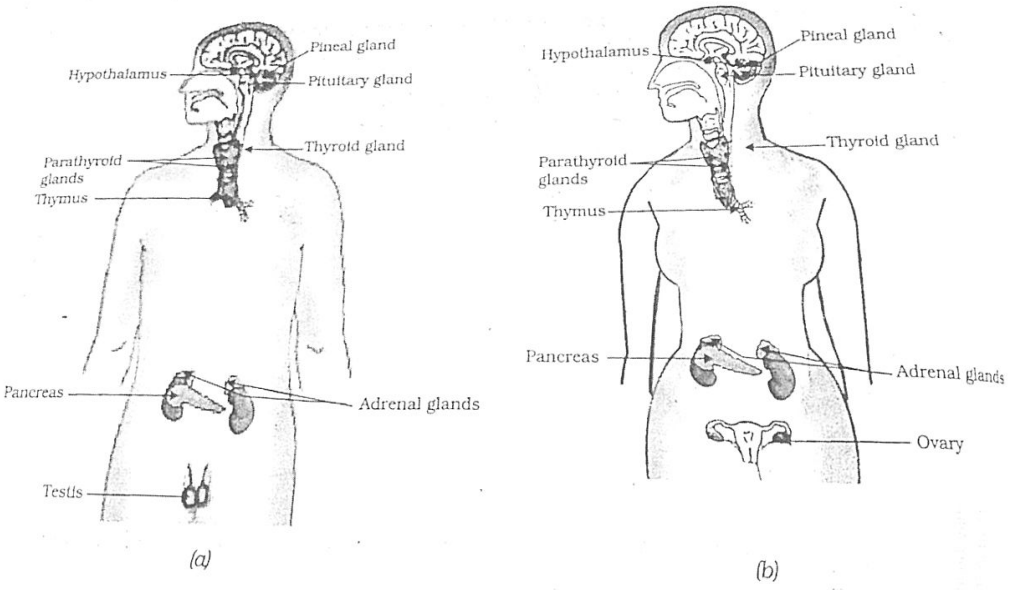
Hormones : Hormones are the chemical substances which coordinate the activities of living organisms and also their growth.

Endocrine glands : These glands secrete their product (hormone) into the blood.

Endocrine Gland, Hormones and their Functions

S. No.	Hormone	Endocrine Gland	Location	Functions
1.	Thyroxine	Thyroid	Neck/Throat region	Regulation of metabolism of carbohydrates, fats and proteins.
2.	Growth hormone	Pituitary (master gland)	Mid brain	Regulates growth and development.
3.	Adrenaline	Adrenal	Above both kidneys	Regulation (increasing) of blood pressure, heart beat, carbohydrate metabolism (during emergency)
4.	Insulin	Pancreas	Below stomach	Reduces and regulates blood sugar level
5. Sex Hormone	(a)Testosteron in males	Testis	Genital/lower abdomen area	Changes associated with puberty (Sexual maturity)
	(b)Estrogen in females	Ovaries		
6.	Releasing Hormone	Hypothalmus	Mid brain	Stimulates pituitary gland to release hormones

Human Endocrine Glands



Iodised salt is necessary because iodine mineral is essential part of thyroxine hormone secreted by thyroid gland. Thyroxine regulates metabolism of carbohydrates, fats and proteins. So, we must consume iodised salt which is necessary for proper working of thyroid gland. It's deficiency causes a disease called goiter (Swollen neck).

Diabetes

Disease in which blood sugar level increase.

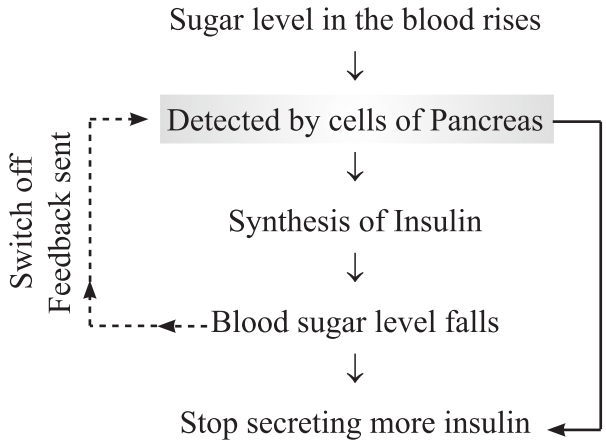
Cause : Due to the deficiency of insulin hormone secreted by pancreas that is responsible to control blood sugar levels.

Treatment : Injections of insulin hormone.

Feedback Mechanism

The excess or deficiency of hormones has a harmful effect on our body. Feedback mechanism makes sure that hormones should be secreted in precise quantity and at right time.

E.g., Feedback mechanism to control the sugar level in blood is as follows :



Very Short Answer Type Questions (1 Mark)

MCQs

1 Centre for hunger is situated in-

a) Fore-Brain b) Mid-Brain

c) Hind-Brain d) All of the above

2 Which is the main co-ordinating centre of the body.

a) Nerves b) Spinal Card

c) Brain d) Heart

3. Spinal cord originates from-

(a) Cerebrum (b) Medulla

(c) Pons (d) Cerebellum

4. The movement of shoot towards light is

(a) Geotropism (b) hydrotropism

(c) Chemotropism (d) Phototropism

5. Choose the incorrect statement about insulin

(a) It is produced from pancreas

(b) It regulates growth and development of the body

(c) It regulates blood-sugar level

(d) Insufficient secretion of insulin will cause diabetes

6. Which phytohormone is responsible for wilting of leaves-

(a) Auxin (b) Abscisic acid

(c) Cytokinin (d) Gibberellin

7. Which of the following is not an effect produced after secretion of adrenalin into the blood-
   (a) Blood supply to the digestive system & skin is reduced
   (b) Heart beats faster
   (c) Breathing rate increses
   (d) Blood supply to skeletal muscles is reduced
8. Which part of the brain is responsible for involuntary actions like blood-pressure, vomitting etc.
   (a) Pons (b) Cerebrum
   (c) Medulla (d) Cerebellum
9. Dwarfism results due to
   (a) Less secretion of growth hormone
   (b) Less secretion of adrenaline
   (c) Excess secretion of growth hormone
   (d) Less secretion of thyroxin
10. Which of the followning endocrine glans is unpaired-
   (a) Adrenal (b) Testes
   (c) Pituitary (d) Ovary

Answer :

1. (a)	2. (c)	3. (b)	4. (d)	5. (b)
6. (b)	7. (d)	8. (c)	9. (a)	10. (c)

11. In a neuron, where in impulse converted into chemical signal for onward transmission?
12. Name the two parts of Human nervous syst em.
13. What is the basic structural and functional unit of nervous system?
14. Where is auxin synthesized in plants ?
15. Which gland is known as master gland ?
16. Name the hormone that regulates blood sugar level.
17. What is synapse ?
18. What are tropic movements ?

19. Which part of the brain is responsible for maintaining posture and balance of our body ?

20. Which hormone has inhibiting effects on growth of plants ?

21. What is phototropism ?

22. What are the components of central nervous system ?

23. What happens at synapse between two neurons ?

24. In following questions 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.

I. Asseration : It is imporatant to have iodised salt in our diet.

Reason: Iodine is necessary for thyroid gland to make thyroxin hormone.

II. Asseration : Reflex arcs have evolved in animals

Reason: The thinking process of the brain is not fast enough.

III. Asseration : The brain sits inside a bony box

Reason: Brain, a delicate organ, is very important for organisms.

IV. Asseration : Auxin helps the cells of stem grow longer

Reason: Auxin is a growth inhibitor.

V. Asseration : The hormones should be secreted in precise quantities

Reason: Feedback mectranism operates in body to control hormone secretion

Answer:

1. (a) 2. (a) 3. (a) 4. (c) 5. (a)

Case-Study

25. Read the following and answer the questions:

The nervous tissue is made up of an organised network of nerve cells or neurons and is specialized for conducting information via electrical impulses from one part of the body to another.

1. Which part of the neuron acquires the information
   (a) Dendrite (b) Cell body
   (c) Axon (d) Nerve ending
2. Junction between two neurons is called
   (a) Cell junction (b) Neuro-muscular junction
   (c) Neural joint (d) Synapse
3. Identify the diagram

   (a) Neural joint
   (b) Neuro-muscular junction
   (c) Cell junction
   (d) None of the above
4. In a neuron, conversion of electrical signal to a chemical signal occurs at/in
   (a) Cell body (b) Axonal end
   (c) Dendritic end (d) None of the above
5. The neurons that carry signals from spinal cord to muscles are
   (a) Sensory neuron (b) Motor neuron
   (c) Relay neuron (d) None of the above

Answer:

1. (a) 2. (d) 3. (b) 4. (b) 5. (b)

SHORT ANSWER TYPE QUESTIONS (2 AND 3 Marks)

1. Draw a labelled diagram of neuron.
2. What is reflex arc ? Explain with the help of flow chart.
3. What is the cause of diabetes ? How it can be controlled ?
4. Why is it advisable to use iodised salt ?
5. What are sensory and motor neurons ? Write their functions.
6. Why is Abscisic acid called as stress hormone ?
7. What is the need for a system of control and coordination in an organism?

8. List two different functions performed by pancreas (CBSE-2019)

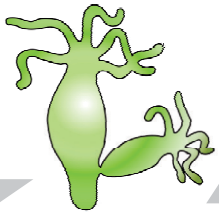
9. What are plant hormones ? Name a plant hormone that promotes growth in plants.

10. What is the significance of tropic movements in plants ? Explain any two types of tropic movements.

11. Which hormone is known as emergency hormone in our body ? How it helps in coping during emergency ?

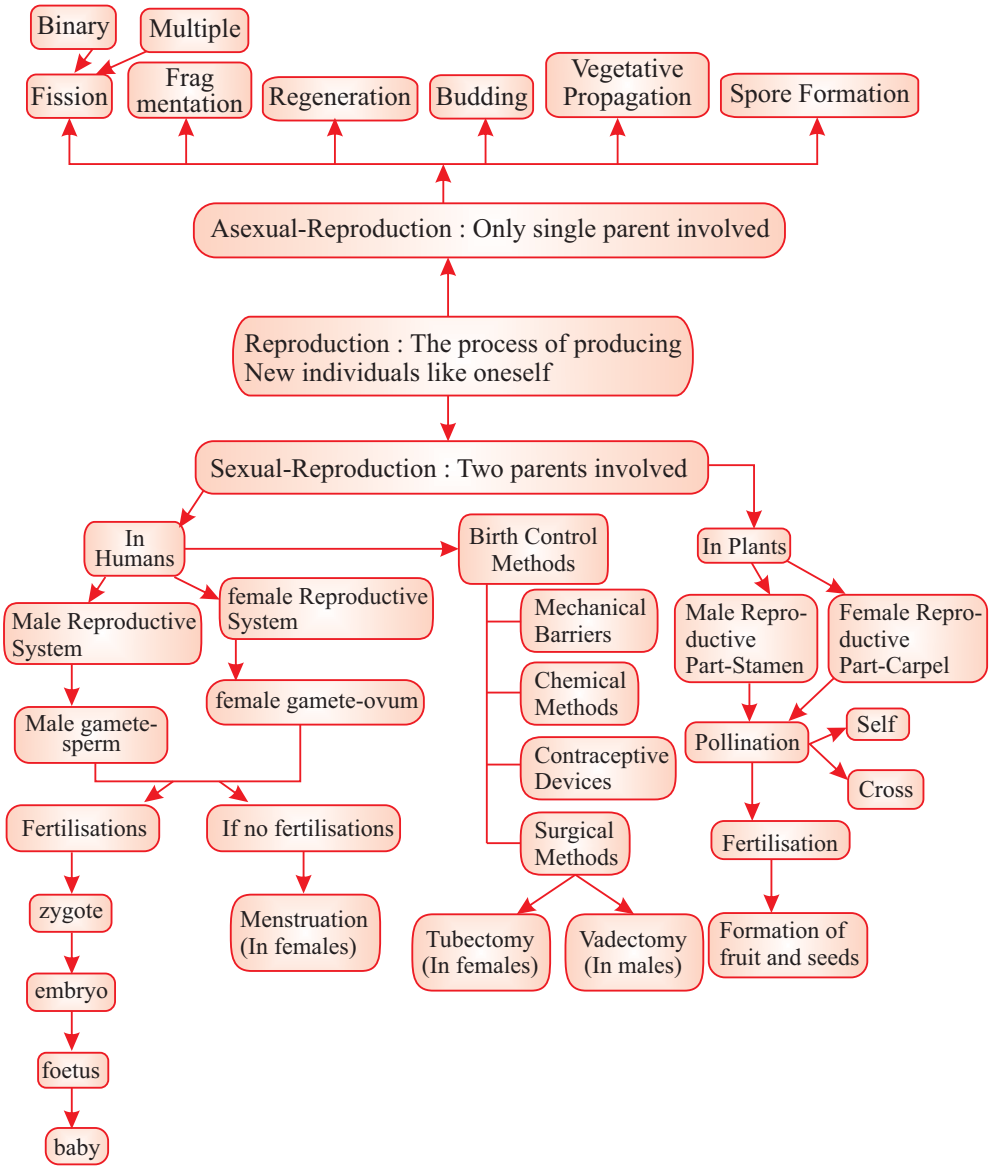
12. Where are different receptors present in our body ? What are their functions ?

13 Trace the sequence of events which occur when a bright light is focused on your eyes. (CBSE-2019)



Chapter - 8

How do Organisms Reproduce



- 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 heredity 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 as well as basis for 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.
- It is extremely useful as a means of rapid multiplication.
- Adopted by lower organisms.

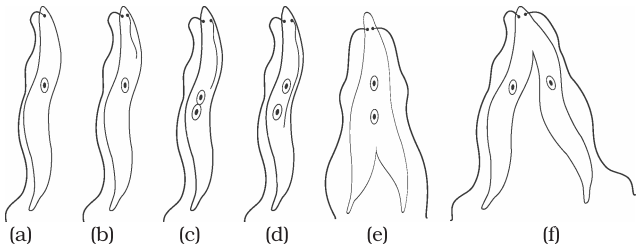
(b) Sexual Reproduction

- 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.

Modes of Asexual Reproduction

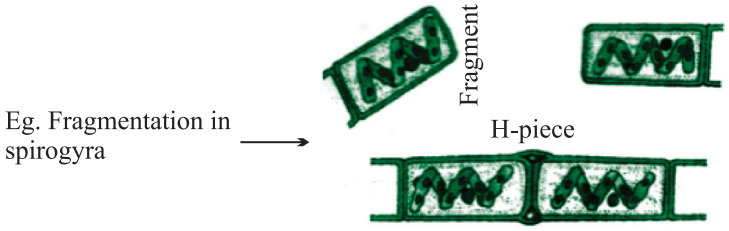
(i) Fission : The parent cell divides into daughter cells.

- **Binary fission :** 2 cells are formed. *E.g.,* amoeba.
- **Multiple fission :** Many cells are formed. *E.g.,* Plasmodium.



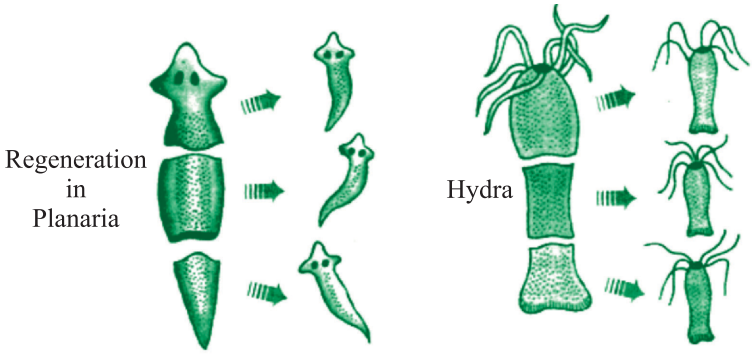
Binary fission in Leishmania

(ii) Fragmentation : The organism breaks-up into smaller pieces upon maturation, each piece develops into new individual. *E.g.,* Spirogyra.



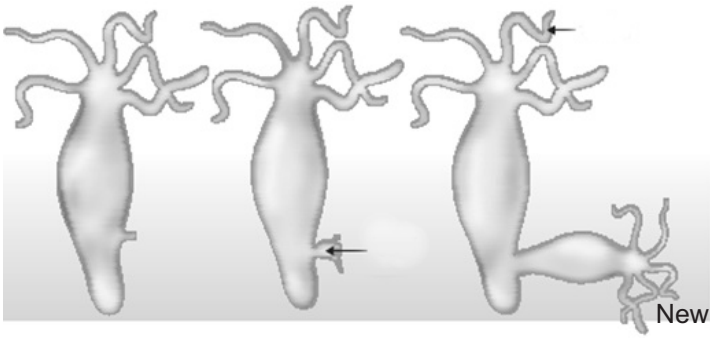
Fragmentation in Spirogyra

(iii) Regeneration : If organism is somehow cut or broken into many pieces, each piece grows into a complete organism. *E.g.,* Planaria, Hydra.



Regeneration in Planaria and Hydra

(iv) Budding : A bud is formed which develops into tiny individual. It detaches from parent body upon maturation and develops into new individual. *E.g.,* Hydra



Budding in Hydra

(v) Vegetative Propagation : In many plants, new plants develops from vegetative parts such as :

- By roots : *E.g.,* dahlias, sweet potato.
- By stem : *E.g.,* potato, ginger.
- By leaves : *E.g.,* bryophyllum (leaf notches bear buds which develop into plants).
- Artificial methods :

(a) Grafting : *E.g.,* Mango

(b) Cutting : *E.g.,* Rose

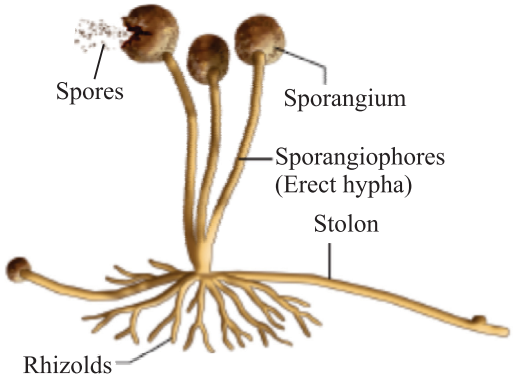
(c) Layering : *E.g.,* Jasmine

(d) **Tissue culture :** New plants are grown by using growing tip of a plant. These growing cells are kept in a culture medium leads to the formation of callus. Callus is then transferred to hormone medium which causes growth and differentiation. *E.g.,* ornamental plants, orchid.

Benefits of tissue culture :

- We can grow plants like banana, rose, jasmine etc. that have lost the capacity to produce seeds.
- New plants are genetically similar to parents.
- Helps in growing seedless fruits.

(vi) Spore Formation : Spores are small bulb like structures which are covered by thick walls. Under favourable conditions, they germinate and produce new organism.



Spore formation in Rhizopus

Sexual Reproduction

When reproduction takes place as a result of the fusion of male and female gametes is called sexual reproduction.

Fusion of gametes is called fertilization which results in variation.

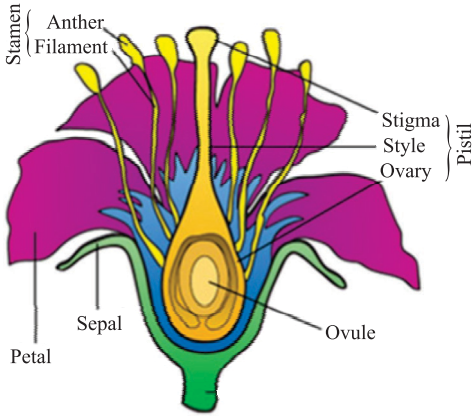
Sexual Reproduction in Plants

- Flowers are the reproductive organs of plants.
- A typical flower consists of four main whorls namely sepals, petals, stamen and pistil.

Types of Flowers

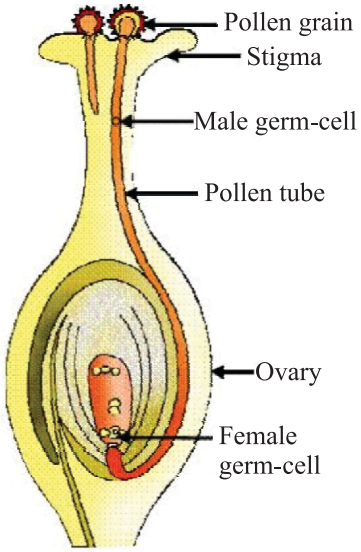
- **Bisexual flower :** Both male and female reproductive parts are present. *E.g.,* Hibiscus, mustard.
- **Unisexual flower :** Either male or female reproductive part is present. *E.g.,* Papaya, watermelon.

Structure of Flower :



Process of Seed Formation

- Pollen grains, produced in the anther, are transferred to the stigma of same flower (self pollination) or stigma of another flower (cross pollination) through agents like air, water or animals.
- Pollen grains germinate and form pollen tubes which pass through style to reach upto the ovules present in ovary.
- The fusion of male and female gametes is called fertilization. Zygote is produced inside the ovary.
- Zygote divides to form embryo. Ovule develops thick coat and changes into seed gradually.
- Ovary changes into fruit and other parts of flower fall off.



Germination of pollen on stigma

- The seed germinates to form a plant under suitable conditions such as air, moisture etc.

Reproduction in Human Beings

- Humans use sexual mode of reproduction.
- **Sexual maturation :** The period of life when production of germ cells *i.e.,* ova (female) and sperm (male) start in the body. This period of sexual maturation is called puberty.

Changes at Puberty

(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 begin to increase.
- Girls begin to menstruate.

(c) In boys

- Thick hair growth on face.
- Voice begin to crack.

These changes signals that sexual maturity is taking place.

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.

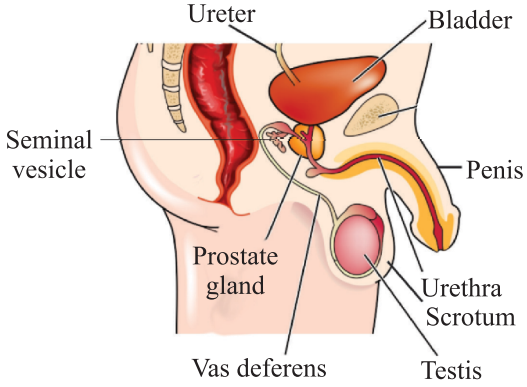
- Male germ cell *i.e.,* sperms are formed here.
- Testes release male sex hormone (testosterone). Its function is :
  (i) Regulate production of sperms.
  (ii) Bring changes at puberty.

(b) Vas deferens : It passes sperms from testes upto urethera.

(c) Urethera : It is a common passage for both sperms and urine. Its outer covering is called 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 alongwith secretion of glands form semen.



Human – male reproductive system

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.
- One egg is produced every month by one of the ovaries.

(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 baby takes place after implantation of embryo in its wall.

- Uterus opens into vagina through cervix.

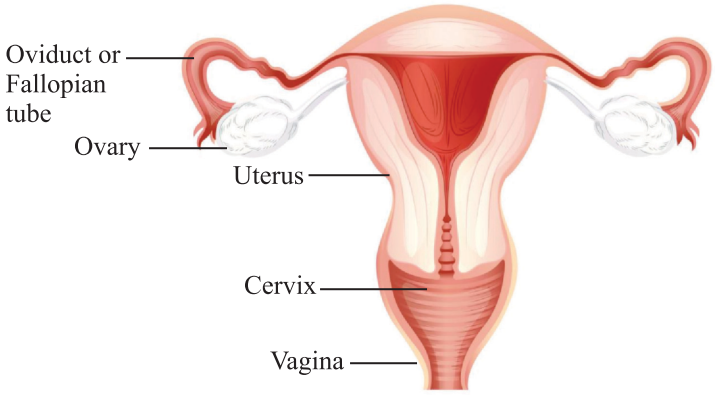


Fig. Human – female reproductive system

When egg is fertilised :

- The fertilized egg called zygote is planted in uterus and develops into an embryo.
- The embryo gets nutrition from the mother's blood with the help of a special tissue called placenta. It provides a large surface area for the exchange of glucose, oxygen and waste material.
- The time period from fertilization upto the birth of the baby is called gestation period. It is about 9 months.

When egg is not fertilised :

- The uterus prepares itself every month to receive fertilized egg.
- The lining of the uterus becomes thick and spongy, required to support the embryo.
- When fertilisation had not taken place, this lining is not needed any longer.
- This lining breaks and comes out through vagina as blood and mucus. This cycle takes around 28 days every month and called menstruation.

Reproductive Health

Reproductive health means a total well-being in all aspects of reproduction *i.e.,* physical, emotional, social and behavioural.

Sexually Transmitted Diseases (STDs)

- Many diseases can be sexually transmitted such as :

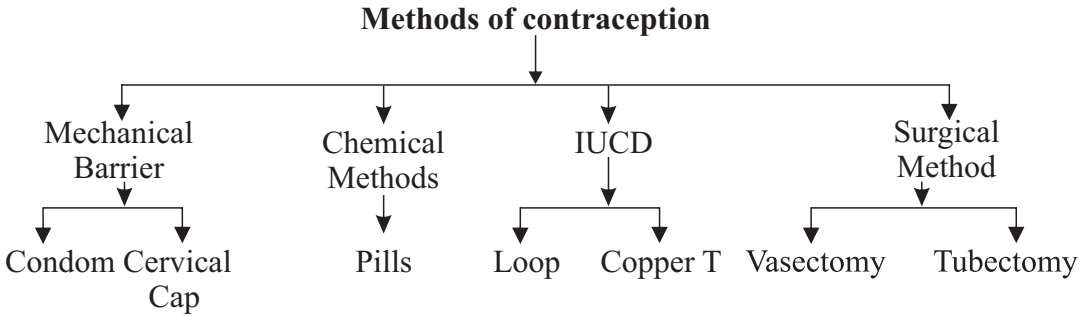
  Bacterial : Gonorrhoea and syphilis

  Viral : Warts and HIV-AIDS

- Use of condom prevents these infections to some extent.

Contraception

It is the avoidance of pregnancy, 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.

Female Foeticide

- The practice of killing a female child inside the womb is called female foeticide.
- For a healthy society, a balanced sex ratio is needed that can be achieved by educating people to avoid malpractices like female foeticide and prenatal sex determination.
- Prenatal sex determination is a legal offence in our country so as to maintain a balanced sex ratio.

MCQ Very Short Answer Type Qestions (1 Marks)

Q.1 Gametes are formed in-

a) Asexual Reproduction b) Sexual Reproduction
c) Vegetative is Propagation d) Tissue Culture

Q.2 Plasmodium reproduced by-

a) Budding b) Binary Fission
c) Fragmentation d) Multiple fission

Q. 3 Which of the following is not a part of flower.

a) Stem b) Carpel
c) Stamen d) Sepals

Q. 4 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

Q. 5 Which among the following diseases is not serwaly transmitted.

a) Syphillis b) HIV-AIDS

c) Cholera d) Gonorrhoea

Q. 6 The ability of a cell to divide into several cells during reproduction in wishmania is called.

a) Budding b) Reduction division

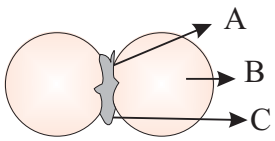
c) Binary fission d) Multiple fission

Q. 7 Characters transmitted from paresnts to off springs are present in

a) Cyptoplasm (b) Ribosome

c) Genes d) Golgi bodies

Q. 8 In figure given here identify the parts A, B and C sequentially.



a) Cotyledon, Plumble, Radicle b) Plumule, Redicle, Cotyledon

c) Plumule, Cotyledon, Radicle d) Radicle, Cotyledon, Plumule

Q. 9 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) Weight gain d) Cracking of voice

Q.10 Which of the following is an example of unisexual

a) Papaya b) Hibiscus

c) Mustard d) Petunia

Answer

1. (b) 2. (d) 3. (a) 4. (d) 5. (c) 6. (c)

7. (c) 8. (c) 9. (d) 10. (a)

11. Labelled Aseertion two other labelled are given one select the correct answer to these question 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 cortrect explanation of the assertion

(c) A is true but R is false

(d) A is false but R is true

1. Asseration : Testes in males are located outside the abdominal cavity in scrotum

   Reason: Sperm formation requires a lower temperature than the normal body temperature

2. Asseration : The lining of uterus thickens and prepares itself every month to receive a fertilised egg.

   Reason: The unfertilized egg implants itself to uterus wall for nutrition

3. Asseration : Conventionally the motile germ cell is male gamete

   Reason: The germ cell has stored food is female gamete

4. Asseration : Hibiscus is a un sexual flower

   Reason: A sexual flower contains both male and female parts

5. Asseration : The human population size is a cause for concern

   Reason: An expanding population makes it easier to improve living conditions

Answer:

1. (a)
2. (a)
3. (c)
4. (d)
5. (c)

Read the following and answer the questions

The female reproductive system is made up of internal and external organs. The function of the system is reproduction of new offsprings. In humas the female reproductive system is immature at birth and develops to maturity at puberty to be able to produce gametes.

1. Which organ of female reproductive system acts as site of implantation of foetus
   (a) Ovary
   (b) uterus
   (c) Cervix
   (d) Fallopain tube
2. Which of the statements is incorrect
   (a) When a girl is born the ovaries contain thousand of immature eggs
   (b) The site of fertilization is uterus
   (c) The menstrual cycle takes place roughly month
   (d) If the egg is not fertilised it is discarded out with the uterus living
3. What is the life span of an unfertilized egg in human females
   (a) One week
   (b) One month
   (c) One day
   (d) 2–8 days
4. The disc like structure in uterine wall that provides foetus a surface for oxygen to pass is called
   (a) Cervix
   (b) Ovary
   (c) Placenta
   (d) None of these
5. Identify the correct statement
   (a) The development of child inside mother's body takes apporoximately nine months
   (b) Theovary releases two eggs per month
   (c) The placenta contains villi on mother's side of the tissue
   (d) The fertilized egg is called embryo and it divides to form zygote

Answer

1. (b) 2. (b) 3. (c)
4. (c) 5. (a)

VERY SHORT ANSWER TYPE QUESTIONS (1 Mark)

13. Name the two types of reproduction.
14. What type of reproduction takes place in plasmodium ?
15. Define vegetative propagation.
16. Where is DNA present in a cell ?
17. Name the glands associated with male reproductive system.
18. What is menstruation ?
19. Name two contraceptive methods.
20. Where are the reproductive parts located in a plant ?

SHORT ANSWER TYPE QUESTIONS (3 Marks)

1. Write important functions of testosterone.
2. What is placenta ? Also write its functions. (CBSE-2018)
3. Why do we see different types of organisms around us ?
4. What is the importance of variation ? (CBSE-2018)
5. Why is vegetative propagation practiced for growing some types of plants ?
6. Write names of male and female sex hormones.
7. Mention the parts of a flower.
8. Differentiate between bisexual and unisexual flowers.
9. What is tissue culture ?
10. Explain the process of fertilisation in flowering plants.
11. Name the different constituents of semen.
12. Draw a well-labelled diagram of male reproductive system.
13. What is pre-natal sex determination ? Why is it banned ?
14. Draw a labelled diagram of the longitudinal section of a flower.

LONG ANSWER TYPE QUESTIONS (5 Marks)

1. What are the different modes of asexual reproduction ?
2. Draw a labelled diagram of female reproductive system and write the function of its different parts. (CBSE-2018)
3. What is contraception ? Give different methods of contraception. (CBSE-2018)
4. What happens in human female :
   (a) when egg is fertilised ?
   (b) when egg is not fertilised ?
5. Trace and explain the steps involved in the formation of seed.
6. Define pollination. Explain the different types of pollination. List two agents of pollination? How does suitable pollination had to fertilization? CBSE-2019

Hints to Long Answer Type Questions

1. Methods of asexual reproduction :
   (a) Fission
   (b) Fragmentation
   (c) Regeneration
   (d) Budding
   (e) Vegetative propagation
   (f) Spore formation
2. Labelled diagram of female reproductive system.

   Functions :

   Ovary : Production of eggs.

   Oviduct : Site for fertilization.

   Uterus : Place of development of embryo.

3. **Contraception :** Barrier for fertilisation.
   - Physical barrier
   - Chemical methods
   - Surgical methods
   - Intrautrine contraceptive device (IUCD)

4. (a) (i) Zygote is formed → Implanted in uterus

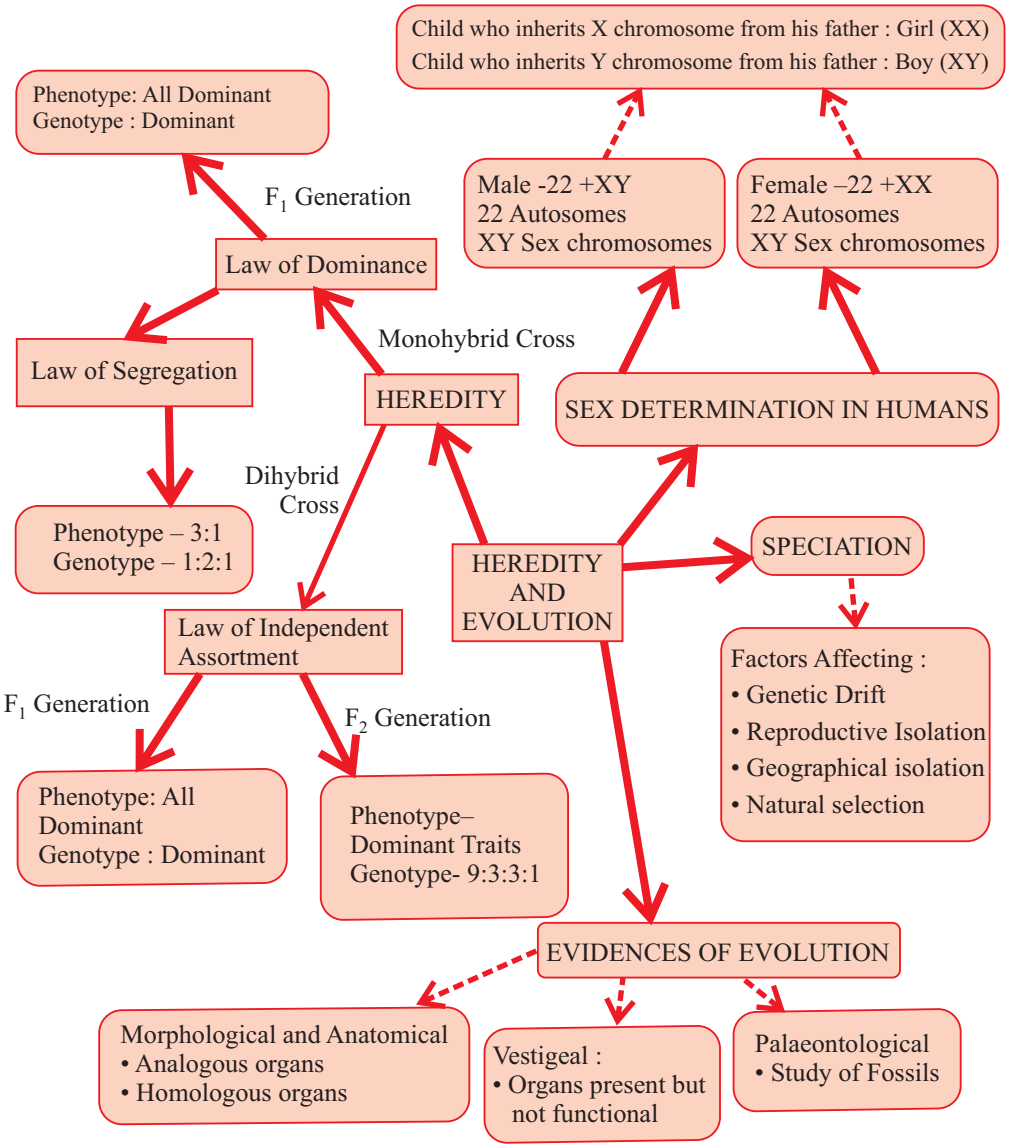
   (ii) Onset of pregnanacy

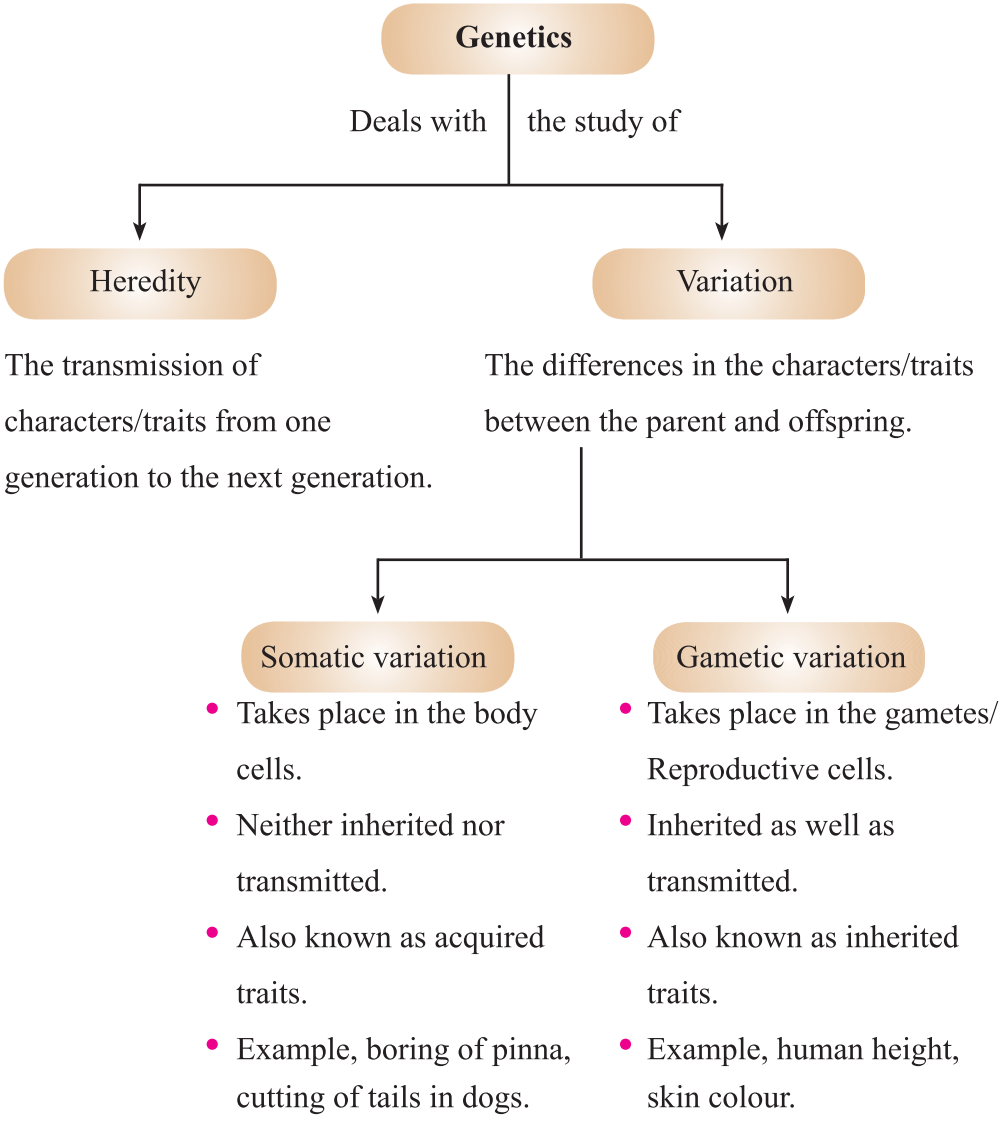
   (b) Menstruation

5. Labelled diagram of germination of pollen grain on stigma of flower.

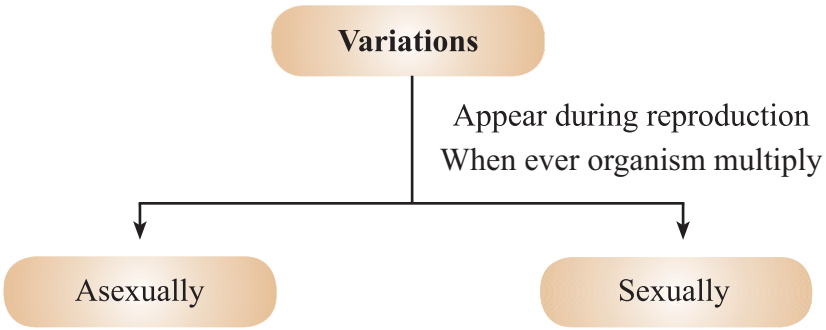
Chapter - 9

Heredity and Evolution




Genetics
Deals with
the study of
Heredity
Variation
The transmission of characters/traits from one generation to the next generation.
The differences in the characters/traits between the parent and offspring.
Somatic variation
Gametic variation
• Takes place in the body cells.
• Neither inherited nor transmitted.
• Also known as acquired traits.
• Example, boring of pinna, cutting of tails in dogs.
• Takes place in the gametes/ Reproductive cells.
• Inherited as well as transmitted.
• Also known as inherited traits.
• Example, human height, skin colour.

Accumulation of Variation during Reproduction



- Variations are fewer.
- Occurs due to small inaccuracies in DNA copying. **(Mutation)**

- Variations are large.
- Occurs due to crossing over, separation of chromosomes, mutation.

Importance of Variation :

(i) Depending upon the nature of variations different individuals would have different kinds of advantage.

Example, Thermostatic 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.

Free ear lobes and **attached ear lobes** are two variants found in human populations.

Mendel and His Work on Inheritance

- **Gregor Johann Mendel (1822 & 1884) :** Started his experiments on plant breeding and hybridisation. He proposed the laws of inheritance in living organisms.

  Mendel was known as **Father of Genetics.**

- **Plant selected by Mendel :** *Pisum sativum* (garden pea). Mendel used a number of contrasting characters for garden pea.

CHARACTER	DOMINANT TRAIT	RECESSIVE TRAIT
Seed shape	 Round	 Wrinkled
Seed colour	 Yellow	 Green
Flower colour	 Violet	 White
Pod shape	 Inflated/full	 Constricted

Mendel's Experimental Material : He chose Garden Pea *(Pisum sativum)* as his experiment material because of :

(i) Availability of detectable contrasting traits of several characters.

(ii) Short life span of the plant.

(iii) Normally allows self-fertilisation but cross-fertilisation can also be carried out.

(iv) Large no. of seeds produced.

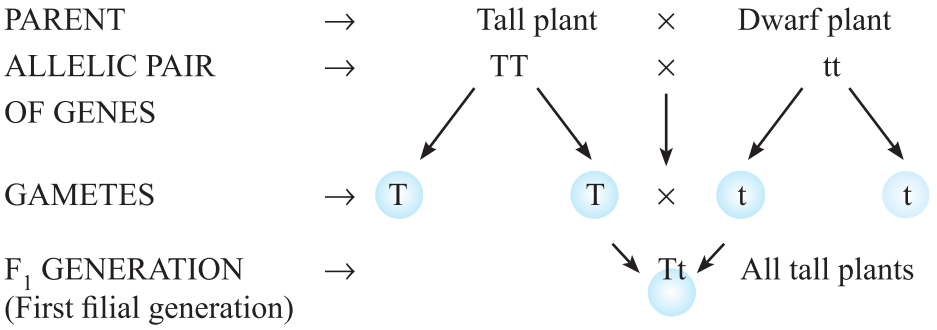
- **Mendel's Experiments :** Mendel conducted a series of experiments in which he crossed the pollinated plants to study one character (at a time).

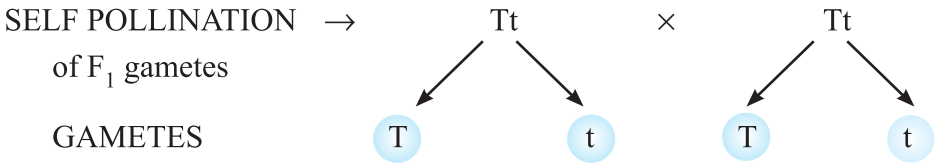
Monohybrid Cross

Cross between two pea plants with one pair of contrasting characters is called a monohybrid cross.

Example : Cross between a tall and a dwarf plant (short).

MONOHYBRID CROSS



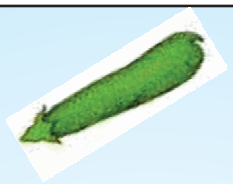
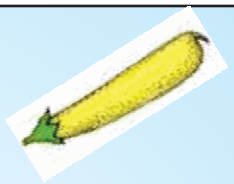


F_2 GENERATION →

Gametes →	T	t
T	TT tall	Tt tall
t	Tt tall	tt dwarf

Phenotypic ratio → 3 : 1 Tall : Dwarf 3 : 1

Genotypic ratio → 1 : 2 : 1 TT : Tt : tt 1 : 2 : 1

Pod Colour	 Green	 Yellow
Flower position	 Axial	 Terminal
Stem height	 Tall	 Dwarf

TT, tt] Both dominant traits / Both recessive alleles] — Pure or homozygous condition

Tt] One dominant, one recessive trait] — Hetrozygous condition – Hybrid

Phenotypic ratio → 3 : 1

Genotypic ratio → 1 : 2 : 1

Phenotype → Physical appearance [Tall or Short]

Genotype → Genetic make up [TT, Tt or tt]

Observations of Monohybrid Cross

(i) All F_1 progeny were tall, no medium height plant. (Half way characteristic)

(ii) F_2 progeny ¼ were short, ¾ were tall.

(iii) Phenotypic ratio F_2 – 3 : 1 (3 tall : 1 short)

Genotypic ratio F_2 – 1 : 2 : 1 $\begin{pmatrix} TT & : & Tt & : & tt \\ 1 & : & 2 & : & 1 \end{pmatrix}$

Conclusions

1. TT and Tt both are tall plants while tt is a short plant.
2. A single copy of T is enough to make the plant tall, while both copies have to be 't' for the plant to be short.
3. Characters/traits like 'T' are called dominant trait (because it express itself) and 't' are recessive trait (because it remains suppressed).

Dihybrid Cross

A cross between two plants having two pairs of contrasting characters is called dihybrid cross.

PARENT GENERATION → Round green seeds × Wrinkled yellow seeds

RRyy ↓ rrYY ↓

GAMETES → Ry rY

F_1 → RrYy [Round, yellow]

F_1 × F_1

Selfing F_1 gametes → Rr Yy (RY, Ry, rY, ry) x Rr Yy (RY, Ry, rY, ry)

F_2 gametes $\rightarrow$

	RY	Ry	rY	ry
RY	RRYY	RRYy	RrYY	RrYy
Ry	RRYy	RRyy	RrYy	Rryy
rY	RrYY	RrYy	rrYY	rrYy
ry	RrYy	Rryy	rrYy	rryy

Phenotypic Ratio

Round, yellow : 9

Round, green : 3

Wrinkled, yellow : 3

Wrinkled, green : 1

Observations

(i) When RRyy was crossed with rrYY in F1 generation all were Rr Yy round and yellow seeds.

(ii) Self pollination of F1 plants gave parental phenotype and two mixtures (recombinants round yellow and wrinkled green) seeds plants in the ratio of 9 : 3 : 3 : 1.

9	:	3	:	3	:	1
(Round yellow)		(Round green)		(Wrinkled yellow)		(wrinkled green)

Conclusions

1. Round and yellow seeds are Dominant characters.

2. Occurrence of new phenotype combinations show that genes for round and yellow seeds are inherited independently of each other.

Mendel's Law of Inheritance

Based on his hybridisation experiments, mendal proposed the laws of inheritance.

1. Law of dominance - This law states that when two alternative forms of a trait or character (genes or alleles) are present in as organism, only

one facter expresses itself in F, progery and is called dominant while the other that remains masked is called recessive.

Characters are controlled by discrete units called factors. Factors occur in pairs.

2. Law of segregation or law of purity of gametes.

This law states that the facters ot alleles of a pair segregate from each other durting gamete formation such that a example recieve only one of the factors. They do not show any blending but simply remain together.

Homozygous parent produces all gametes that are similar, heterozygous parent produces two types of gametes, each having one allele in equal proportion.

3. Law of independent assortment - This law states that the two factors of each character assort or separate out independent of the factors of other characters at the time of gamete formation and get randomly rearranged in the offsprings producing both parental and new combination of characters.

When two pairs of traits are combined in a hybrid, segreration of one pair of character is independent of the other pair of characters.

How do these traits get expressed

Cellular DNA (Information source)
↓ For synthesis of
Proteins (Enzyme)
↓ Works efficiently
More Hormone
↓ produced
Tallness of plant

Therefore, genes control characteristics/traits.

SEX DETERMINATION

Determination of sex of an offspring.

FACTORS

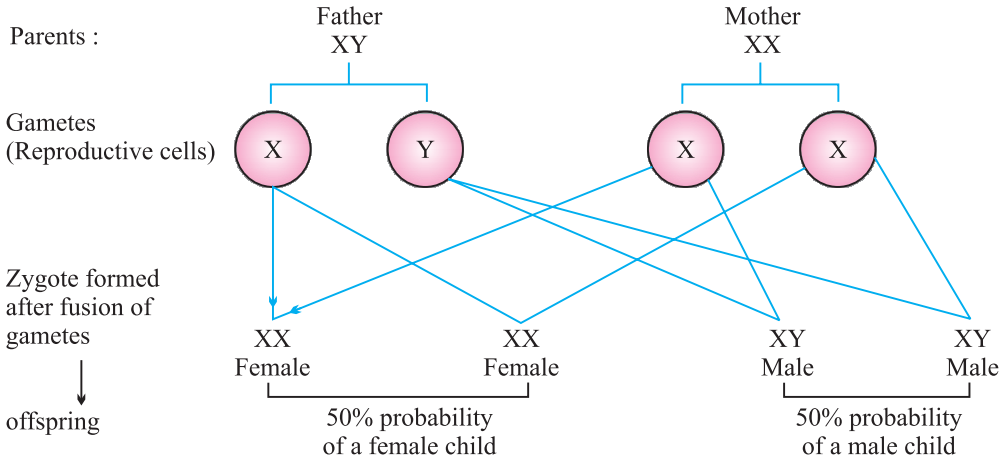
Responsible for Sex Determination

Environmental	**Genetic**
In some animals, the temperature at which the fertilized eggs are kept decides the gender. E.g., in turtle	In some animals like humans gender of individual is determined by a pair of chromosomes called sex chromosome. XX – Female XY – Male

Sex Chromosomes : In human beings, there are 23 pairs of chromosome. Out of these 22 chromosomes pairs are called autosomes and the last pair of chromosome that help in deciding gender of that individual is called sex chromosome.

XX – Female SEX
XY – Male CHROMOSOMES

Sex determination in Human Beings



This shows that half the children will be boys and half will be girls. All children will inherit an X chromosome from their mother regardless whether they are boys or girls. Thus, sex of children will be determined by what they inherit from their father, and not from their mother.

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.

Situation I

Group of red beetles

↓

Colour variation arises during reproduction

All beetles red except one that is green	One beetle green
↓	↓ Reproduction
Crows feed on red beetle	Progeny beetles green
↓	↓
No. of red beetles reduces	Crows could not feed on green beetles as they got camouflaged in green bushes
	↓
	Number of green beetles increases

Conclusion

Green beetles got the survival advantage or they were naturally selected as they were not visible in green bushes. This natural selection is exerted by crows resulting in adaptations in the beetles to fit better in their environment.

Situation II

Group of red beetles

↓ Reproduction

All beetles are red except one that is blue — One blue beetle

↓ Reproduces

Number of red beetles increases — No. of blue beetles increases

↓

Crows can see both blue and red beetles and can eat them

↓

Number reduces but still red beetles are more and blue ones are few

↓

Suddenly elephant comes and stamps on the bushes

↓

Now beetles left are mostly blue

Conclusion

Blue beetles did not get survivals advantage. Elephant suddenly caused major havoc in beetles population otherwise their number would have been considerably large.

From this we can conclude that accidents can change the frequency of some genes even if they do not get survival advantage. This is called genetic drift and it leads to variation.

Situation III

Group of red beetles

↓

Habitat of beetles (bushes)
suffer from plant disease

↓

Average weight of beetles
decreases due to poor nourishment

↓

Number of beetles kept on reducing

↓

Later plant disease gets eliminated

↓

Number and average weight of beetles increases again

Conclusion

No genetic change has occurred in the population of beetle. The population gets affected for a short duration only due to environmental changes.

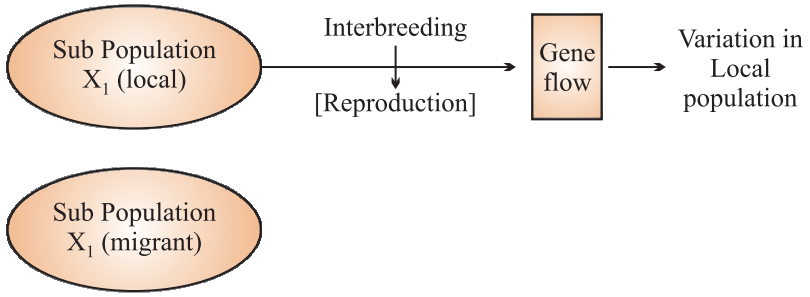
ACQUIRED AND INHERITED TRAITS

Acquired Traits	Inherited Traits
1. These are the traits which are developed in an individual due to special conditions.	1. These are the traits which are passed from one generation to the next.
2. They cannot be transferred to the progeny.	2. They get transferred to the progeny.
3. They cannot direct evolution. *E.g.,* Low weight of starving beetles.	3. They are helpful in evolution. *E.g.,* Colour of eyes and hair.

WAYS BY WHICH SPECIATION TAKES PLACE

Speciation takes place when variation is combined with geographical isolation.

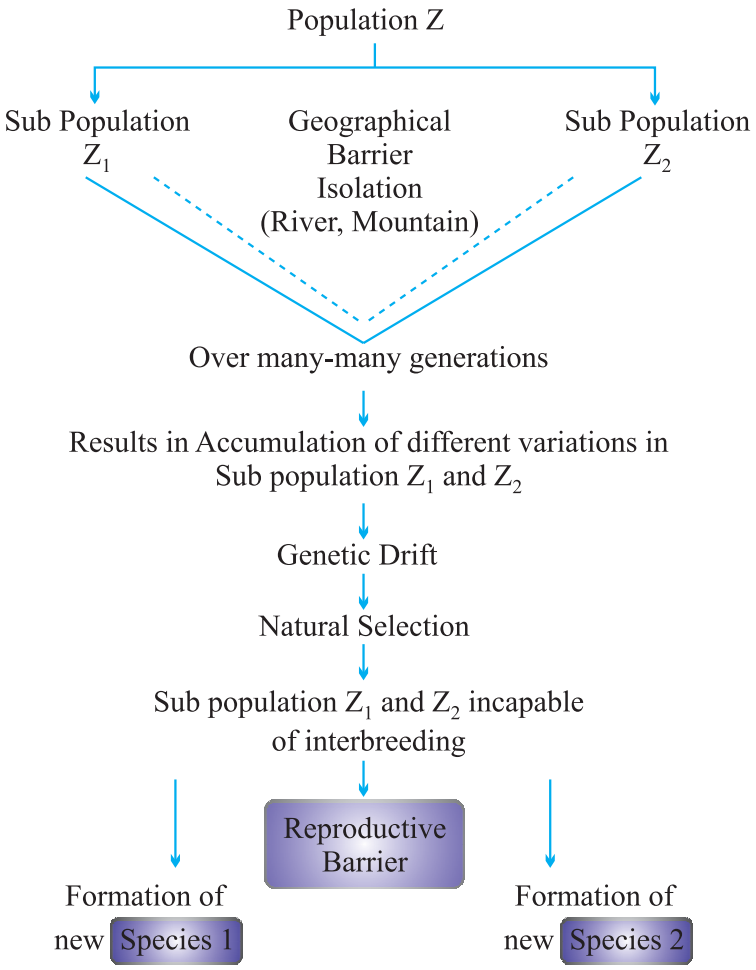
1. Gene flow : Occurs between population that are partly but not completely separated.



2. Genetic drift : It is the random change in the frequency of alleles (gene pair) in a population over successive generations.

3. Natural selection : The process by which nature selects and consolidate those organisms which are more suitable adapted and possesses favourable variations.

4. Geographical isolation : It is caused by mountain ranges, rivers etc. Geographical isolation leads to reproductive isolation due to which there is no flow of genes between separated groups of population.



Genetic drift takes place due to :

(a) Severe changes in the DNA

(b) Change in number of chromosomes

Evolution and Classification

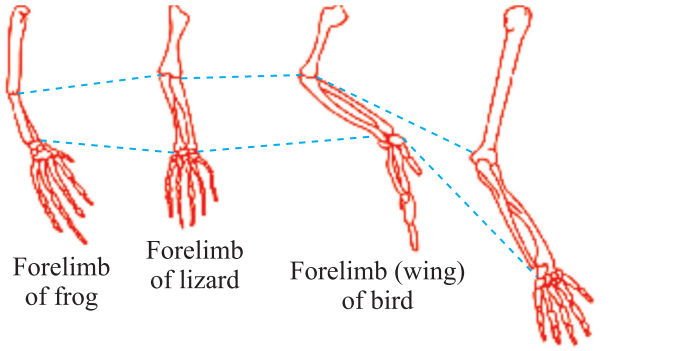
Both evolution and classification are interlinked.

1. Classification of species is reflection of their evolutionary relationship.

2. The more characteristic 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 characteristic.



Homologous organs of some vertebrates

(a) Wing of bird (b) Wing of insect

Analogous organ of flying birds

TRACING EVOLUTIONARY RELATIONSHIPS

(Evidences of Evolution)

I. Homologous Organs : (Morphological and anatomical evidences). These are the organs that have same basic structural plan and origin but different functions.

Homologous organs provides evidence for evolution by telling us that they are derived from the same ancestor.

Example :

Forelimb of horse	(Running)	Same basic structural plan, but different functions perform.
Wings of bat	(Flying)	
Paw of a cat	(Walk/scratch/attack)	

II. Analogous Organs : These are the organs that have different origin and structural plan but same function.

Example : Analogous organs provide mechanism for evolution.

Wings of bat → Elongated fingers with skin folds

Wings of bird → Feathery covering along the arm

Different basic structure, but perform similar function *i.e.,* flight.

III. Fossils : (Paleontological evidences)

The remains and relics of dead organisms of the past.

FOSSILS ARE PRESERVED TRACES OF LIVING ORGANISMS

Fossil Archaeopteryx possess features of reptiles as well as birds. This suggests that birds have evolved from reptiles.

Examples of Fossils

AMMONITE	-	Fossil-invertebrate
TRILOBITE	-	Fossil-invertebrate
KNIGHTIA	-	Fossil-fish
RAJASAURUS	-	Fossil-dinosaur skull

AGE OF THE FOSSILS

I. Deeper the fossil, older it is.

1. (Top layer of the earth surface)

Recent →

II. Detecting the ratios of difference of the same element in the fossil material *i.e.,* **Radio-carbon dating** [C-(14) dating]

2. .....
3. .....
4. .....
5. .....

layer of Earth Surface

← Older

6. .....

Evolution by Stages

Evolution takes place in stages *i.e.,* bit by bit over generations.

I. Fitness Advantage

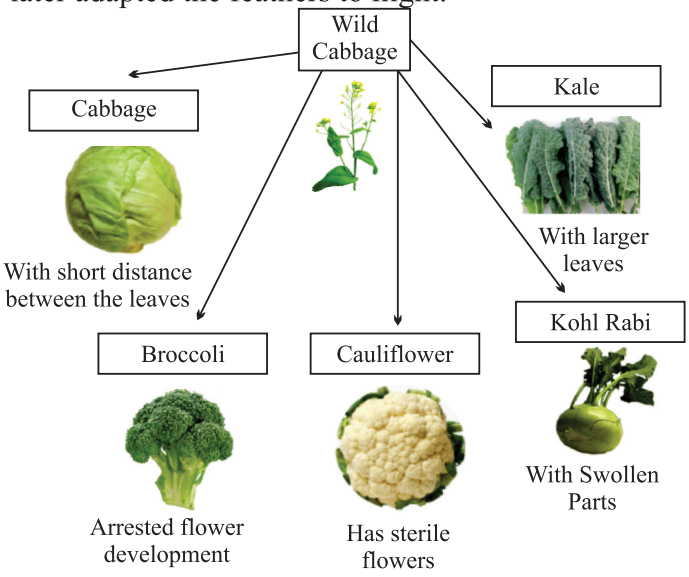
Evolution of Eyes : Evolution of complex organs is not sudden. It occurs due to minor changes in DNA, however takes place bit by bit over generations.

- Flat worm has **rudimentary eyes.** (Enough to give fitness advantage)
- Insects have **compound eyes.**
- Humans have **binocular eyes.**

II. Functional Advantage

Evolution of Feathers : Feathers provide insulation in cold weather but later they might become useful for flight.

Example, Dinosaurs had feathers, but could not fly using feathers. Birds seem to have later adapted the feathers to flight.



Evolution by artificial selection

Evolution by Artificial Selection

Humans have been a powerful agent in modifying wild species to suit their own requirement throughout ages by using artificial selection. *E.g.,*

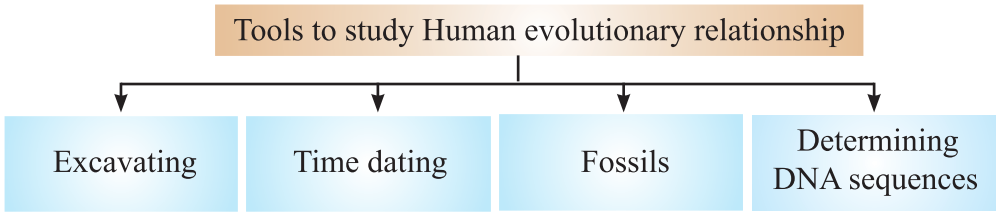
(i) From wild cabbage many varieties like broccoli, cauliflower, red cab bage, kale, cabbage and kohlrabi were obtained by artificial selection.

(ii) Wheat (many varieties obtained due to artificial selection).

Molecular Phylogeny

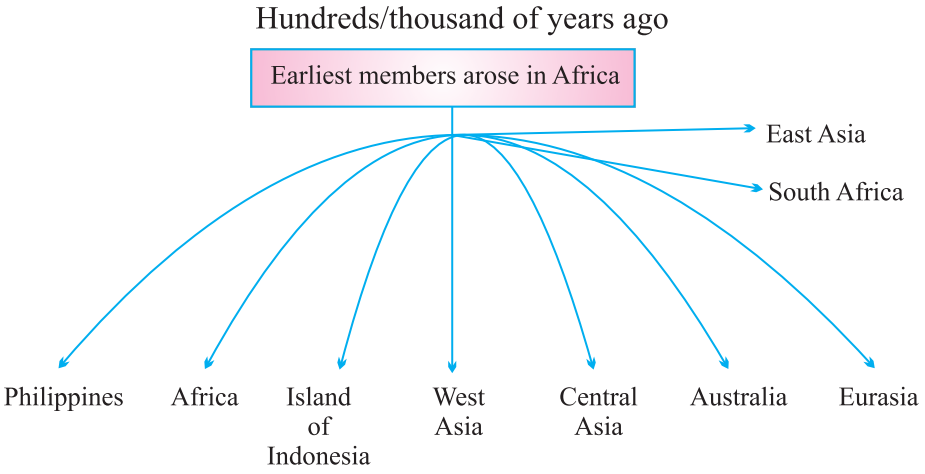
- It is based on the idea that changes in DNA during reproduction are the basic events in evolution.
- Organisms which are most distantly related will accumulate greater differences in their DNA.

HUMAN EVOLUTION



Although there is great diversity of human forms all over the world, yet all humans are a single species.

GENETIC FOOTPRINTS OF HUMANS



- They did not go in a single line.
- They went forward and backward.
- Moved in and out of Africa.
- Sometimes came back to mix with each other.

Genetic Terminology

1. Gene : Mendel used the term factor for a gene. A gene is the unit of DNA responsible for the inheritance of character.

2. Allele : A pair of genes that control the two alternatives of the same phenotypic characterstic *e.g.,* TT/tt.

3. Heterozygous : The organism in which both the genes of a character are unlike *e.g.,* Tt.

4. Homozygous : The organism in which both the able of genes of a character are similar *e.g.,* TT, tt.

5. Dominant : The gene which expresses itself in F_1 generation is known as dominant gene.

6. Recessive : The gene which is unable to express itself in presence of the dominant gene.

7. Genotype : It is the genetic constitution of an organism which determines the characters.

8. Phenotype : It is the appearance of an individual.

9. Micro-evolution : It is the evolution which is on a small scale.

10. Species : A group of similar individuals within a population that can interbreed and produce fertile offspring.

11. Chromosome : Thread like structures present in the nucleus of a cell, containing hereditary information of the cell.

12. DNA : Deoxyribose Nucleic Acid.

It is present in chromosomes which carries traits in a coded form, from one generation to the next.

QUESTIONS

VERY SHORT ANSWER TYPE QUESTIONS (1 Mark)

Multiple Choice Questions (M.C.Q.'s)

1. Genetics is defined as:
   a) Study of genes
   b) The study of chromosomes
   c) The study of humans
   d) Branch of science dealing with heredity and variation.
2. The organism on which Mendel performed his experiments (CBSE-2019)
   a) Gram b) Garden Pea c) Peanut d) Pigeon Pea
3. A cross between a tall plant (TT) and short pea plant (tt) resulted in progeny that were all tall plants because—
   a) Shortness is a dominant trait
   b) Tallness is a recessive trait
   c) Tallness is the dominant trait
   d) Height of pea plant is not governed by gene 'T' or 't'
4. The character which can be acquired but not inherited is :
   a) Colour of Eye
   b) Colour of skin
   c) Nature of hair
   d) Size of body
5. A zygote has an X-chrmosome in herewith from the father will develop into a
   a) Boy
   b) X-Chromosome does not determine the sex of child.
   c) Girl
   d) Either boy or girl

6. A pregnent women has an equal chance of her baby being blood group A or blood group AB. Which one of the following shows the possible of the woman and the father of her child?

a) I^AI^A & I^BI^B b) I^AI^B * I^BI^O

c) I^AI^O & I^BI^O d) I^AI^B & I^AI^O

7. A normal cell of human body contains 23 pairs of chromosomes. The number of chromosomes is a sex cell (sperm or ovum) of a human being is most likely to be.

a) 46 b) 23

c) 21 d) 42

8. The visible charactertistics in an organism is known as

a) Prototype b) Sterotype

c) Phenotype d) Genotype

9. A cross between two individuals results in a ratio of 9 : 3 : 3 :1 for four possibler phenotypes of progeny. This is an example of a :

a) Dihybrid cross b) Monohybrid cross

c) Test cross d) None of these

10. Of what chromosomes are made up of

a) DNA b) DNA & RNA

c) DNA, RNA & proteis d) None of these

Answer

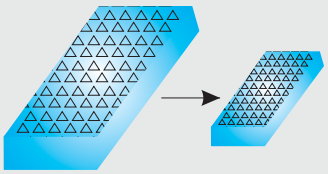
1. (d)	2. (b)	3. (c)	4. (d)
5. (c)	6. (d)	7. (a)	8. (c)
9. (a)	10. (a)		

II Read the following passge and answer the given questions

Specation is how a new kind of plant or animal species is created. Speciation occurs when a group within a species separates from other members of its species and develops its own unique characteristics. The demands of a different environment or the characteristics of the members of the new group will differentiate the new species from their ancestors.

The reproductive isolation that is integral to the process of speciation occurs due to reproductive barries behavioural or physical differences arising between the new species.

1. The difference in the characeters among the individuals of a species is called.
   a) Speciation
   b) Variation
   c) Evolution
   d) Heredity
2. What is the difference between genetic drift and natural selection?
3. Which factor of speciation is illustrated on the right?
   a) Genetic drift
   b) Geographical isolation
   c) Varriations
   d) All of them



4. The disappearance of a gene from a population is called?
   a) Genetic code
   b) Genetic modification
   c) Genetic drift
   d) Genetic mutation
5. The table below shows the survival rate of two types of beetles in the save environment over a period of three years.

Survival Rate

Year Green	Beetles (%)	Brown Beetles (%)
1	78	45
2	83	42
3	77	40

Obeserve the above table carefully and choose the correct option for the asked question below.

Why do you think green beetles have more survival percentage?

(a) Due to natural selection and high reproductive rate.

(b) Due to genetic drift and variations

(c) Due to protection from predators because of thir body colour and natural selection

(d) Due to their longer life span than that of brown beetles

Read the assertion and reason carefully and then mark the correct option out of the option given below:

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

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

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

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

1. Asseration (A) : Mendel chose a pea plant for his experiments.

   Reason (R) : Pea in easy to grow and had distinctly easily detectable contrastine varients of features.

2. Asseration (A) : Geographical isolation cannot be a major factor in speciation of a sexually reproducing organisms.

   Reason (R) : Asexually reproducing organisms do not require any other organism for reproduction.

3. Asseration (A) : Variation is minimum is asexual reproduction.

   Reason (R) : All variation in a species have equal chance of survival.

4. Asseration (A) : Evolution is the gradual change which takes place in organism over millions of years and new species are product.

   Reason (R) : Heredity is the transmissions of characters or traits from parents to off springs.

5. Asseration (A) : Recessive trait can only be expressed in homozygous condition.

   Reason (R) : Dominant trait cannot be expressed in heterozygous condition.

7. Name of the following

   (1) The formation of new species due to gradual over long period of time.

   (2) The carrier of heredity.

   (3) The alternative form of gene controlling character of the same trait.

   (4) An animal having rudimentary eye.

(5) Thread like structure present in the nucleus of a cell, containning hereaditary information of the cell.

Very Short Answer Type Questions (1 Marks)

8. (1) Write the scientific name of garden pea.
   (2) Where are genes located
   (3) No two individuals are absolutely alike in a population. Why?
   (4) What are the chromosomes XY and XX known as?
   (5) Name varieties of vegetables which have been produced form 'wild cabbage' by the process of artificial selection.

9. Give Reasons :
   (1) Mendal chose pea plant for his experiments
   (2) Human beings who look different from each other in terms of size, colour and looks said to belong to same species.

Short Answer Type Question

1. Differentiate between homologous and analgous organs, with examples.
2. What are fossils? How can the of fossils be determined?
3. Varriation is beneficial to the species but not necessarily for the individual. Give three reasons to justify it.
4. The human hand, cat paw and horse foot, when studied in detail show the same structure of bones and point towards a comoon origin.
   (a) What do you conclude from this?
   (b) What is the term given to such structure
5. What is genetic drift. Explain with examples.
6. Write a short note on (a) gene flow (b) Natural selection
7. Distinguish between autosomes and sex chromosomes.
8. Distinguish between inherited traits and acquired traits giving one example of each. Give reason why the traits acquired by an individual during the life time are not inherited.
9. A cross is carried between pure bred tall plant and pure bred dward pea plant.

(a) What is the phenotype of F_1 progeny and why

(b) What is the phenotype of F_2 progeny when F is selfed.

10. Why a small population of surviving genes faces a greater thread of extinction. provide a suitable explanation from the point of view of genetics.

2 Marks

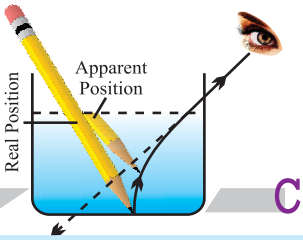
1. Explain sex determination.
2. What are geres? Where are they located?
3. What is meant by dominant genes and recessive genes? Give one example of each.
4. What are sex chromosomes?
5. How many sex chromosomes are there? Name them.
6. Name the four blood groups in human.
7. Why did Mendel choose pea plants for conducting his expiriments or inheritance?
8. What does law of segregation states?
9. Differentitate between somatic varriation and genetic variation?
10. Write down the phenotypic ratio and gertypic rarto in monohybrid cross.

Long Answer Type of Questions (5 Marks)

1. Evolution should not be equated with progress Explain.
2. Explain few mechanism of sex determination in human being.
3. (a) What are homologous structure ! Give an example.

   (b) What are fossils. How the age of fossils is determined.
4. What is speciation. List the factors responsible for speciation and mention how they could lead to the rise of a new species.
5. (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.



Chapter - 10

Light

- Light is the form of energy that enables us to see.

Properties of Light

- Electromagnetic wave, so does not require any medium to travel.
- Light tends to travel in straight line.
- Light has dual nature *i.e.,* wave as well as particle.
- Light casts shadow.
- Speed of light is maximum in vaccum. Its value is 3×10^8 ms^{-1}.
- When light falls on a surface, following may happen :
  - (a) Reflection
  - (b) Refraction
  - (c) Absorption

REFLECTION

Bouncing back of light when it strikes on a polished surface like mirror.

Laws of Reflection :

(1) Angle of incidence is equal to the angle of reflection.

(2) The incident ray, the reflected ray and the normal at the point of incidence, all lie in the same plane.

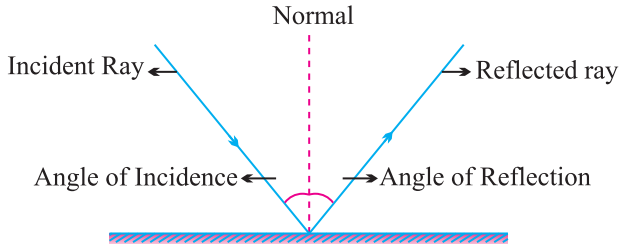
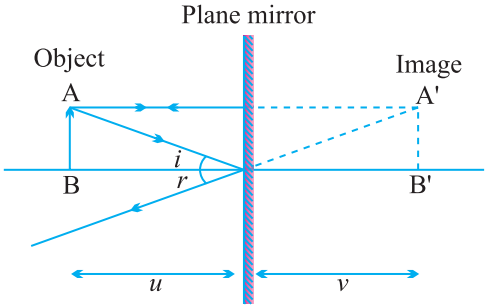


Image : It is a point where atleast two light rays actually meet or appear to meet.

Real Image	Virtual Image
• Formed when light rays actually meet. • Can be obtained on screen. • Inverted • *E.g.,* image formed on cinema screen.	• Formed when light rays appear to meet. • Can't be obtained on screen. • Erect • *E.g.,* image formed by plane mirror or convex mirror.

Image Formed by Plane Mirror



Characteristics of Image

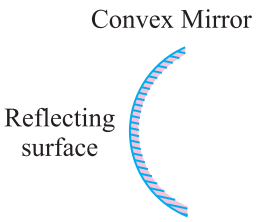
(i) Virtual and erect.
(ii) Size of image is equal to the size of object.
(iii) Image is formed as far behind the mirror as the object is in front of it.
(iv) Laterally inverted.

Lateral Inversion : The right side of the object appears left side of the image and vice-versa.

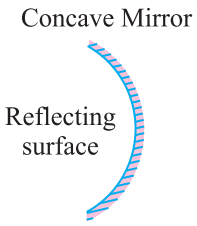
Application of lateral inversion : The word AMBULANCE is written as ƎƆИAJUBMA so that it can be read correctly in rear view mirror of vehicles going in front of it.

Spherical Mirrors : Mirrors whose reflecting surface is curved.

Convex Mirror

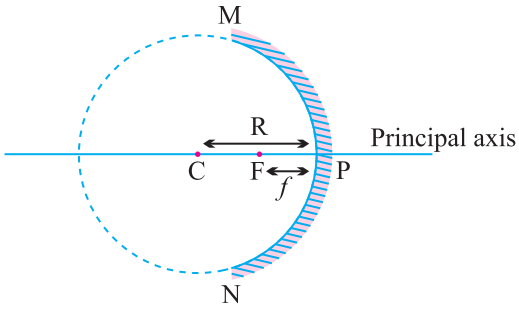


Concave Mirror



- Reflecting surface is curved outwards.
- Diverging mirror

- Reflecting surface is curved inwards.
- Converging mirror



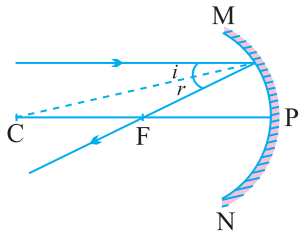
- **Principal axis :** The line joining the pole and center of curvature.
- **Pole (P) :** The centre of the spherical mirror.
- **Aperture (MN) :** It is the effective diameter of the spherical mirror.
- **Center of Curvature (C) :** The centre of the hollow glass sphere of which the mirror was a part.
- **Radius of Curvature (R) :** The distance between the pole and the centre of curvature.
- **Focus (F) :** The point on principal axis where all the parallel light rays actually meet or appear to meet after reflection.
- **Focal length (*f*) :** The distance between the pole and the focus.

Relationship between focal length and radius of curva ture :

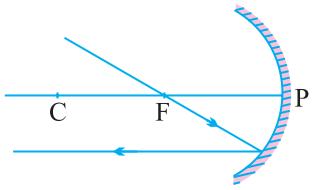
$$f = \frac{R}{2}$$

Rules for making ray diagrams by concave mirror

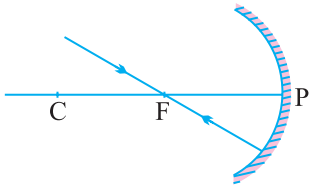
(i) A ray parallel to the principal axis will pass through the principal focus, after reflection.



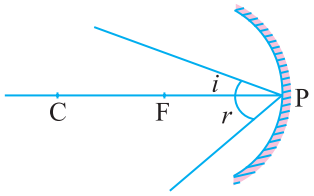
(ii) A ray passing through the principal focus of concave mirror will emerge parallel to principal axis after reflection.



(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.

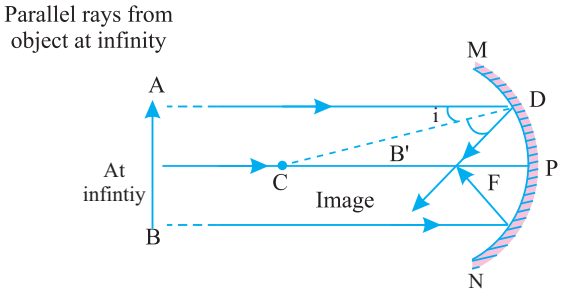


(iv) A ray incident obliquely to the principal axis of a concave mirror is reflected obliquely making equal angle.



Ray diagrams for images formed by concave mirror

(i) When object is at infinity :



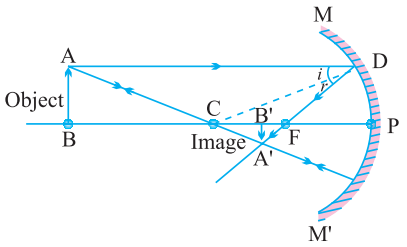
Image

Position – At 'F'

Nature – Real, inverted

Size – Point sized or highly diminished

(ii) When object is beyond 'C'



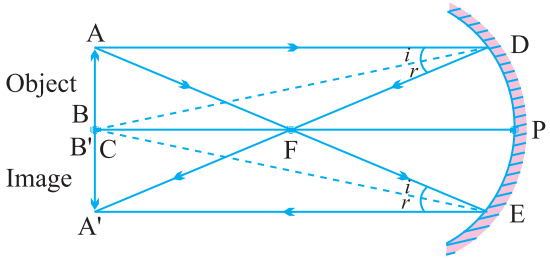
Image

Position – Between 'F' and 'C'

Nature – Real, inverted

Size – Diminished

(iii) When object is at 'C'



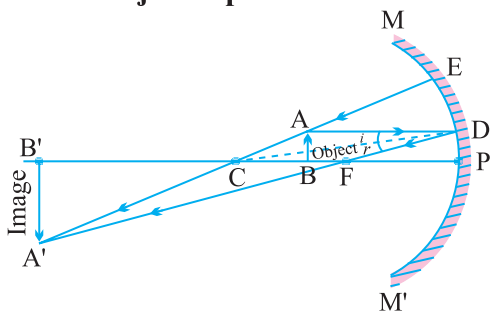
Image

Position – At 'C'

Nature – Real, inverted

Size – Same size as that of object

(iv) When object is placed between 'F' and 'C'



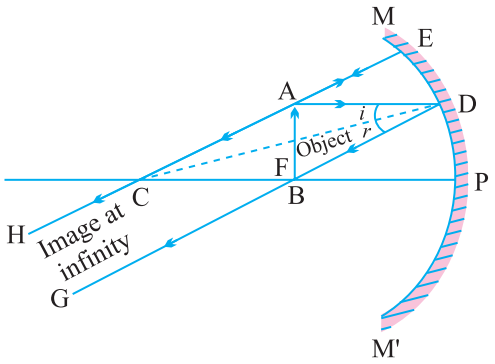
Image

Position – Beyond 'C'

Nature – Real, inverted

Size – Enlarged

(v) When object is placed at 'F'



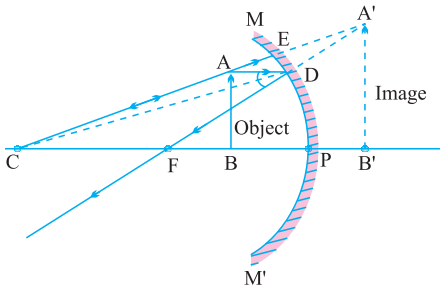
Image

Position – At Infinity

Nature – Real, inverted

Size – Highly enlarged

(vi) When object is between 'P' and 'F'



Image

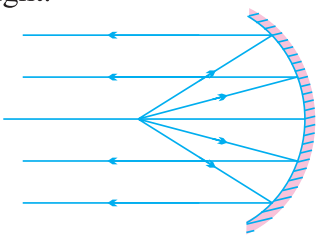
Position – Behind the mirror

Nature – Virtual, erect

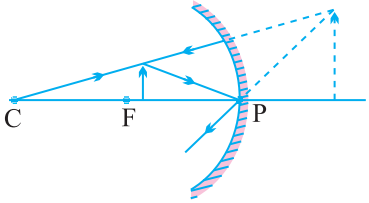
Size – Enlarged

Uses of Concave Mirror

(i) Used in torches, search lights and vehicles headlights to get powerful parallel beam of light.



(ii) Concave mirrors are used by dentists to see large image of teeth of patients. (Teeth have to be placed between pole and focus).

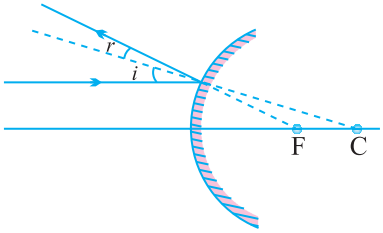


(iii) Concave mirror is used as shaving mirror to see a larger image of the face.

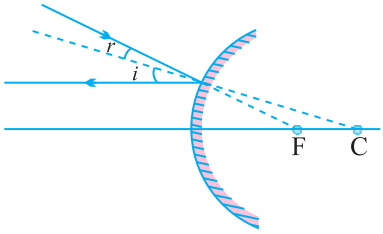
(iv) Large concave mirrors are used to concentrate sunlight to produce heat in solar furnace.

Rule for image formation by Convex Mirror

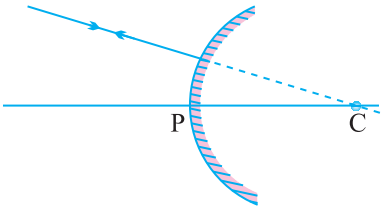
(i) A ray of light parallel to the principal axis of a convex mirror appear to diverge from the principal focus.



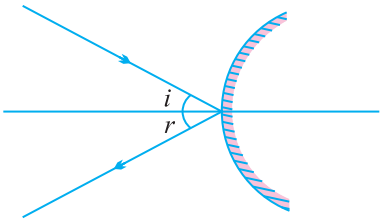
(ii) A ray which is directed towards the focus of the convex mirror will emerge parallel to the principal axis after reflection.



(iii) A ray directed towards the center of curvature of a convex mirror is reflected back along the same.

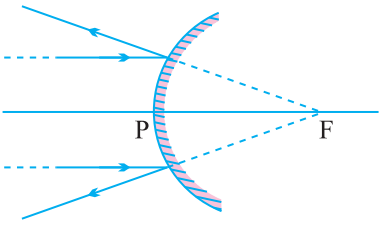


(iv) A ray incident obliquely to the principal axis is reflected obliquely.



Ray diagrams of images formed by convex mirror

(i) When object is placed at infinity : **Image**

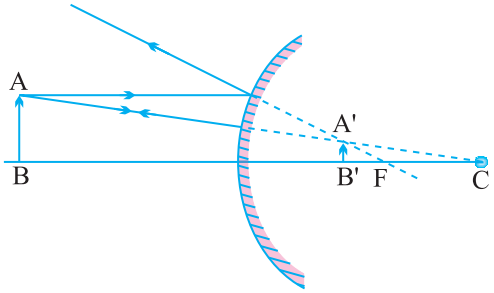


Position – At 'F'

Nature –Virtual, erect

Size –Point sized

(ii) When object is placed between pole and infinity: **Image**



Position – Between 'P' and 'F'

Nature–Virtual, erect

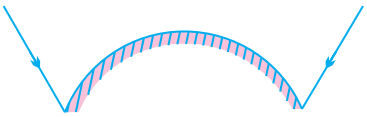
Size–Diminished

- A full length image of a tall building/tree can be seen in a small convex mirror.

Uses of Convex Mirror

(i) Convex mirrors are used as rear view mirrors in vehicles because

(a) they always give an erect though diminished image.
(b) they have a wider field of view as they are curved outwards.



(ii) Convex mirrors are used at blind turns and on points of merging traffic to facilitate vision of both side traffic.
(iii) Used in shops as security mirror.

Sign Convention for Reflection by Spherical Mirror
Or
New Cartesian Sign Convention

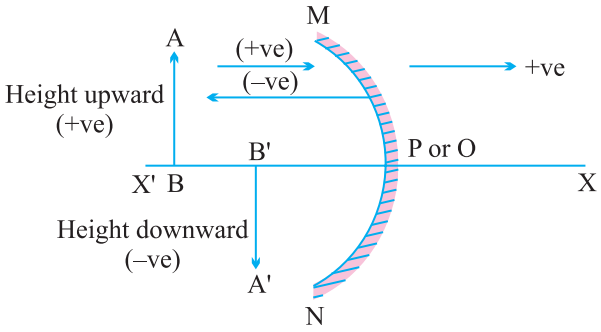
(i) The object is placed to the left of the mirror.

(ii) All distances parallel to the principal axis are measured from the pole of the mirror.

(iii) All distances measured in the direction of incident ray (along + X-axis) are taken as positive and those measured against the direction of incident ray (along – X-axis) are taken as negative.

(iv) Distance measured perpendicular to and above the principal axis are taken as positive.

(v) Distances measured perpendicular to and below the principal axis are taken as negative.



- Object distance = '*u*' is always negative.
- Focal length of concave mirror = Negative
- Focal length of convex mirror = Positive

Mirror Formula :

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

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.

$$m=\frac{\text{Height of image}}{\text{Height of object}}$$

$$m=\frac{h_i}{h_o}$$

Also,

$$m=-\frac{v}{u}$$

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 $h_i > h_i$ 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.

Check Your Knowledge

1. Magnification of plane mirror is + 1. What does it indicate ?
2. A real image, 1/5 th size of object is formed at a distance of 18 cm from a mirror. What is the nature of the mirror ? Calculate its focal length.

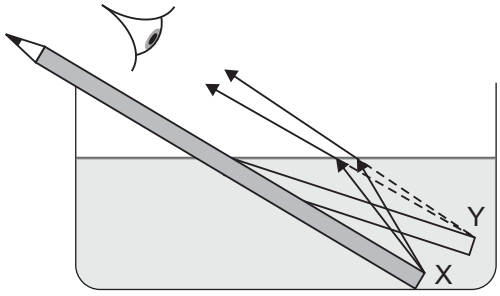
3. Name the type of mirror used in the following and reason for using it :
   (a) Solar furnace
   (b) Rear view mirror in a vehicle
4. What should be the position of the object, when a concave mirror is used :
   (a) as a shaving mirror ?
   (b) in torches as reflecting mirror ?
5. (a) Define principal focus of a spherical mirror.
   (b) For what position of the object does a concave mirror form a real, inverted and diminished image of the object ? Draw the ray diagram.
   (c) An object 4 cm high is placed at a distance of 6 cm in front of a concave mirror of focal length 12 cm. Find the position of the image.
6. For what position of an object, a concave mirror forms a real image equal to size of object ?
7. Identify the nature of mirror and mention two characteristics of image formed when magnification $m = +6$.
8. Suggest a method to find approximate focal length of a concave mirror.
9. Draw ray diagram when :
   (a) object is placed between pole and focus of a concave mirror.
   (b) object is placed at infinity from a convex mirror.
10. Name the type of spherical mirror which
   (a) has positive focal length.
   (b) always forms a virtual image.

REFRACTION

Bending of light when it enters obliquely from one transparent medium to another.

- Speed of light is maximum in vaccum. It is 3×10^8 m/s.
- **Cause of refraction :** Change in speed of light.
- **Some examples of refraction :**
  (i) The bottom of swimming pool appears higher.

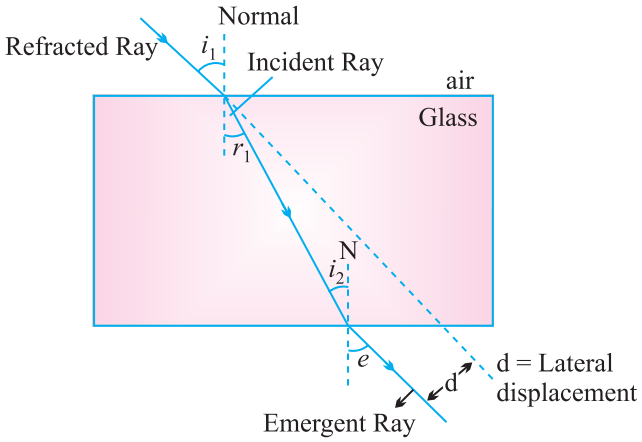
(ii) A pencil partially immersed in water appears to be bent at the interface of water and air.



(iii) Lemons placed in a glass tumbler appear bigger.

(iv) Letters of a book appear to be raised when seen through a glass slab.

Refraction through glass slab



- The extent of bending of ray of light at the opposite parallel faces of rectangular glass slab is equal and opposite, so the ray emerges parallel to incident ray.
- Lateral displacement depends on :

(a) Refractive index of glass slab

(b) Thickness of the glass slab

Laws of Refraction

(i) The incident ray, the refracted ray and the normal to the interface of two transparent media at the point of incidence, all lie in the same plane.

(ii) **Snell's law :** The ratio of sine of angle of incidence to the sine of angle of refraction is a constant, for a light of given colour and for a given pair of media.

$$\frac{\sin i}{\sin r} = \text{constant}$$

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.

$$n_{12} = \frac{V_2}{V_1}$$

- **Absolute Refractive Index :** Refractive index of a medium with respect to vaccum or air.

$$n = \frac{c}{v} \quad (c = 3 \times 10^8 \text{ ms}^{-1})$$

- Refractive index of one medium is reciprocal of other's refractive index in a given pair.

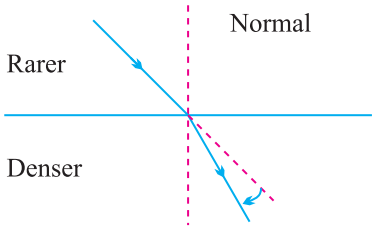
$$n_{12} = \frac{1}{n_{21}}$$

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 ${}_2n^{air}$

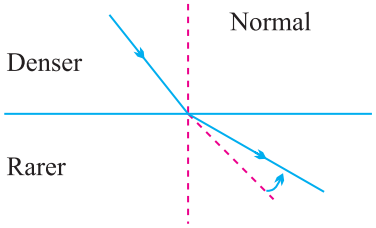
Then, refractive index of medium 1 w.r.t. medium 2 = $\frac{{}_1n^{air}}{{}_2n^{air}}$

- 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 vaccum.
- **Optically denser medium :** Out of two given media, the medium with higher value of refractive index.

- **Optically rarer medium :** Out of two given media, the medium with lower value of refractive index.
- When light enters obliquely from a rarer to a denser medium, it bends towards the normal.



- When light enters obliquely from denser to a rarer medium, it bends away from the normal.

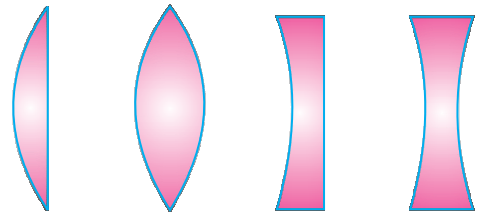


- Refractive index of a medium does not depend on physical density.

Spherical lens : A transparent medium bound by two surfaces, of which one or both surfaces are curved.

Spherical lens

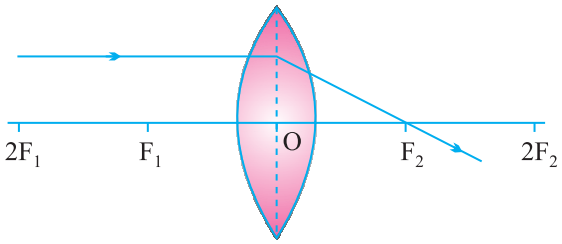
Convex lens	Concave lens
• Thin from corners • Thick at center • Converging	• Thick from corners • Thin at centre • Diverging



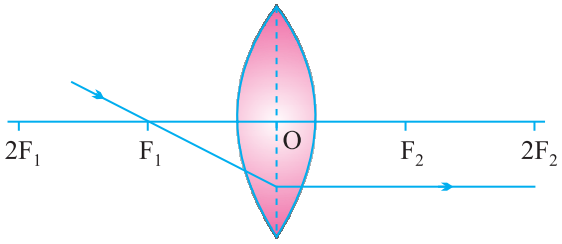
Plano convex | Biconvex | Plano convex | Biconcave

Rules for image formation by convex lens

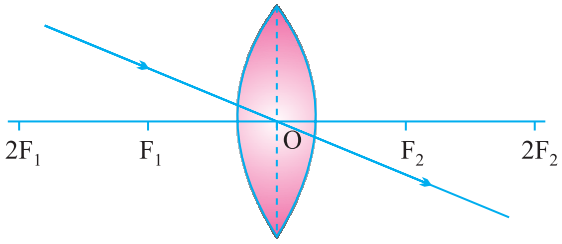
(i) A ray of light parallel to principal axis of a convex lens always pass through the focus on the other side of the lens.



(ii) A ray of light passing through the principal focus will emerge parallel to principal axis after refraction.

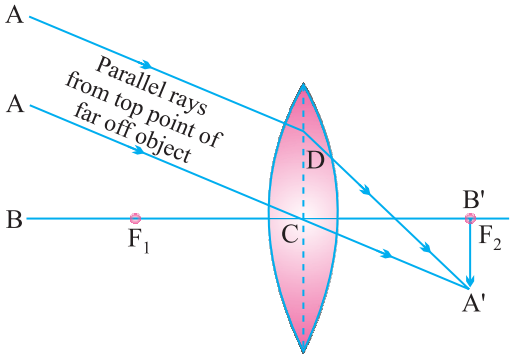


(iii) A ray of light passing through the optical center will emerge without any deviation.



Ray Diagrams of Imaged formed by Convex Lens

(i) When object is at infinity :



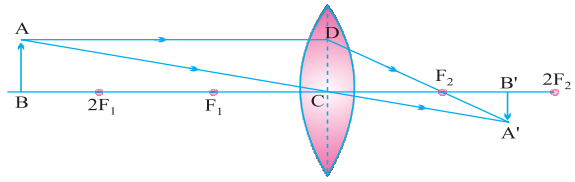
Image

Position – At 'F_2'

Nature – Real, inverted

Size – Point sized or highly diminished

(ii) When object is beyond '$2F_1$' **Image**

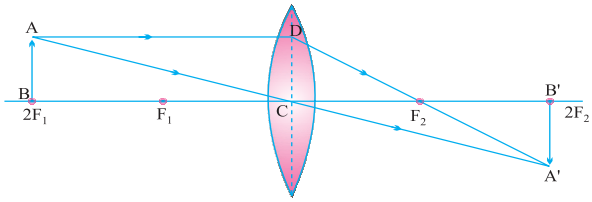


Position – Between 'F_2' and '$2F_2$'

Nature – Real, inverted

Size – Diminished

(iii) When object is at '$2F_1$' **Image**

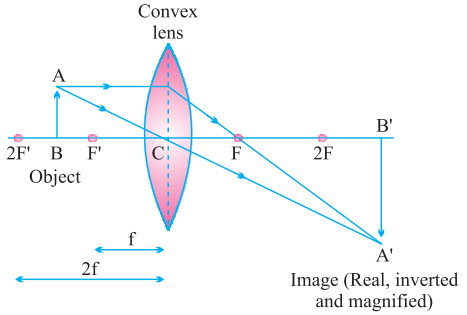


Position – At '$2F_2$'

Nature – Real, inverted

Size – Same size

(iv) When object is between 'F_1' and '$2F_1$' **Image**

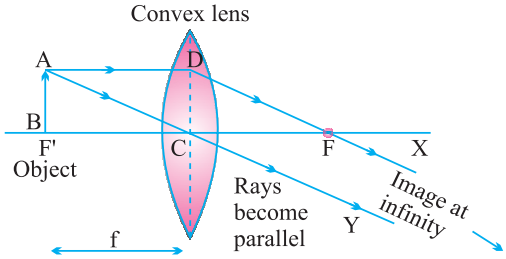


Position – Beyond '$2F_2$'

Nature – Real, inverted

Size – Enlarged

(v) When object is at 'F_1' **Image**

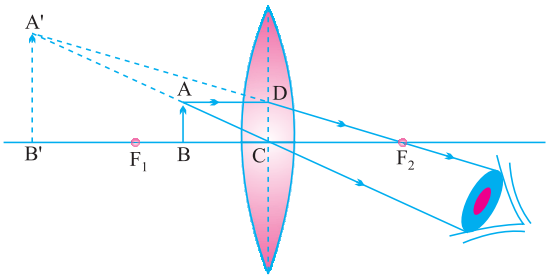


Position – At Infinity

Nature – Real, inverted

Size – Highly enlarged

(vi) When object is between 'F_1' and optical centre **Image**



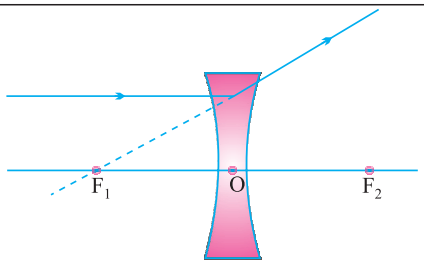
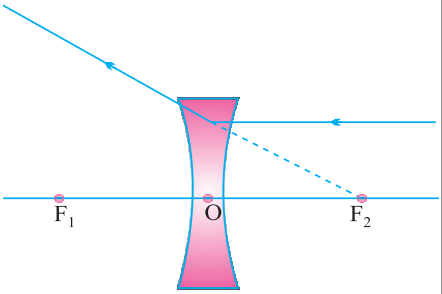
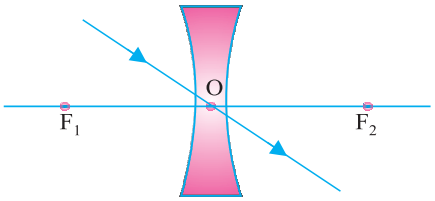
Position – On the same side of the lens as object

Nature – Virtual and erect

Size – Enlarged

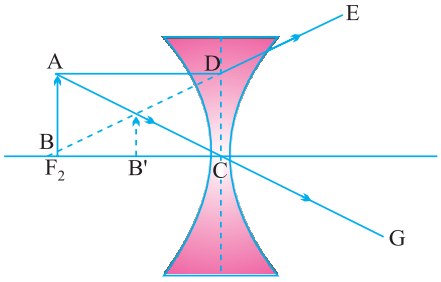
On the basis of this position, this lens is also known as magnifying lens.

Rules for Image Formation by Concave Lens

S.No.	Light ray from object is	Ray diagram	How it appears after refraction
1.	Parallel to the principal axis		After refraction from a concave lens, the ray appears to diverge from the principal focus located on the same side of the lens
2.	Passing through a principal focus		After refraction from a concave lens, the ray appears to diverge from the principal focus located on the same side of the lens
3.	Passing through the optical center of a lens		After refraction from a concave lens will emerge without any deviation

Ray Diagrams of Images Formed by a Concave Lens

(i) When object is placed at infinity :



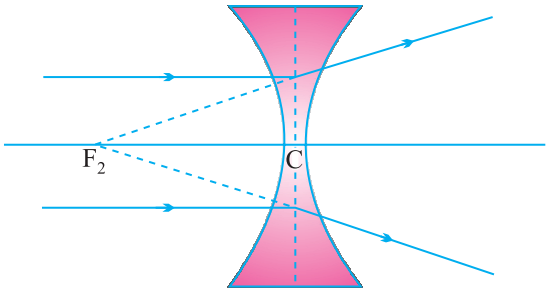
Image

Position – At 'F_1'

Nature – Virtual, erect

Size – Point sized or highly diminished

(ii) When object is placed between infinity and optical centre



Position – Between 'F' and 'O'

Nature – Virtual, erect

Size – Diminished

Sign convention for spherical lenses

- Sign conventions are similar to the one used for spherical mirrors, except that measurements are taken from optical center of the lens.
- Focal length of convex lens = Positive
  Focal length of concave lens = Negative

Lens Formula :

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

Magnification :

$$m = \frac{h_i}{h_o}$$

$\therefore$ h_i = height of image

h_o = height of object

Also,

$$m = \frac{v}{u}$$

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.

$$\text{Power} = \frac{1}{\text{focal length (in meter)}} \quad P = \frac{1}{f}$$

- SI unit of Power = dioptre = D

  1 D = 1 m^{-1}

  1 dioptre is the power of lens whose focal length is one meter.

- Power of convex lens = Positive
- Power of concave lens = Negative
- $\text{Power} \propto \frac{1}{\text{focal length or thickness}}$
- Power of a lens combination

$$P = P_1 + P_2 + P_3 .....$$

1 MARKER OBJECTIVE QUESTIONS

I. MULTIPLE CHOICE QUESTIONS

1. Focal length of plane mirror is
   a) At infinity b) Zero
   c) Negative d) None of these
2. Image formed by plane mirror is
   a) Real and erect b) Real and inverted
   c) Virtual and erect d) Virtual and inverted
3. A concave mirror gives real, inverted and same size image if the object is placed
   a) At F b) At infinity
   c) At C d) Beyond C
4. Power of the lens is-40, its focal length is
   a) 4m b) -40m
   c) -0.25m d) 25 m
5. A concave mirror gives virtual, erect and enlarged image of the object. The position of the object is-
   a) At infinity b) Between F and C
   c) Between P and F d) At F
6. In optics and object which has higher refractive index is called -
   a) Optically rarer b) Optically denser
   c) Optical dense d) Refractive index
7. The optical phenomena, twinkling of stars, is due to
   a) Atmospheric reflection b) Total reflection
   c) Atmospheric refraction d) Total refraction

8. Convex lens focus a real, point sized image at focus, the object is placed-

a) At focus b) Between F and 2F

c) At infinity d) At 2F

9. The unit of power of lens is

a) Metre b) Centimeter

c) Diopter d) M-1

10. The radius of curvature of a mirror is 20cm the focal length is-

a) 20cm b) 10cm

c) 40cm d) 5cm

Answer

1. a	2. c	3. c	4. c	5. c
6. b	7. c	8. c	9. c	10. b

11. Fill in the blanks:

(i) Image formed by a plane mirror is always ..... and ..... .

(ii) A spherical mirror, whose reflecting surface is curved inwards, that is, faces towards the centre of the sphere, is called a ..... .

(iii) The focal length of a spherical mirror is equal to ..... its radius of curvature.

(iv) Speed of light is ..... .

(v) Light rays always travels in ..... .

12. Answer in one word/one sentence.

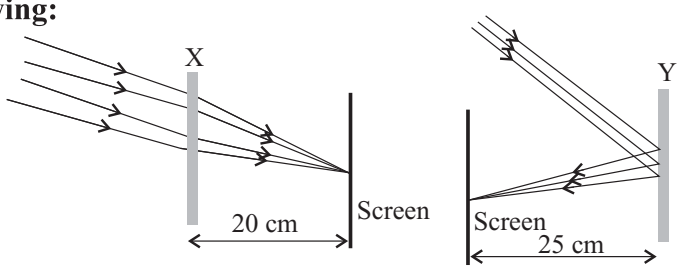
(i) A concave mirror produces three times magnified (enlarged) real image of an object placed at 10 cm in front of it. Where is the image located?

(ii) The magnification produced by a plane mirror is +1. What does this mean?

(iii) An object is placed at a distance of 10 cm from a convex mirror of focal length 15 cm. Find the position and nature of the image.

(iv) Define the principal focus of a concave mirror.

13. Study the given ray diagrams and select the correct statement from the following:



(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 10 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. (CBSE 2017)

14. A student obtains a blurred image of 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 2017)

15. Assertion (A): The bottom of a tank or pond, filled with water appears to be raised.

Reason (R): The apparent depth of the tank is given by 1/n times the original depth.

(a) (A) is incorrect and (R) is correct.

(b) (A) is correct and (R) is incorrect.

(c) Both (A) and (R) are correct but (R) is not the correct explanation of (A).

(d) Both (A) and (R) are correct but (R) is the correct explanation of (A).

16. Assertion (A): The shaving mirrors are convex mirrors.

Reason (R): Convex mirror always forms a virtual image.

(a) (A) is incorrect and (R) is correct.

(b) (A) is correct and (R) is incorrect.

(c) Both (A) and (R) are correct but (R) is not the correct explanation of (A).

(d) Both (A) and (R) are correct but (R) is the correct explanation of (A).

3 Marker Questions

1. Refractive indices of medium A, B and C are 1.3, 1.5 and 1.4 respectively. In which of the following the speed of light will be the :
   (a) fastest
   (b) slowest and why?
2. A compound lens is made up of two thin lenses having power + 12.5 D and – 2.5 D. Find the focal length and power of the combination.
3. Light enters from air to kerosene having a refractive index of 1.47. What is the speed of light in kerosene ?
4. A 5 cm tall object is placed perpendicular to principal axis of a convex lens of focal length 10 cm. If the object is placed 30 cm away from the lens, find the position, size and nature of image.
5. A ray travelling in water enters obliquely into glass. Does the light bend towards or away from the normal and why ?
6. An object is placed at the focus of a convex lens. Draw ray diagram to locate the position of image formed.
7. If the image formed by a spherical mirror for all positions 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. (CBSE 2018)
8. 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. (CBSE 2018)
9. What is meant by power of a lens? Write its 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. (CBSE 2018)
10. An object is placed at a distance of 15 cm from a concave lens of focal length 30 cm. List four characteristic (nature, position, etc.) of the image formed by the lens. (CBSE 2017)
11. "A lens can form a magnified erect image as well as magnified inverted image of an object placed in front of it". Same the nature of this lens and draw ray diagrams to justify the above statement.
    Mark the position of O, F and 2F in the diagram. (2017)
12. 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 2×108 m/s, find the speed of light in water. (CBSE 2016)

5 Marker Questions

1. One half of a convex lens is covered with black paper.
   (a) Show the formation of image of a object placed at 2F, of such covered lens with the help of ray diagram. Mention the position and nature of the image.
   (b) Draw the ray diagram for same object at same position in front of the same lens, but now uncovered. Will there be any difference in image obtained in the two cases ? Give reasons for your answers.
2. A thin converging lens forms a (i) real magnified image, (ii) virtual magnified image.
   (a) Write the position of object in each case.
   (b) Draw labelled diagram for each case.
3. (a) What happens to a ray of light when it travels from one medium to another having equal refractive indices ?
   (b) State the cause of refraction of light.
4. (a) Define 1 dioptre of power. Find the focal length of a lens of power – 2.0 D.
   (b) Why does a lemon kept in water in a glass tumbler appear to be bigger than actual size ?
5. Analysis 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 calculation:

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

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 approximate scale and draw a ray diagram for the observation at S. No. 2 Also find the approximate value of magnification.

6. (a) If the image formed by a mirror for all position 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 such mirrors are put to and why.

b) Define the radius of curvature of spherical mirror. Find the nature and focal length of a spherical mirror whose radius of curvature is +24 cm.

Hints to Long Answer Type Questions

3. (a) No bending of light.

(b) Change in refractive index of two medium.

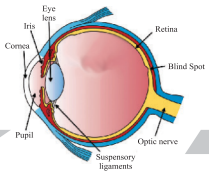
4. (a) **1 dioptre :** It is the power of lens whose focal length is 1 m.

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

(b) Due to refraction of light.

6. Ray diagram.

Image formed	:	At infinity
Size	:	Enlarged
Nature	:	Real and inverted



Chapter - 11

The Human Eye and The Colourful World

Reflection And Refraction/Source based Question

If there is no light, there is no sight!

Apart from looking directly at a light source, most of what we see is as a result of the process of reflection.

Reflection is when light bounces off an object. If the surface is smooth and shiny, like glass, water or polished metal, the light will reflect at the same angle as it hit the surface. This is called specular or regular reflection.

If you look at a bird, light has reflected off that bird and travelled in nearly all directions.This is diffuse reflection. If some of that light enters your eyes, it hits the retina at the back of your eyes. An electrical signal is passed to your brain, and your brain interprets the signals as an image.

1. Light is a phenomenon which makes things-
   a) happen
   b) visible
   c) bounce off
   d) hit the surface.
2. Light follows -
   a) Laws of Reflection
   b) Laws of Refraction

c) Both Laws

d) Neither (a) nor (b)

3.

This picture shows-

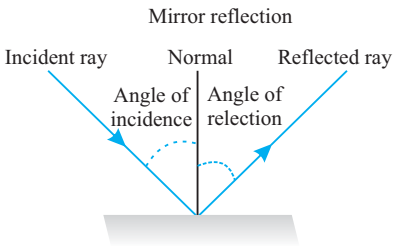
a) Regular Reflection

b) Diffuse Reflection

c) Refraction of light

d) Internal Reflection

4.



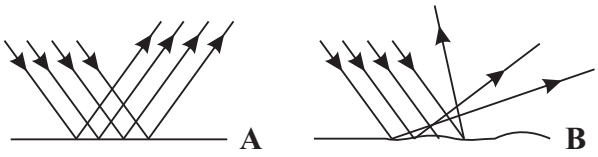
a) Angle of incidence> Angle of reflection

b) Angle of incidence= Angle of refraction

c) Angle of incidence = Angle of reflection

d) Angle of incidence< Angle of reflection

5.



a) A shows refraction, B shows reflection

b) A shows reflection , B shows refraction

c) A shows diffuse reflection, B shows internal diffusion

d) A is regular reflection, B shows diffuse reflection

Human eye : The sense organ that helps us to see.

- Located in eye sockets in skull.
- Diameter of eye ball – 2.3 cm

Parts of Human Eye

Cornea : It is the outermost, transparent part. It provides most of the refraction of light.

Lens : It is composed of a fibrous, jelly like material. Provides the focused real and inverted image of the object on the retina. This is convex lens that 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.

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.

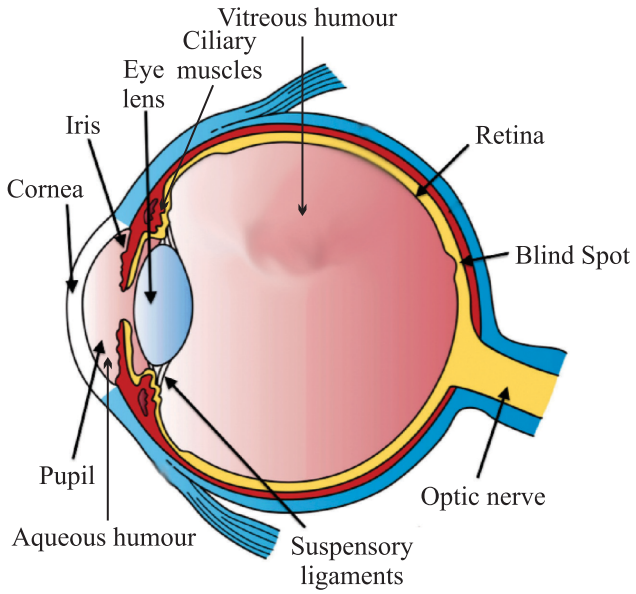
Near point or Least distance of distinct vision

The minimumdistance at which objects can be seen most distinctively without strain.

- For a normal adult eye, its value is 25 cm.
- Range of human vision – 25 cm to infinity.

Accomodation : 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.

Ciliary muscles	Ciliary muscles
↓	↓
Relaxed	Contract
↓	↓
Lens thin	Lens thick
↓	↓
Focal length increases	Focal length decreases



The Structure of human eye

Myopia (Near sightedness)

- A myopic person can see nearby objects clearly but cannot see distant objects clearly.
- Image is formed in front of retina.

Causes of Myopia

- Excessive curvature of eye lens
- Elongation of eye ball

Correction

Use of concave lens of appropriate power.

CHECK YOUR KNOWLEDGE

VERY SHORT ANSWER TYPE QUESTIONS

1. What type of lens is used to correct (a) Hypermetropia, (b) Myopia ?
2. Name the defect of vision in which the eye-lens loses its power of accommodation due to old age.
3. What is the far point of a person suffering from myopia ?
4. What is the other name of old age hypermetropia ?
5. You friend can read a book perfectly well but cannot read the writing on black-board unless she sits on the front row in class. Is she short-sighted or long-sighted ?

SHORT ANSWER TYPE QUESTIONS

1. Differentiate between Hypermetropia and Myopia.
2. What is presbyopia ? Write two causes of this defect. Name the type of lens which can be used to correct presbyopia.
3. The near point of a person suffering from hypermetropia is at 50 cm from his eye. What is the nature and power of the lens needed to correct this defect ?
4. How is the amount of light entering the eye controlled ?

LONG ANSWER TYPE QUESTIONS

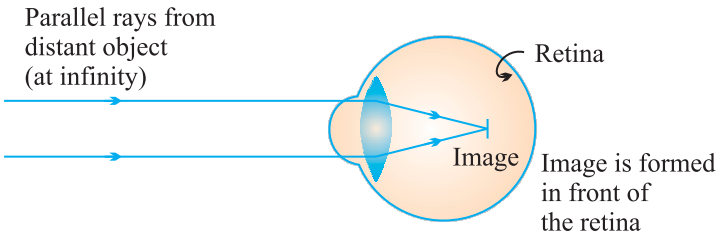
1. (a) What happens to the size of pupil of our eye in (i) dim light, (ii) bright light ?

   (b) Name the cells on the retina sensitive to (i) bright light, (ii) dim light.
2. (a) Draw a simple diagram of the human eye and label clearly the cornea, iris, pupil, ciliary muscles, eye lens, retina and optic nerve.

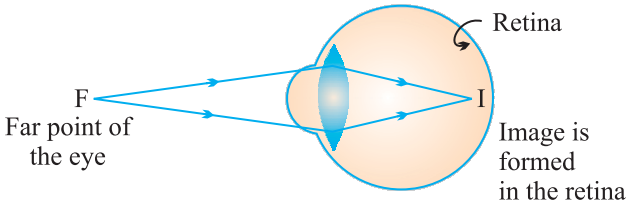
   (b) Describe the working of the human eye with the help of the above diagram.
3. What is short sightedness ? State the two causes of short-sightedness. With the help of ray diagrams, show :

   (a) the eye defect short sightedness.

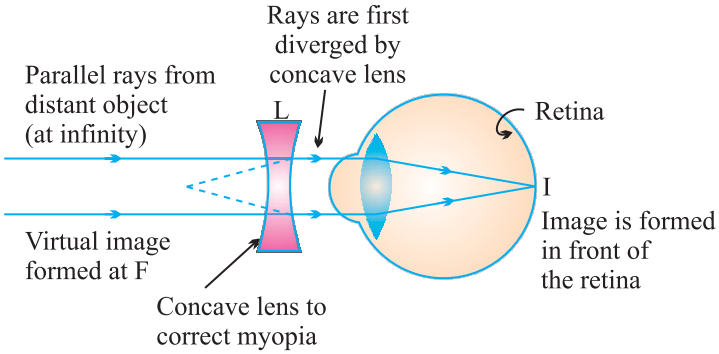
   (b) correction of short sightedness by using a lens.



(a) In a myopic eye, image of distant object is formed in front of the retina (and not on the retina)



(b) The far point (F) of a myopic eye is less than infinity



(c) Correction of myopia. The concave lens placed in front of the eye forms a virtual image of distant object at far point (F) of the myopic eye.

Hypermetropia (Far sightedness)

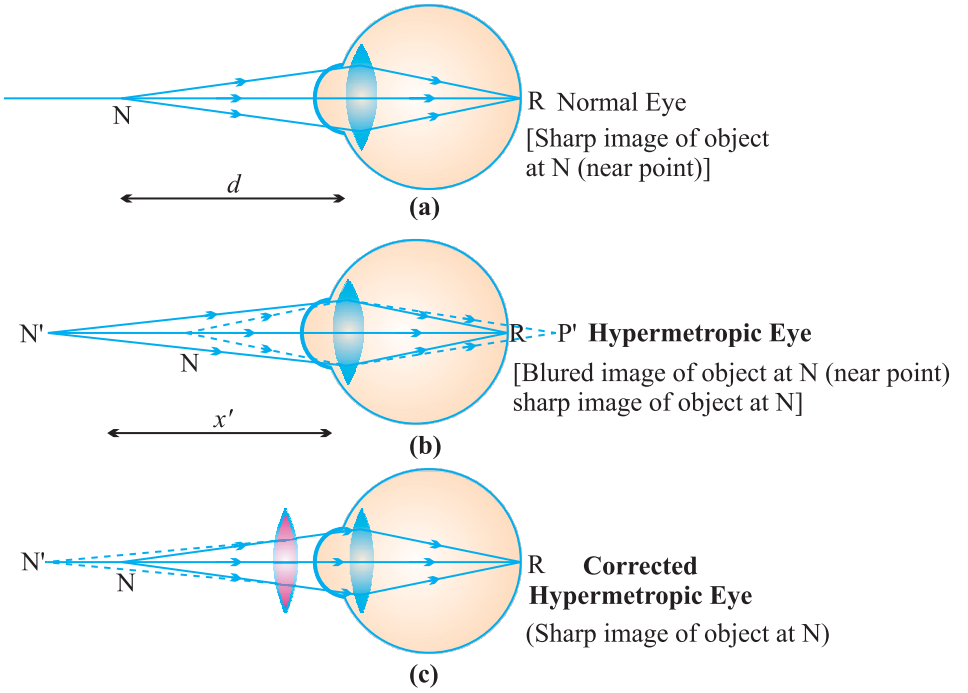
- Affected person can see far objects clearly but cannot see nearby objects clearly.
- The near point of the eye moves away.
- Image is formed behind the retina.

Causes of Hypermetropia

- Focal length of the eye lens becomes too long.
- Eye ball becomes too small.

Correction

Use of convex lens of suitable power can correct the 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 loss of power of accomodation of the eye.

- The near-point of the old person having presbyopia gradually recedes and becomes much more than 25 cm away.

Causes

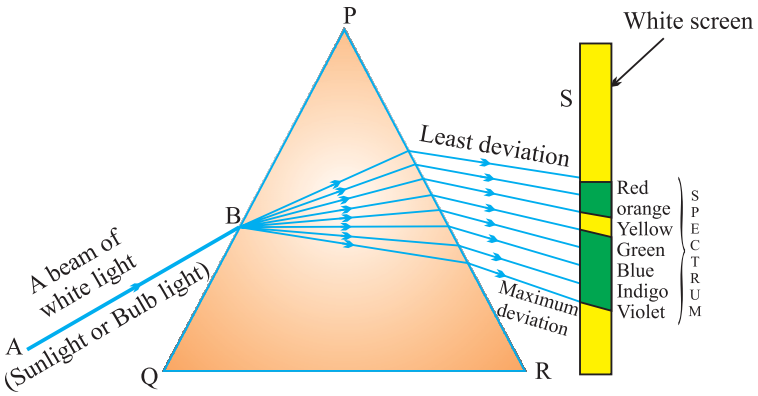
- Gradual weakening of ciliary muscles.
- Diminishing flexibility of eye lens.

Correction

- Use of both concave and convex lens of suitable power.
- Sometimes a person may suffer from both myopia and hypermetropia.
- Such people require bifocal lens for correction.

Advantage of the eyes in front of the face

- It gives a wider field of view.
- It enhances the ability to detect faint objects.
- It provides three dimensional view.



When white light is passed through a glass prism, it splits into its seven constituent colours to form a band of seven colours. This phenomenon is called dispersion.

Spectrum : The band of seven colours formed due to dispersion of white light is called spectrum.

Acronym : It is a group of alphabets that represent sequential colours in spectrum.

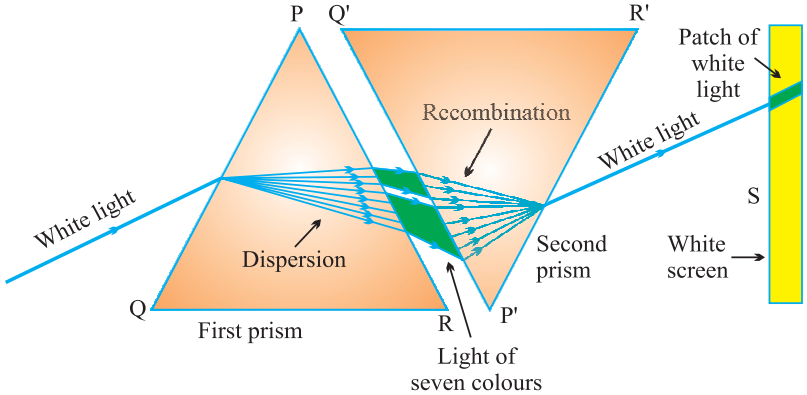
V I B G Y O R

$$\text{Angle of deviation} \propto \frac{1}{\text{wavelength}}$$

- Red is the **least deviated** colour as it has largest/longest wavelength.
- Violet is the **most deviated** colour as it has smallest wavelength in visible spectrum.

Q. *Why spectrum is formed when white light is passed through a glass prism ?*

Ans. Each colour has a definite wavelength and for each wavelength the angle of deviation differs. Red is the least deviated and violet is the most deviated colour so different colours deviate at different angles to form spectrum.



Hints to Long Answer Type Questions

1. (a) (i) Increases (ii) Decreases
   (b) (i) Cones (ii) Rods
2. Labelled diagram of eye
3. A person can see nearby objects clearly but cannot see distinct objects clearly.

   Reason :

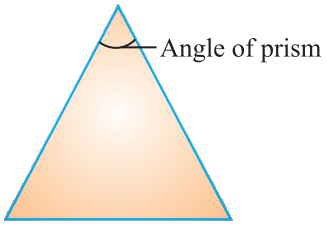
   (a) Elongation of eye ball.

   (b) Excessive curvature of eye lens.

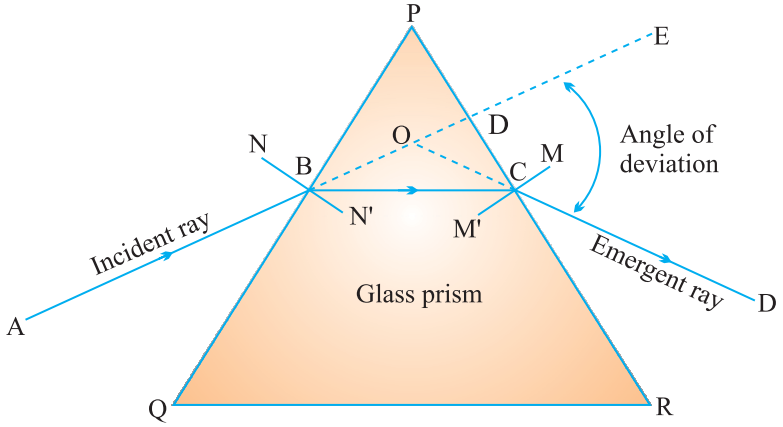
   Diagram of myopic eye and correction using concave lens.

Prism : It is a pyramidal piece of glass with two triangular bases and three rectangular lateral surfaces.

Angle of Prism : The angle between two adjoining lateral surfaces.



Refraction through a glass prism



Angle of deviation (d) : It is the angle between incident ray and emergent ray.

Issac Newton was the first person who proved that sunlight is made up of seven colours :

(i) He passed sunlight through a glass prism to form a band of seven colours.

(ii) He tried to split the colours further by putting another prism ahead of the prism forming spectrum but he failed to obtain more colours.

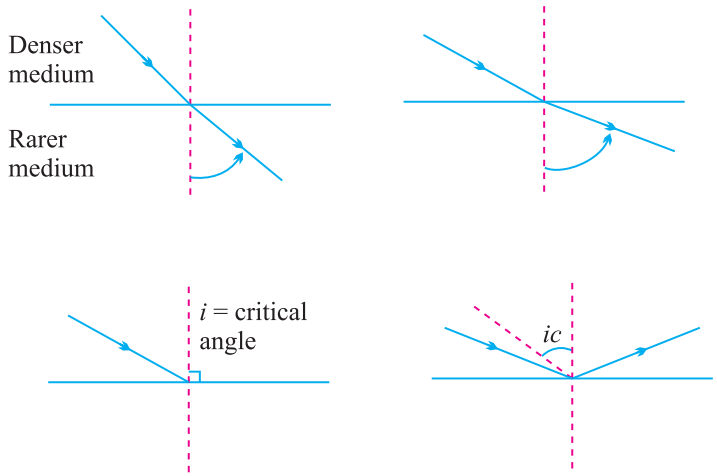
(iii) He formed a spectrum from sunlight and placed an identical but inverted prism in front of prism forming the spectrum. All the seven colours combined by the inverted prism and emerged as white light.

Q. *What is referred as white light ?*

Ans. Any light that forms a spectrum similar to that of sunlight is referred as white light.

Total Internal Reflection

When light enters obliquely from a denser medium to a rarer medium and the angle of incidence exceeds critical angle, the light reflects in the denser medium. This is called internal reflection.



Conditions necessary for Internal Reflection

(i) Light should enter obliquely from a denser to a rarer medium.

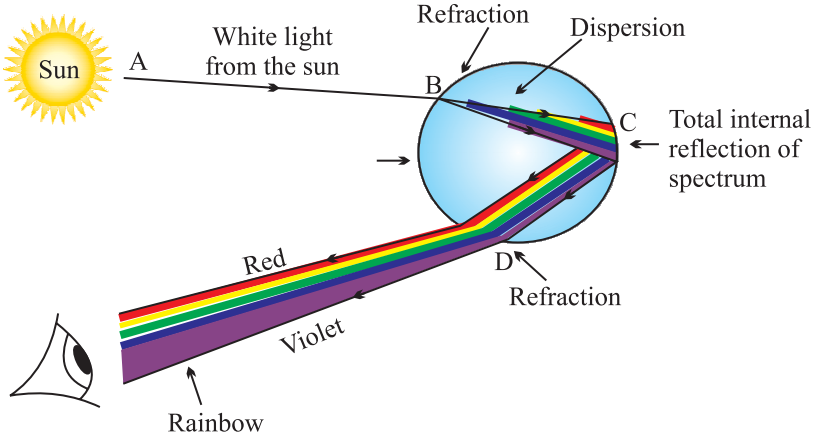
(ii) The angle of incidence should exceed critical angle, the light reflects in the denser medium.

Critical angle : The angle of incidence for which the angle of refraction is 90º.

Rainbow : It is a natural spectrum appearing in the sky after rain showers.

- Rainbow is observed in the direction opposite to the sun.
- Three phenomenon which are involved in rainbow formation are :
  (a) Dispersion
  (b) Refraction
  (c) Internal reflection

Some water droplets remain suspended in air after rain. These droplets behave as glass prism. When light enters the rain drop, it first refracts and disperses. Then it reflects internally and again refracts as it come out of the drop and the seven colours reach the eye of observer in form of rainbow.



Atmospheric Refraction : The refraction by different layers of atmosphere is called atmospheric refraction.

(i) Apparent flickering of objects placed behind a hot object or fire.

(ii) Stars near the horizon appear slightly higher than their actual position.

(iii) Advanced sunrise and delayed sunset.

(iv) Apparent flattering of sun's disc.

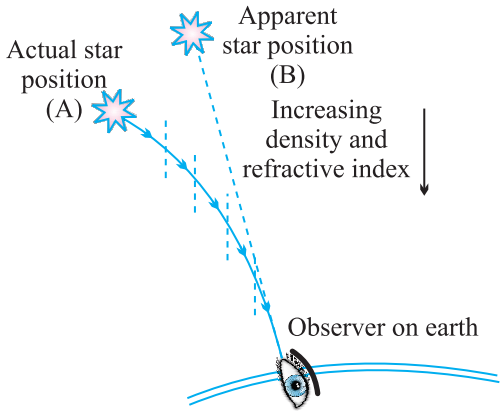
(v) Twinkling of stars.

(i) *An object placed behind the fire or a hot surface appears to flicker when seen through the air .*

The air above hot surface becomes hot and rises. The space is occupied by cool air. The refractive index of hot air is less than that of cool air. So, the physical condition of the medium are not constant. Due to changing Refractive Index (RI) of medium, the light appears to come from different directions.

It results in fluctuation in apparent position of object.

(ii) Stars when seen near the horizon appear slightly higher than their actual position due to atmospheric refraction.

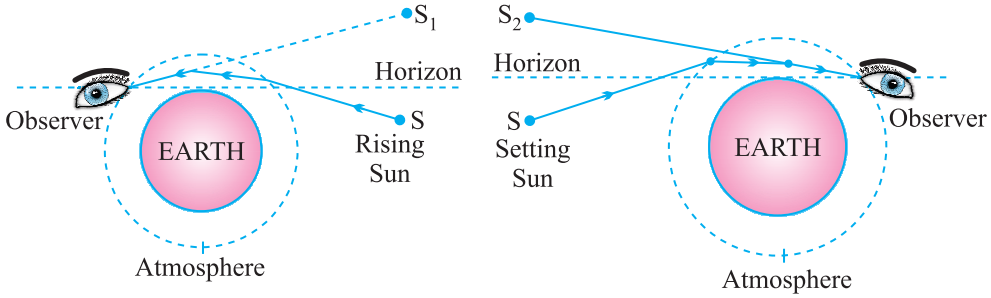


The refractive index of earth's atmosphere in general increases from top to bottom. So, the light coming from a star near the horizon has to travel from rarer to denser medium and it bends towards the normal. As a result the star appears higher.

(iii) Advanced sunrise

The sun appears about two minutes earlier than actual sunrise and the sun remains visible for about two minutes after actual sunset.

When the sun is below horizon, the rays have to pass from rarer to denser medium. So rays bend towards the normal. As a result the sun appears higher than its actual position.



(iv) Twinkling of stars

Stars are very far from us, so they behave as point source of light. Since the physical conditions of the earth's atmosphere are not constant the light from stars appears to come from different directions. This results in fluctuation of apparent position of star.

The amount of light coming from stars also vary due to changing Refractive Index of atmosphere.

The star appears bright when more light from star reaches our eyes and the same star appears dull when less amount of light reaches our eyes.

Both these effects are responsible for twinkling of stars.

Q. *Why do planets not twinkle ?*

Ans. The planets are much closer to the earth and are thus seen as extended source. If we consider a planet as a collection of a 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 and will nullify the twinkling effect.

Scattering effect : Spreading of light in various directions by colloid particles.

$$\text{Scattering} \propto \frac{1}{\text{wavelength}}$$

Tyndall effect : When light passes through a colloid its path becomes visible. This is called **Tyndall effect.**

E.g.,

(i) Path of light becomes visible when light enters a dark and dusty room through a slit or ventilator.

(ii) Path of light becomes visible when light passes through dense canopy of trees in a forest.

The colour of scattered light depends on the size of scattering particles

(i) If particles are very fine, they scatter mainly the blue colour of light (shorter wavelength).

(ii) Medium sized particles scatter mainly the red colour (longer wavelength).

(iii) Even larger particles scatter all the colours of light that is why it appears white.

- Wavelength of red light is about 1.8 times to that of blue light.

Q. *Why danger signs are made of red colour ?*

Ans. Red is the least scattered colour. It is least scattered by fog and smoke and can be seen in the same colour over a long distance. So, danger signs are made in red colour.

Q. *Why the colour of sky appears blue on a clear day ?*

Ans. The upper layer of atmosphere contains very fine particles of water vapours and gases. These particles are more effective in scattering of light of shorter wavelength mainly blue than larger wavelength. So, the sky appears blue.

Q. *How does the sky appear to an astronaut in the space or to a passenger of jet plane flying at high altitude ?*

Ans. The sky would appear dark to an astronaut in the space as scattering is not very prominent at such high altitude due to absence of particles.

Q. *Why clouds appear white ?*

Ans. Clouds are formed by water vapours. Water vapours condense to form water droplets due to larger size of droplets, all colours of light are scattered and clouds appear white.

Q. *Why colour of sun appear red during sunrise and sunset ?*

Ans. While sunset and sunrise, the colour of the sun and its surrounding appear red. During sunset and sunrise, the sun is near horizon and therefore the sunlight has to travel larger distance in atmosphere. Due to this most of the blue light (shorter wavelength) are scattered away by the particles. The light of longer wavelength (red colour) will reach our eye. This is why sun appear red in colour.

QUESTIONS

1 MARKER OBJECTIVE QUESTIONS

I. MULTIPLE CHOICE QUESTIONS

1. The image formed retina of human eye is
   a) Virtual and erect b) Real and inverted
   c) Virtual and inverted d) Real and erect
2. The change in the focal length of human eye is caused due to
   a) Ciliary muscles b) Pupil
   c) Cornea d) Iris
3. The least distance of distinct vision for a young adult with normal vision is
   a) 25 m b) 20 m
   c) 25 cm d) 20 cm

4. The persistence of vision for human eye is

a) 1/10th of a second b) 1/16th of a second

c) 1/6th of the second d) 1/18th of a second

5. The light sensitive cells of retina which are sensitive to the intensity of light are—

a) Cones b) Rods

c) Both rods and cones d) None of these

Answer:

1. (b) 2. (a) 3. (c) 4. (b) 5. (b)

Human Eye and the colourful world

6. A person cannot see distinctly objects kept beyond 2 m. This defect can be corrected by using lens of power-

(a) +0.5 D (b) -0.5 D

(c) +0.2 D (d) -0.2 D

7. A student sitting on the last bench can read the letters written on the blackboard but is not able to read / the letters written in his textbook. Which of the following statements is correct?

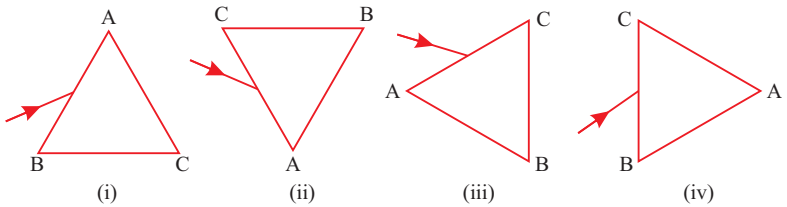
(a) The near point of his eyes has receded away.

(b) The near point of his eyes has come closer to him.

(c) The far point of his eyes has come closer to him.

(d) The far point of his eyes has receded away.

8. A prism ABC (with BC as base) is placed in different orientations. A narrow beam of white light is incident on the prism as shown in the Figures given below. In which of the following cases, after dispersion, the third colour from the top corresponds to the colour of the sky?



(a) (i) (b) (ii)

(c) (iii) (d) (iv)

9. 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.

10. Which of the following statements is correct regarding the propagation of light of different colours of white light in air?

(a) Red light moves fastest.

(b) Blue light moves faster than green light.

(c) All the colours of the white light move with the same speed.

(d) Yellow light moves with the same speed as that of the red and the violet light.

Answers. 6.(b) 7. (a) 8.(b) 9. (a) 10. (c)

VERY SHORT ANSWER TYPE QUESTIONS

1. Which of the two is scattered more easily – light of shorter wavelength or light of longer wavelength ?

2. What is the near and far point of a normal eye ?

3. State two effects produced by the scattering of light by the atmosphere.

4. What is tyndall effect ?

5. Which light has longer wavelength – red light or blue light ?

6. What do you understand by dispersion of light ?

7. As light rays pass from air into a glass prism, are they refracted towards or away from the normal ?

8. Assertion (A): Some persons have the difficulty to see the objects in dim light during night.
Reason (R): Cones respond less to the illumination.
(a) (A) is incorrect and (R) is correct.
(b) (A) is correct and (R) is incorrect.
(c) Both (A) and (R) are correct but (R) is not the correct explanation of (A).
(d) Both (A) and (R) are correct but (R) is the correct explanation of (A).

9. Assertion (A): The colour of the clear sky appears blue.
Reason (R): The sky of the moon appears dark.
(a) (A) is incorrect and (R) is correct.
(b) (A) is correct and (R) is incorrect.
(c) Both (A) and (R) are correct but (R) is not the correct explanation of (A).
(d) Both (A) and (R) are correct but (R) is the correct explanation of (A).

10. Assertion (A): The human eye has more field of view.
Reason (R): For a normal eye, the farthest point upto which the eye can see objects clearly is infinity.
(a) (A) is incorrect and (R) is correct.
(b) (A) is correct and (R) is incorrect.
(c) Both (A) and (R) are correct but (R) is not the correct explanation of (A).
(d) Both (A) and (R) are correct but (R) is the correct explanation of (A).

11. 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 incidence. On analysing these measurements of angles, his conclusion would be

(A) $\angle i > \angle r > \angle e$ (B) $\angle i = \angle e > \angle r$

(C) $\angle i < \angle r < \angle e$ (D) $\angle i = \angle e < \angle r$

Sol. (B) $\angle i = \angle e > \angle r$

SHORT ANSWER TYPE QUESTIONS

1. Why do stars twinkle at night ?
2. Describe the formation of rainbow in the sky with the help of a diagram.
3. Why the sun appear red while sunset and sunrise ? Explain.
4. Why do stars seem higher than they actually are ? Illustrate your answer with the help of a diagram.
5. What is "dispersion of white light"? Draw a labelled diagram to illustrate the recombination of the spectrum of white light. Why it is essential that the two prisms used for the purpose should be identical and placed in an inverted position with respect to each other? (CBSE 2017)
6. With the help of scattering of light, explain the reason for the difference in colours of the Sun as it appears during sunset/sunrise and noon. (CBSE 2015)
7. Write the importance of ciliary muscles in the human eye. Name the defect of vision that arises due to gradual weakening of the ciliary muscles. What types of lenses are required by the person suffering from this defect to see the objects clearly. (CBSE 2015)

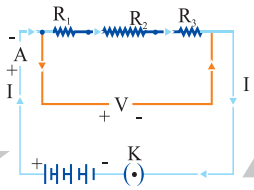
LONG ANSWER TYPE QUESTIONS

1. What is atmospheric refraction ? What causes atmospheric refraction ?
2. Draw a neat and labelled diagram of the experimental set-up for observing the scattering of light in a colloidal solution of sulphur to show how the sky appears blue and the sun appears red at sunrise and sunset.

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.
   (b) Why do stars twinkle? Explain. (CBSE 2018)
4. (a) Write the function of each of the following parts of human eye:
   (i) Cornea (ii) Iris (iii) Crystalline (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.

5. (a) A student suffering from myopia is not able to see distinctly the object 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 cm from his eyes.
   (ii) The type of the corrective lens used to restore proper vision and how this defect is correct by the use of this lens.

   (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.



Chapter - 12

Electricity

Electric Current

SI unit → Ampere

What is it

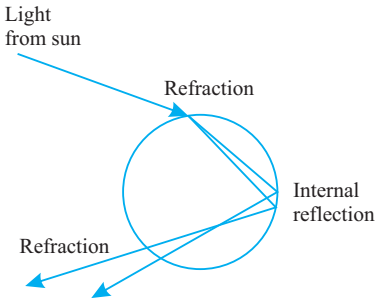
It is the rate of flow of electric charges (electrons) in a conductor.

Experimentaly → Measured by an ammeter → How is it connected → always in series in a circuit through which we measure current → What is a circuit → **Electric circuit** is a continuous and closed path of an electric current. → Direction of current flow in circuit → Positive terminal of the cell to the negative terminal

Mathematically → $I = \frac{Q}{t}$ → Where → Q is the net charge that flows across cross-section of a conductor in time.

Human Eye and the colourful world/Source based Question

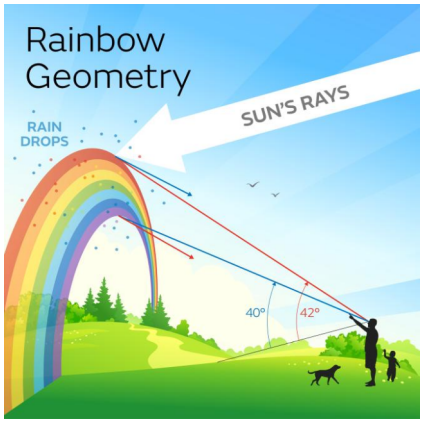
1. Which natural phenomena is being shown here?



   a) Twinkling of stars
   b) Rainbow formation
   c) reddish appearance of the sun early in the morning
   d) blue colour of sky

2. Which of the following conditions are necessary for this phenomenon?
   a) The Sun should be behind us.
   b) It should have rained and the Sun should be present.
   c) None of A and B
   d) Both A and B

3. What colour will be at no. 1 and 2-
   a) blue, red
   b) blue, black
   c) violet, red
   d) blue, violet



4. Dispersion of white light by the glass prism shows-
   a) Spectrum
   b) Tyndall effect
   c) Twinkling of stars
   d) Delayed sunset
5. The phenomena which is/are responsible for such kind of formation are-
   a) atmospheric refraction and internal reflection
   b) dispersion
   c) refraction internal reflection and dispersion
   d) atmospheric refraction and reflection

Answers

1. b 2. d 3. c 4. a 5.a

- **Charge** is a fundamental particle in an atom. It may be positive or negative.
- Like charges repel each other.
- Unlike charges attract each other.

Coulomb (C) : S. I. unit of charge

1 Coulomb charge = Charge present on approx. 6×10^{18} electrons

- Charge on 1 electron = Negative charge of 1.6×10^{-19} C

$$Q = ne$$

Where Q = Charge (total)

n = No. of electrons

e = Charge on 1 electron

Current (I) : The rate of flow of charge is called current.

$$\text{Current} = \frac{\text{Charge}}{\text{Time}}$$

$$I = \frac{Q}{T}$$

S. I. unit of current = Ampere (A)

$$1\ A = 1\ Cs^{-1}$$

$$1\ mA = 10^{-3}\ A$$

$$1\ \mu A = 10^{-6}\ A$$

Current is measured by Ammeter. Its symbol is —— $\overset{+}{}$ A $\overset{-}{}$ ——

Ammeter has low resistance and always connected in series.

Direction of current is taken opposite to flow of electrons as electrons were not known at the time when the phenomenon of electricity was discovered first and current was considered to be flow of positive charge.

Potential Difference (V) : Work done to move a unit charge from one point to another.

$$V = \frac{W}{Q}$$

1 Volt : *When 1 joule work is done in carrying one Coulomb charge then potential difference is called 1 volt.*

S. I. unit of Potential difference = Volt (V)

$$1\ V = 1\ JC^{-1}$$

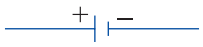
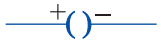
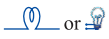
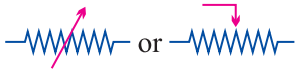
1 Volt : When 1 joule work is done in carrying one Coulomb charge then potential difference is called 1 volt.

Voltmeter : Instrument to measure potential difference.

- It has high resistance and always connected in parallel. Symbol is 

- Cell is the simplest device to maintain potential difference.
- Current always flow from higher potential to lower potential.

Symbols of Some Commonly Used Components in Circuit :

Electric cell	:	
Battery	:	
Key (open)	:	
Key (closed)	:	
Wire joint	:	
Wire Crossing (without join)	:	
Electric bulb	:	
Resistance	:	
Rheostat	:	
Ammeter	:	

Voltmeter : 

Ohm's Law : Potential difference across the two points of a metallic conductor is directly proportional to current passing through the circuit provided that temperature remains constant.

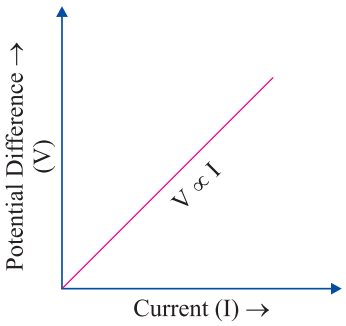
- Mathematical expression for Ohm's law :

$$V \propto I$$

$$V = IR$$

R is a constant called resistance for a given metal.

- V-I graph for Ohm's law :



Resistance (R) : It is the property of a conductor to resist the flow of charges through it.

- Ohm (Ω) : S. I. unit of resistance.
- $1 \text{ ohm} = \frac{1 \text{ volt}}{1 \text{ ampere}}$ *When potential difference is 1 V and current through the circuit is 1 A, then resistance is 1 ohm.*

Rheostat : Variable resistance is a component 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,

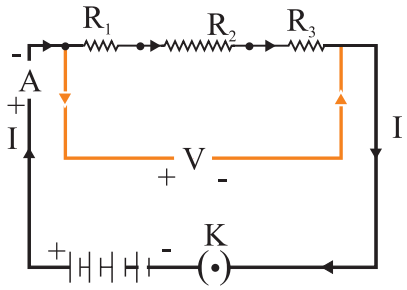
(iii)directly proportional to the temperature and

(iv)depend on nature of 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.

- Its S.I. unit is ohm-metre (Ωm).
- Resistivity does not change with change in length or area of cross-section but it changes with change in temperature.
- Range of resistivity of metals and alloys is 10^{-8} to 10^{-6} Ωm.
- Range of resistivity of insulators is 10^{12} to 10^{17} Ωm.
- Resistivity of alloy is generally higher than that of its constituent metals.
- Alloys do not oxidize (burn) readily at high temperature, so they are commonly used in electrical heating devices.
- Copper and aluminium are used for electrical transmission lines as they have low resistivity.

Resistors in Series :



When two or more resistors are connected end to end, the arrangement is called series combination.

- Total/resultant/overall/effective resistance in series

$$R_s = R_1 + R_2 + R_3$$

- Current through each resistor is same.
- Equivalent resistance is larger than the largest individual resistance.
- Total voltage = Sum of voltage drops

$$V = V_1 + V_2 + V_3$$

- Voltage across each resistor :

$$V_1 = IR_1$$

$$V_2 = IR_2 \qquad [V_1 + V_2 + V_3 = V]$$

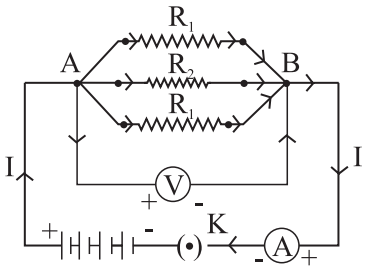
$$V_3 = IR_3 \qquad V = IR$$

$$V = IR_1 + IR_2 + IR_3$$

$$\Rightarrow \quad IR = I(R_1 + R_2 + R_3)$$

$$\Rightarrow \quad R = R_1 + R_2 + R_3$$

Resistors in Parallel :



- Voltage across each resistor is same and equal to the applied voltage.
- Total current is equal to sum of currents through the individual reistances.

$$I = I_1 + I_2 + I_3$$

$$\frac{V}{R} = \frac{V}{R_1} + \frac{V}{R_2} + \frac{V}{R_3}$$

- Reciprocal of equivalent resistance is equal to sum of reciprocals of individual resistances.

$$\frac{1}{R_P} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$$

- Equivalent resistance is less than the value of the smallest individual resistance in the combination.

Advantages of Parallel Combination over Series Combination

(i) In series circuit, when one component fails, the circuit is broken and none of the component works.

(ii) Different appliances have different requirement of current. This cannot be satisfied in series as current remains same.

(iii)The total resistance in a parallel circuit is decreased.

Heating Effect of Electric Circuit

If an electric circuit is purely resistive, the source of energy continually get dissipated entirely in form of heat. This is known as heating effect of electric current.

As $E = P \times T \quad \Rightarrow \quad t\ VI$ $\{E = H\}$

Heat produced, $H = VIt$ $\{V = IR\}$

Or Heat produced, $H = I^2Rt$

Joule's Law of Heating Effect of Electric Current

It states that the heat produced in a resistor is

(i) directly proportional to square of current, $H \propto I^2$

(ii) directly proportional to resistance for a given current, $H \propto R$

(iii) directly proportional to time for which current flows through the conductor, $H \propto t$.

So, $$H = I^2Rt$$

- Heating effect is desirable in devices like electric heater, electric iron, electric bulb, electric fuse, etc.
- Heating effect is undesirable in devices like computers, computer monitors (CRT), TV, refrigerators etc.
- In electric bulb, most of the power consumed by the filament appears a heat and a small part of it is radiated in form of light.
- *Filament of electric bulb is made up of tungsten* as

  (i) it does not oxidise readily at high temperature.

  (ii) it has high melting point (3380° C).
- The bulbs are filled with chemically inactive gases like nitrogen and argon to prolong the life of filament.

Electric Fuse : It is a safety device that protects our electrical appliances in case of short circuit or overloading.

- Fuse is made up of pure tin or alloy of copper and tin.
- Fuse is always connected in series with live wire.
- Fuse has low melting point.
- 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.

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

S.I. unit of power = Watt (W)

$$1 \text{ Watt} = 1 \text{ volt} \times 1 \text{ ampere}$$

- Commercial unit of electric energy = Kilo Watt hour (KWh)

$$1 \text{ KWh} = 3.6 \times 10^6 \text{ J}$$

$$1 \text{ KWh} = 1 \text{ unit of electric energy}$$

QUESTIONS

VERY SHORT ANSWER TYPE QUESTIONS (1 Mark)

1. Define S.I. unit of :
   (a) Electric current
   (b) Potential difference
   (c) Resistance
   (d) Electric power
   (e) Electrical energy consumed
2. Define the term resistivity.
3. Device used for measuring the current is…… .
4. Name the element of filament of a bulb.
5. Write two types of resistors combination.
6. How the voltmeter is connected in a circuit ?
7. How the ammeter is connected in a circuit?
8. Why the filament of bulb has high melting point ?
9. How does fuse wire protect electrical appliances ?
10. Define IKWh in them of joints.
11. On what factors does resistance of a conductor depend ?

I. MULTIPLE CHOICE QUESTIONS

12. What is the rate of flow of electric charges called?
    a) Electric potential b) Electric conductance
    c) Electric current d) None of these
13. Which of the following is the SI Unit of Electric Current?
    a) Ohm b) Ampere
    c) Volt d) Faraday
14. Which instrument is used for measuring electric potential?
    a) Ammeter b) Galvanometer
    c) Voltmeter d) Potentiometer

15. When one unit electric charge moves from one point in an electric circuit, then the amount of work done in joules is known as?
    a) Electric current b) Electric resistance
    c) Electric conductance d) Potential difference
16. The hindrance presented by material of conductor to the smooth passing of electric current is known as:
    a) Resistance b) Conductance
    c) Inductance d) None of these
17. The resistance of a conductor is directly proportional to:
    a) Its area of cross-section b) Density
    c) Melting d) Length
18. The purpose of a rheostat is:
    a) Increase the magnitude of current only
    b) Decrease the magnitude of current only
    c) Increase or decrease the magnitude of current
    d) None of these
19. Point to be kept in mind for verification of Ohm's Law is:
    a) Ammeter and voltmeter should be connected in series
    b) Ammeter should be connected in series and voltmeter in parallel
    c) Ammeter should be connected in parallel and voltmeter in series
    d) Ammeter and voltmeter should be connected in parallel
20. A fuse wire is inserted in a?
    a) Live wire
    b) In the neutral wire
    c) In the earth wire
    d) May be connected in any line

Answer: 1. (c) 2. (b) 3. (c) 4. (d) 5. (a) 6. (d) 7. (c) 8. (a) 9. (c)

21. When electric current is passed, electrons move from:
    (a) high potential to low potential.
    (b) low potential to high potential.
    (c) in the direction of the current.
    (d) against the direction of the current.

Answer. (b)

22. **Very Short Answer Type Questions:**

1. What is electricity?
2. What is the SI unit of electric charge?
3. What is the SI unit of electric current?
4. What is an electric circuit?
5. Which device is used for measuring electric current?
6. An ammeter is attached to the circuit in which combination?

Answer:

1. The set of phenomena; associated with the presence and flow of electric charge is called electricity.
2. Coulomb
3. Ampere
4. The closed path through which electric current flows is called electric circuit.
5. Ammeter
6. Series.

23. Write True/False for the following:

1. Electrons were not discovered at the time of discovery of electric current.
2. The direction of flow of electric current is same as the direction of flow of electrons.
3. Electric current can flow through a closed circuit only.
4. The electric switch helps in opening or closing a circuit.

Answer: 1. → T, 2. → F, 3. → T, 4. → T

24. 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 (amperes)	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). (CBSE 2018)

25. Determine the resistance (R) of the resistor in the above case. (CBSE 2018)

26. Assertion (A): The fuse wire damages the various appliances in household connections.

Reason (R): Depending on the device/appliance used, the fuse wire of proper thickness has to be used.

(a) (A) is incorrect and (R) is correct.

(b) (A) is correct and (R) is incorrect.

(c) Both (A) and (R) are correct but (R) is not the correct explanation of (A).

(d) Both (A) and (R) are correct but (R) is the correct explanation of (A).

27. Assertion (A): When a current I flows through a resistor R, heat produced.

Reason (R): The Joule's law of heating says –$H = I^2RT$.

(a) (A) is incorrect and (R) is correct.

(b) (A) is correct and (R) is incorrect.

(c) Both (A) and (R) are correct but (R) is not the correct explanation of (A).

(d) Both (A) and (R) are correct but (R) is the correct explanation of (A).

SHORT ANSWER TYPE QUESTIONS (3 Marks)

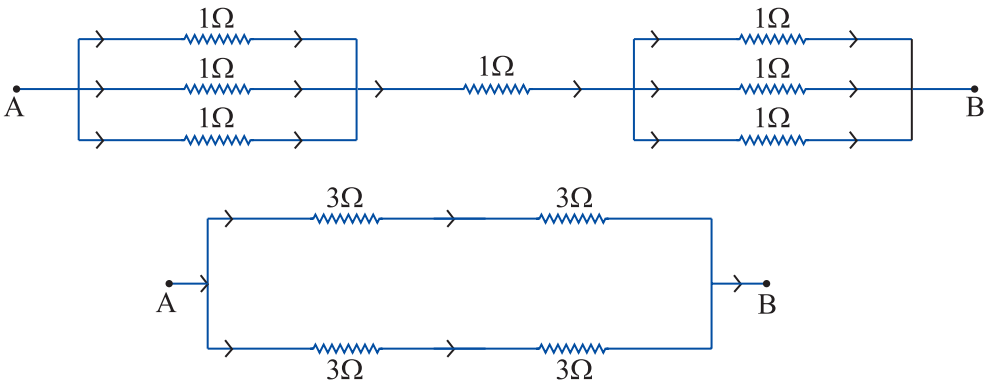
1. Find a relationship between P, I and V.

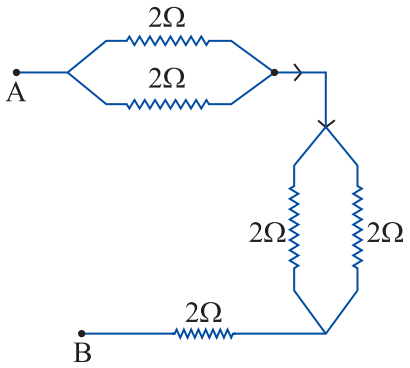
2. State Ohm's law. Derive relation between I, V and R. Draw the graph between V and I.

3. What is Joule's heating effect of current P ? Derive its expression.

4. What would be new resistance if length of conductor is doubled and thickness is halved ?

5. Find the effective resistance between A and B.





6. Which is the better way to connect lights and other appliances in domestic wiring and why ?

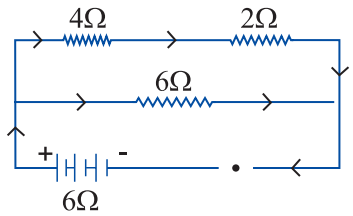
7. Show how would you join three resistors, each of resistance 9 Ω so that the equivalent resistance of the combination is (i) 13.5 Ω, (ii) 6 Ω?

8. (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 current drawn by two bulbs from the line, if the supply voltage is 220 V.

9. (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. (CBSE 2018)

LONG ANSWER TYPE QUESTIONS (5 Marks)

1. Explain the Joule's law of heating. How and on what factors does the heat produced in a conductor depends ?
2. In the circuit given below, calculate :



   (a) Total effective resistance.

   (b) Potential difference across 4Ω, 2Ω.

3. Three resistances of 2Ω, 3Ω and 5Ω are connected in electric circuit. Find :

   (a) maximum effective resistance.

   (b) minimum effective resistance.

4. On what factors, the resistance of a conductor depends ? Give the mathematical expression. Give the SI unit of resistivity.

Hints to Long Answer Type Questions

1. $H = I^2RT$

   Factors : Current, Resistance, Time.

2. (a) Total effective resistance :

$$4\Omega + 2\Omega = 6\Omega$$

$$\frac{1}{R} = \frac{1}{6} + \frac{1}{6} = \frac{2}{6}\Omega = \frac{1}{3}\Omega$$

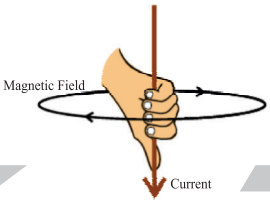
$$R = 3\Omega$$

   (b) V (across 4Ω) = IR = 1 × 4 = 4 V

   V (across 2Ω) = IR = 1 × 2 = 2 V

3. (a) $R = 10\Omega$

   (b) $R = \frac{30}{31}\Omega$



Chapter - 13

Magnetic Effects Of Electric Current

Magnet is any substance that attracts iron or iron-like substances.

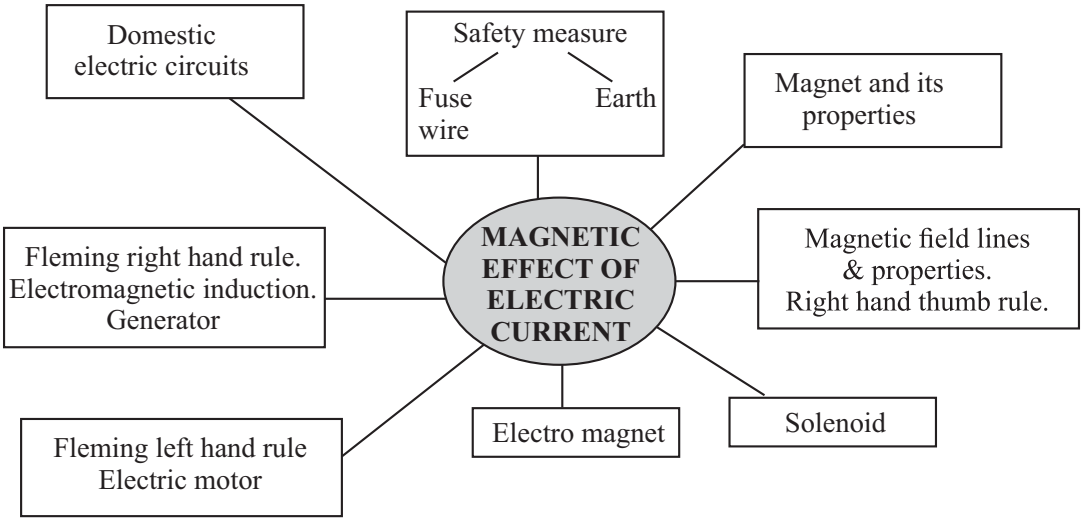
Properties of Magnet

(i) Every magnet has two poles *i.e.,* North and South.

(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 Government of India ordered a nationwide lockdown for 3 weeks irons 25cn March. 2020 to control the spread of COVID-19. The lockdown has been extended a few ennesto date with gradual relaxation. It had a significant impact on the electricit) demanddne to rcdaakn in commercial and industrial activities. The all India electricity consumption dropped fey 22% in the first week oflockdown as compared to the peak of the previous week. In the initial lockdown period, the daily electricity consumption was 25-30% lower than its corresponding value in 2019 (see Figure 1). The residential electricity consumption, on the other hand, is expected to have increased during the lockdown as people spent more time at home.

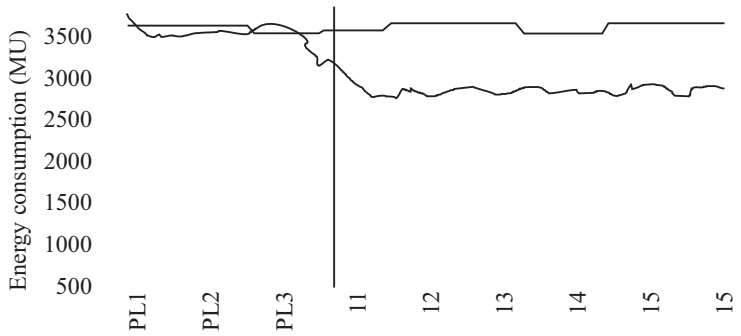


Figure 1: Daily all India electricity consumption (MUs)

1. What is the probable reason of fluctuation in electricity consumption in 2020 as compared to 2019.
   a) reduction in commercial and industrial activities
   b) people spent more time at home.
   c) both of these
   d) There is no change in electricity consumption.

Appliance	watts	hours/Month	kWh/Month
Ceiling Fan	65	15-730	1-47
Electric Heater	1200	30-90	36-108
Iron 1000	1-10	1-10	
Washing Machine	1800	7-40	13-72
Computer (Monitor & Printer)	200	25-160	5-32

2. 'watt is the S.I. unit of-

   a) electric current b) power

   c) potential difference d) Energy

3. Electricity bills come in terms of units of etectricity which have been consumed.

   Here, 1 Unit = ...

   a) 3.6x 105 joules

   b) 3.6x 105 watts

   c) 3.6x 106 watts

   d) 3.6x 106 joules

4. Total energy consumed is given by-

   a) E = QXt b) E = Q/t

   c) E = P X t d) E = P/t

5. A 4kW electric heater is connected to a 220V source of power.The amount of energy ,it wil consume in 2hrs is-

   a) 8 unit

   b) 4 unit

   c) 16 unit

   d) 2 unit

Answers:

1. c 2. b 3. d 4. c 5.a

Magnetic Field : The area around a magnetic in which its magnetic force can be experienced.

- Its SI unit is Tesla (T).

Magnetic field has both magnitude and direction.

Magnetic field can be described with help of a magnetic compass.

- 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.

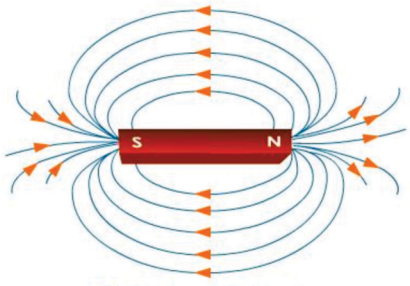
(iii) Field lines are closer in stronger magnetic field.

(iv) Field lines never intersect each other as for two lines to intersect, there must be two north directions 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.

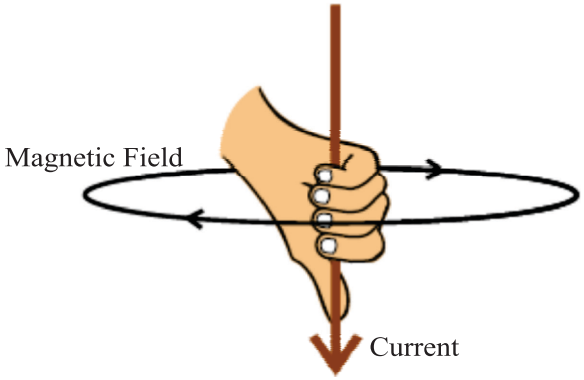
Magnetic Field of a Bar Magnet



- H. C. Oersted was the first person to state that electric current has magnetic field.

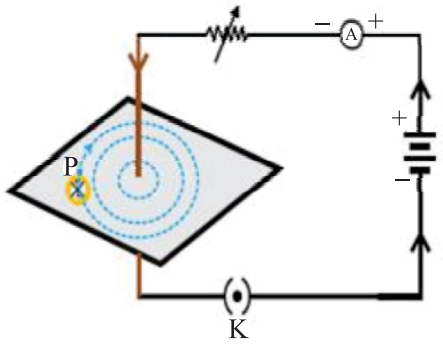
Right Hand Thumb Rule

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.



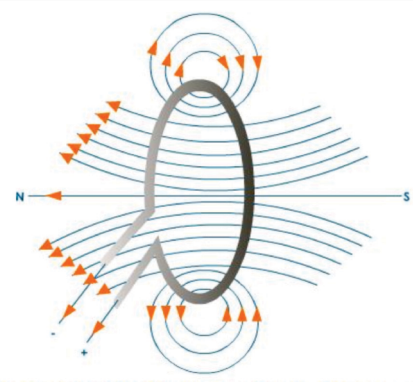
Magnetic Field Due to Current Through a Straight Conductor

- 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 $\propto$ Strength of current
- Magnetic field $\propto \frac{1}{\text{Distance from conductor}}$



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 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

- Magnetic field $\propto$ Current passing through the conductor
- Magnetic field $\propto \frac{1}{\text{Distance from conductor}}$
- Magnetic field $\propto$ No. of turns in the coil

Magnetic field is additive in nature *i.e.,* magnetic field of one loop adds up to magnetic field of another loop. This is because the current in each circular turn has some direction.

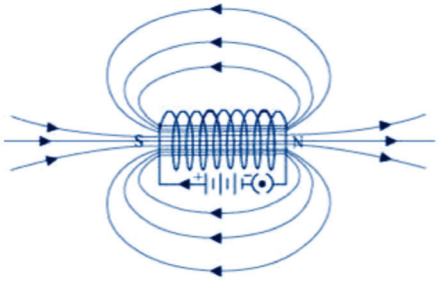
Solenoid

A coil of many circular turns of insulated copper wire wrapped closely in a cylindrical form.

- Magnetic field of a solenoid is similar to that of a bar magnet.
- Magnetic field is uniform inside the solenoid and represented by parallel field lines.
- Direction of magnetic field

  (i) Outside the solenoid : North to South

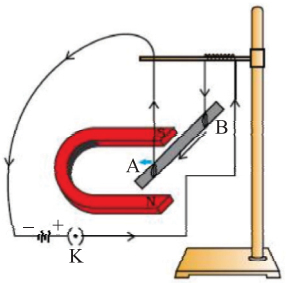
  (ii) Inside the solenoid : South to North
- Solenoid can be used to magnetise a magnetic material like soft iron.



Electromagnet	Permanent Magnet
1. It is a temporary magnet, so, can be easily demagnetised.	1. Cannot be easily demagnetised.
2. Strength can be varied.	2. Strength is fixed.
3. Polarity can be reversed.	3. Polarity cannot be reversed.
4. Generally strong magnet.	4. Generally weak magnet.

Force on a Current carrying Conductor in a Magnetic Field

Andre Marie Ampere suggested that the magnet also exerts an equal and opposite force on a current carrying conductor.

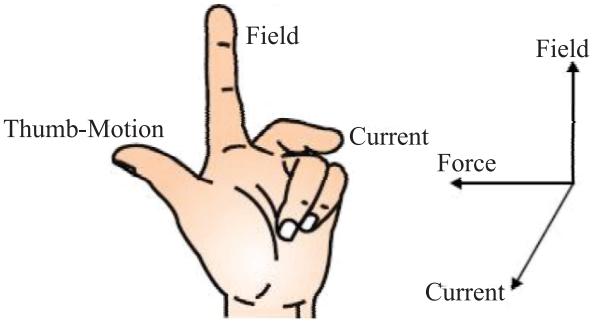


The displacement in the conductor is the maximum when the direction of current is at right angle to the direction of magnetic field.

Direction of force is reversed on reversing the direction of current.

Fleming□s Left Hand Rule

Stretch the thumb, fore finger 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.



Electric Motor

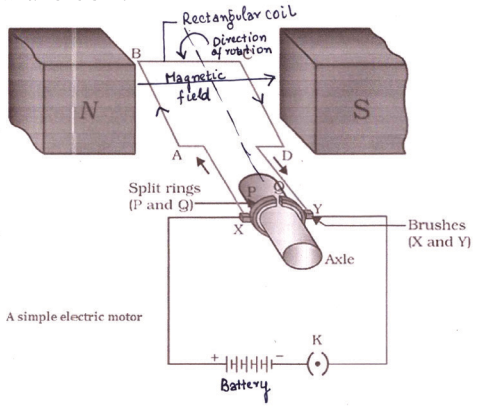
A motor is a device which converts electrical energy into mechanical energy. Electric motor is used in electric fans, washing machines refrigerators, mixer and grinder and other appliances.

Principle of a Motor :

An electric motor utilizes the magnetic effect of current. It works on the principle that when a rectangular coil is placed in a magnetic field and current is passed through it a torque acts on the coil which rotates it continuously. When the coil rotates the shaft to it also rotates and electrical energy supplied to the motor is converted into mechanical energy.

Construction of a Motor :

1. Armature Coil : An electric motor consists of an rectangular coil ABCD of insulated copper wire wound on a soft iron core called armature.
2. Strong Field magnet. : The coil (armature) is placed between two poles of a strong magnet such that arm AB and CD are perpendicular to the direction of the magnetic field.
3. Split ring type commutator : It consists of two halves of a metallic ring named as P and Q. The two ends of armature coil are connected to these two halves of ring. The function of commutators is that it reverses the direction of current in armature coil.



4. Brushes : Two carbon brushes X and Y press against the commutator. These brushes act as contact between commutator and terminal battery.
5. Battery : It is connected across the carbon brushes. It supplied current to the armature coil. Current in the coil ABCD enters from the source battery through conducting brush X and flows back to the battery through brush Y.

Working of a Motor :

1. When current flows through coil, arm AB and CD experiences magnetic force.
2. On applying Fleming left hand rule, the force acting on arm AB pushes it downwards and arm CD experiences force in upward direction.
3. Both these forces are equal and opposite. Two equal and opposite forces acting at different position of armature constitute a couple and rotate the coil in anti-clockwise direction.
4. At half rotation Q makes contact with brush X and P with brush Y. Now the current in the coil get reversed and flows along the path DCBA.
5. The arm AB of the coil that was earlier pushed down is now pushed up and the arm CD previously pushed up is now pushed down. These two equal and opposite forces constitute a couple, this couple now rotate the coil in clockwise direction.
6. The reversing of the current is repeated at each half rotation, giving rise to a continuous rotation of the coil and to the axle. Hence electric energy is converted into mechanical energy.

Commercial motor use :

(i) An electromagnet in place of permanent magnet.

(ii) Large number of turns of the conducting wire in the coil.

(iii) A soft iron core on which coil is wound plus the coils, is called the armature.

(iv) This enhances the power of the motor.

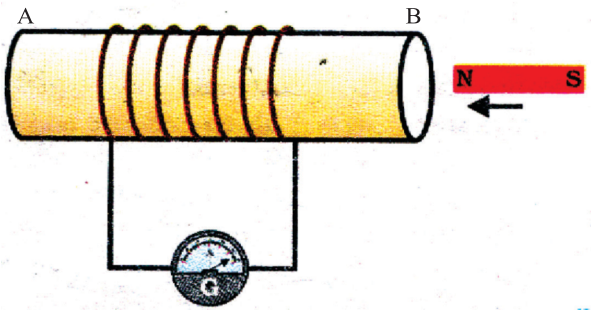
- Heart and brain in the human body have significant magnetic field.
- **MRI (Magnetic Resonance Imaging) :** Image of internal organs of body can be obtained using magnetic field of the organ.

Galvanometer : Instrument that can detect the presence of current in a circuit. It also detects the direction of current.

Electro Magnetic Induction

When a conductor is placed in a changing magnetic field, some current is induced in it. Such current is called induced current and the phenomenon is called electromagnetic induction.

Activity No. 1

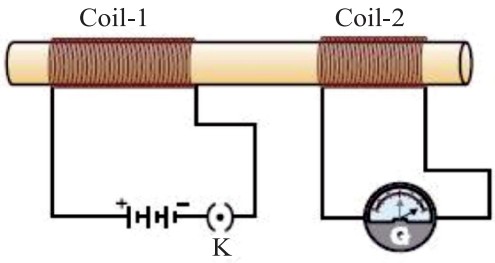


(i) **Magnet moved into the coil :** Momentary deflection in G indicating presence of current.

(ii) **Magnet kept stationary inside the coil :** No deflection.

(iii) **Magnet is withdrawn :** Momentary deflection in G but in opposite direction of first case.

Activity No. 2



Primary Coil **Secondary Coil**

(i) **Switched on :** Momentary deflection in G.

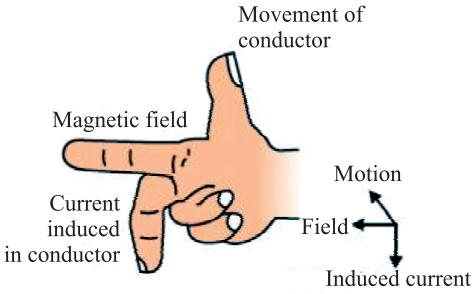
(ii) **Steady current :** No deflection.

(iii) **Switched off :** Momentary deflection in G but in opposite direction of the first case.

Fleming's Right Hand Rule

Hold the thumb, the fore finger 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.

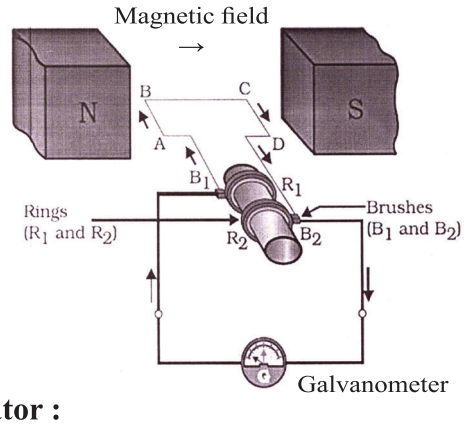
- Working principle of electric generator.
- Used to find direction of induced current.



Electric Generator

The electric generator is a machine for producing electric current or electricity. The electric generator converts mechanical energy (or kinetic energy) into electrical energy.

Principle of Electric Generator : (AC Generator) In an electric generator, mechanical energy is used to rotate a conductor in a magnetic field to produce electricity. Generator works on the principle of electromagnetic induction. When a closed coil is rotated in a uniform magnetic field with its axis perpendicular to the magnetic field, the magnetic field lines passing through the coil change and an induced emf is set-up. The principle behind the electric generator is based on Fleming's right hand rule.



Construction of Generator :

1. Field Magnet : It is strong horse-shoe shaped permanent magnet with concave poles.
2. Armature : ABCD is a rectangular armature coil. It consists of a large number of turns of insulated copper wire wound on a soft iron cylindrical core.
3. Slip rings : These are two brass rings, R_1 and R_2 rigidly connected to the two ends of the armature coil. As coil rotates slip rings also rotates.

4. Brushes : These are two graphite rods B_1 and B_2 which are kept pressed against the slip rings R_1 and R_2. Through these brushes, the current induced in the armature coil is sent to the external circuit.
5. Axle : The slip rings are placed on the axle which is made to rotate freely from an external source.
6. Galvanometer : To measure current the outer ends of the brushes are converted to the galvanometer.

Working of Generator :

1. The armature coil ABCD is in horizontal position.
2. Now, the coil is rotated clockwise.
3. The arm AB moves upwards while the arm CD moves downwards.
4. The coil cuts the magnetic lines of force.
5. According to Flemings' right hand rule, the induced current flows from A to B in arm AB and C to D in arm CD i.e. it flows along ABCD.
6. The induced current flows in the circuit through B_2 to B_1.
7. After half the rotation of the armature, the arm CD moves upwards and AB moves downwards. The induced current now flows in reverse direction i.e. along DCBA. The current now flows from B_1 to B_2.
8. Thus the direction of current in the external circuit changes after every rotation. Such a current which changes its direction after equal intervals of time is called alternating current.
9. This device is called AC Generator.

D.C. GENERATOR

DC Generator : It is a device which convert mechanical energy into electrical energy.

DC Generator has split ring commutator instead of slip rings.

Split ring commutator : It consists of two semi cylindrical brass rings R_1 and R_2 attached to the two ends of the armature coil. As the armature coil rotates, the two split rings also rotate about the same axis of rotation.

Alternate Current (A. C.) : The current which reverses its direction periodically.

- In India, A. C. reverses its direction in every $\frac{1}{100}$ second.

$$\text{Time period} = \frac{1}{100} + \frac{1}{100} = \frac{1}{50}\text{s}$$

$$\text{Frequency} = \frac{1}{\text{Time period}}$$

$$= \frac{1}{1/50} \quad \Rightarrow \quad 50 \text{ Hz}$$

Advantage

- A. C. can be transmitted over long distance without much loss of energy.

Disadvantage

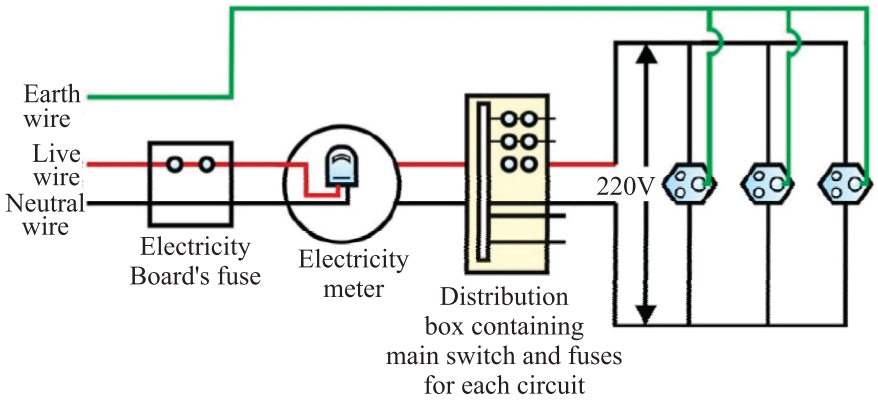
- A. C. cannot be stored.

Direct Current (D. C.) : The current which does not reverse its direction.

- D. C. can be stored.
- Loss of energy during transmission over long distance is high.
- Sources of D. C. : Cell, Battery, Storage cells.

Domestic Electric Circuits

- There are three kinds of wires used :
  (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



Earth Wire : Protects us from electric shock in case of leakage of current especially in metallic body appliances. It provides a low resistance path for current in case of leakage of current.

Short Circuit : When live wire comes in direct contact with neutral wire accidently.

- Resistance of circuit becomes low.
- Can result in overloading.

Overloading : When current drawn is more than current carrying capacity of a conductor, it results in overloading.

Causes of overloading :

(i) Accidental hike in voltage supply.

(ii) Use of more than one appliance in a single socket.

Safety devices :

(i) Electric fuse

(ii) Earth wire

(iii)MCB (Miniature Circuit Breaker)

QUESTIONS

VERY SHORT ANSWER TYPE QUESTIONS (1 Mark)

1. Define magnetic field lines.
2. What is the frequency of a.c. in India ?
3. Who discovered the electromagnetic induction ?
4. What is short circuit ?
5. Why does two magnetic field lines not intersect ?

6. What should be the core of an electromagnet?
   a) Soft iron b) Hard iron
   c) Rusted iron d) None of above
7. Who has stated the Right hand Thumb Rule?
   a) Oersted b) Fleming
   c) Einstein d) Maxwell
8. In all the electrical appliances, the switches are put in the
   a) Live wire b) Earth wire
   c) Neutral wire d) All of above
9. What is the condition of an electromagnetic induction?
   a) There must be a relative motion between the coil of wire and galvanometer
   b) There must be a relative motion between the galvanometer and a magnet
   c) There must be a relative motion between the galvanometer and generator
   d) There must be a relative motion between the coil of wire and a magnet
10. No force acts on a current carrying conductor when it placed—
   a) Perpendicular to the magnetic field b) Parallel to the magnetic field
   c) Far away from the magnetic field d) Inside a magnetic field
11. What is that instrument which can detect the presence of electric current in a circuit?
   a) Galvanometer b) Motor
   c) Generator d) None of above
12. Which device produces the electric current?
   a) Generator b) Galvanometer
   c) Ammeter d) Motor
13. What is electromagnetic induction?
   a) The process of charging a body
   b) The process of rotating a coil of an electric motor.
   c) Producing induced current in a coil due to relative motion between a magnet and the coil.
   d) The process of generating magnetic field due to a current passing through a coil.
14. What happens to the current in short circuit?
   a) Reduces substantially b) Does not change
   c) increase heavily d) Vary continuously

15. An alpha particle is diverted towards west is deflected towards north by a field. The field is magnetic. What will be the direction of field?

a) Towards south b) Towards east

c) Downward d) Upward

Answer: 6. (a) 7. (d) 8. (c) 9. (d) 10. (b) 11. (a) 12. (a) 13. (b) 14. (c) 15. (c)

16. Very Short Answer Type Questions:

1. What is a magnet?
2. What is a permanent magnet?
3. What is a temporary magnet?
4. What is an electromagnet?
5. What is the direction of magnetic field lines?
6. What is the shape of magnetic field lines due to a straight current-carrying conductor?

17. Assertion (A): Every magnet has two poles–North and South.

Reason (R): Like poles repel each other.

(a) (A) is incorrect and (R) is correct.

(b) (A) is correct and (R) is incorrect.

(c) Both (A) and (R) are correct but (R) is not the correct explanation of (A).

(d) Both (A) and (R) are correct but (R) is the correct explanation of (A).

18. Assertion (A): Magnetic field lines never intersect each other.

Reason (R): There must not be two north directions at a point.

(a) (A) is incorrect and (R) is correct.

(b) (A) is correct and (R) is incorrect.

(c) Both (A) and (R) are correct but (R) is not the correct explanation of (A).

(d) Both (A) and (R) are correct but (R) is the correct explanation of (A).

19. Assertion (A): As the speed of the coil in the motor increases, there is reduction in the current flowing through it.

Reason (R): During rotation in electric motor, some induced current is produced.

(a) (A) is incorrect and (R) is correct.

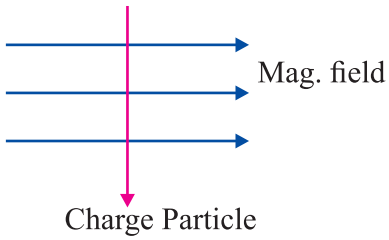
(b) (A) is correct and (R) is incorrect.

(c) Both (A) and (R) are correct but (R) is not the correct explanation of (A).

(d) Both (A) and (R) are correct but (R) is the correct explanation of (A).

SHORT ANSWER TYPE QUESTIONS (3 Marks)

1. A charged particle enters at right angle into a uniform magnetic field. What is the nature of charge particle if it experiences a force in a direction pointing vertically out of page.



Use Fleming's Left Hand Rule

2. When does short circuit occur ?
3. Write the three ways to produce magnetic field.
4. What is overloading ?
5. Write the use of safety device used in electric circuit.
6. What is solenoid ? Where the magnetic field is uniform in solenoid ?
7. Draw the pattern of magnetic field lines due to current carrying straight conductor.
8. What is earth wire ? How it works in our domestic circuit ?

LONG ANSWER TYPE QUESTIONS (5 Marks)

1. What is electromagnetic induction ? Explain with an activity. Write its one application.

2. Draw the schematic diagram of domestic circuit. Write the colour and nature of neutral wire, live wire and earth wire.

3. What is an electromagnet ? What material are used to make electromagnet ? Can we use steel to make electromagnet ?

4. (a) State Fleming's left hand rule.
   (b) Write the principle of working of an electric motor.
   (c) Explain the function
   (i) Armature (ii) Brushes (iii) Split ring. (CBSE 2018)

Hints to Long Answer Type Questions

1. The process by which a changing magnetic field in a conductor induces a current in another conductor is called electromagnetic induction.

   See Fig. 15.17 NCERT

2. Refer to given diagram

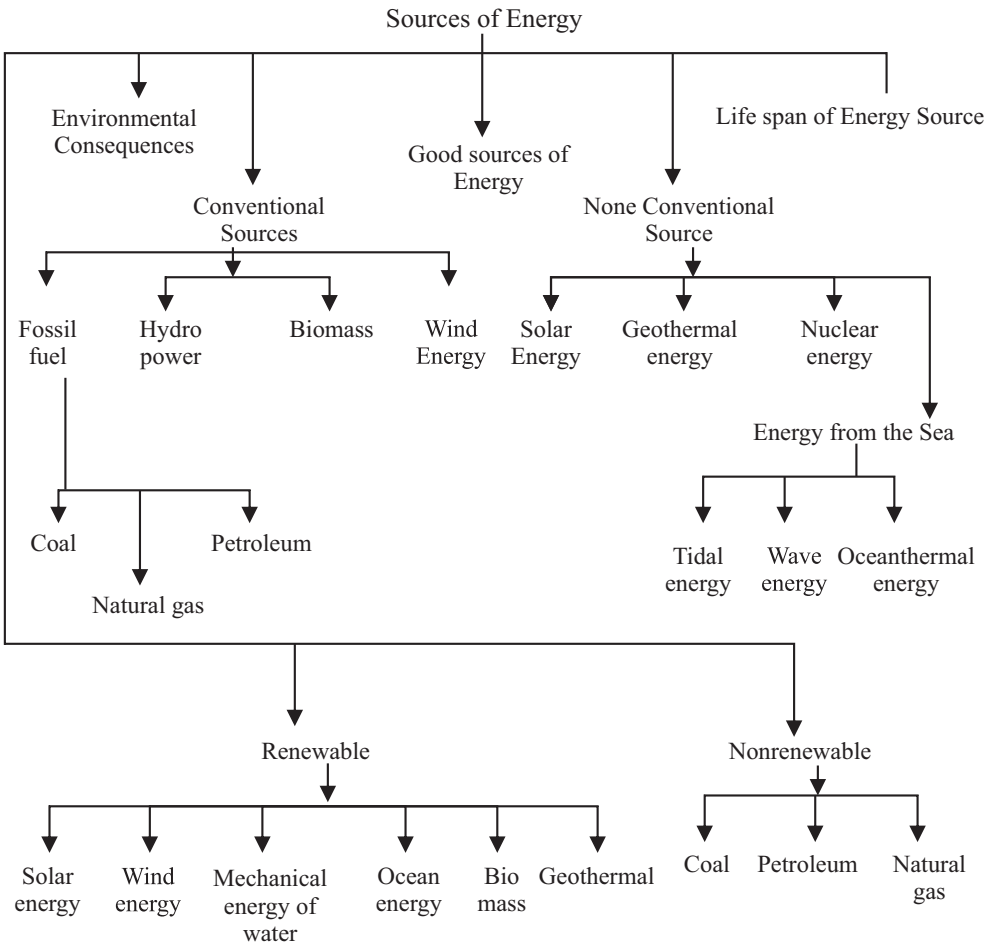
3. A strong magnetic field produced inside a solenoid can be used to magnetise a piece of magnetic material, like soft iron, when placed inside the coil. The magnet so formed is called an electromagnet.

   Yes, steel can be used to make electromagnet.

Chapter - 14

Sources Of Energy

Concept map

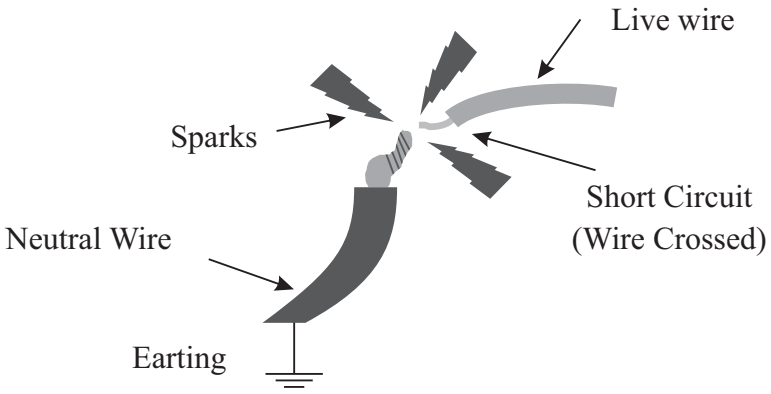


- Energy comes in different forms and one form can be converted into another.
- A source of energy is one which provide adequate amount of energy in a convenient form over a long period of time.

Magnetic effects of electric currrent-case study

By nature, electricity seeks to return to ground, and in a properly functioning circuit, this means that the current Hows through the established wiring circuit back to the service panel, and onward back through the utility wires. However, if the connections within the wiring loosen or break, electrical current may "leak." In this instance, the electrical current instantly seeks to flow back to ground by a shorter pathway. That pathway may very well be through flammable materials or even through a human being, which is why a short circuit presents the danger of fire or lethal shock.

The reason this happens is that these other materials offer a pathway of lesser resistance than is present in the copper wiring of a circuit.



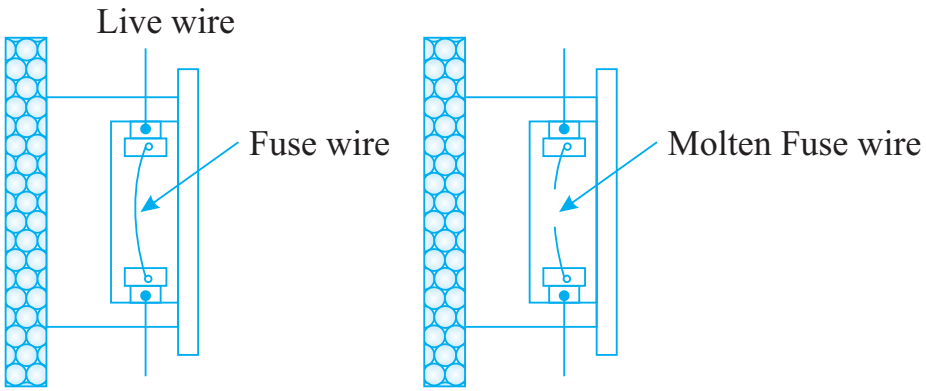
Short circuit is prevented by using a device known as fuse.

1. At the time of short circuit, the current in the circuital
   a) Reduces substansially
   b) Doesnot change
   c) Increases heavily
   d) Vary continously
2. During short circuit, live wire and neutral wire comes in direct contact with each other. What may be the reason behind this-
   i) faulty circuit wire insulation
   ii) loose wire connections
   iii) faulty appliance wiring

a) (i) and (ii) only
b) (ii) and (iii) only
c) (i) and (iii) only
d) (i),(ii) and (iii) all.

3. What is a fuse?

a) Safety device
b) circuit breaker
c) both
d) none of these



4. With the device, the fuse wire is placed -

a) in series
b) in parallel
c) anywhere
d) nowhere

5. The fuse is an application of-

a) Right hand thumb Rule
b) Left hand thumb Rule
c) Fleming's left-hand Rule
d) Joule's law of heating

Answers: 1.c 2. d 3. c 4. a 5. d

Need of energy :

- Photosynthesis
- For cooking food
- For lightning (CFL, LED, bulb)
- For transport
- For running machines
- For industrial activities and agricultural work

Qualities of a Good Source of Energy

(i) Which would do a large amount of work per unit mass.

(ii) Cheap and easily available.

(iii)Easy to store and transport.

(iv)Safe to handle and use.

(v) Does not cause environmental pollution.

Fuels : The materials which are burnt to produce heat energy are known as fuels. e.g. wood, coal, LPG, kerosene.

Characteristics of a Good Fuel

- High calorific value (give more heat per unit mass).
- Burn without giving out any smoke or harmful gases.
- Proper ignition temperature.
- Cheap and easily available.
- Easy to handle, safe to transport.
- Convenient to store.
- Burn smoothly.

Sources of Energy

Conventional Sources of Energy	Non-conventional Sources of Energy
• Fossil fuels (Coal, Petroleum)	• Solar energy (*e.g.,* solar cooker, solar cell panel)
• Thermal power plant	• Energy from the sea (tidal wave, OT energy)
• Hydro power plants	• Biomass-biogas plant • Wind energy
• Geothermal energy	• Nuclear energy

CONVENTIONAL SOURCES OF ENERGY

Sources of energy which are used by people: *e.g.,* fossil fuels, bio mass, water energy, wind energy etc.,

I. FOSSIL FUELS : Used in several areas.

- Fuels developed from the fossils *e.g.,* coal, petroleum.
- Take millions of years to form.
- Available in very limited amount.
- These are non-renewable sources of energy.

India has about 6% share in the world reserved coal, that may last 250 years more at the present rate of consumption.

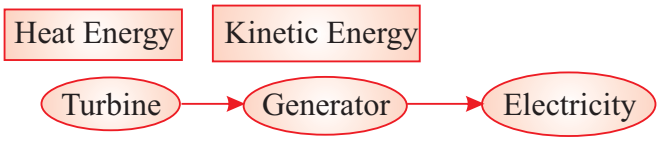
Pollution Caused by Fossil Fuels

- Release oxides of carbon, nitrogen and sulphur (acidic in nature) which causes acid rain that damages trees, plants, reduces fertility of soil.
- Produces large amount of CO_2 in the atmosphere which causes green house effect leading to excessive heating of the earth.

Controlling Pollution Caused by Fossil Fuels

- Increasing the efficiency of the combustion process.
- Using various techniques to reduce the escape of harmful gases and ashes into the surroundings.

II. THERMAL POWER PLANT :



A power plant which uses heat energy to generate electricity.

- Burning of fossil fuels produces steam to run turbines.
- Set up (power plants) near the coal and oil fields to minimize the cost of transportation and production.
- Elements present in fly ash increases crop production.

III. HYDRO POWER PLANTS :

- Convert the potential energy of falling water into electricity.
- Hydro power plants are associated with dams.

Around 25% of our country's energy requirement is met by Hydro Power plants.

Advantages :

(i) No environmental pollution.

(ii) Flowing water is a renewable source of electric energy.

(iii) Construction of dams prevents flooding of rivers, provide water for irrigation, and possibility for fish farming.

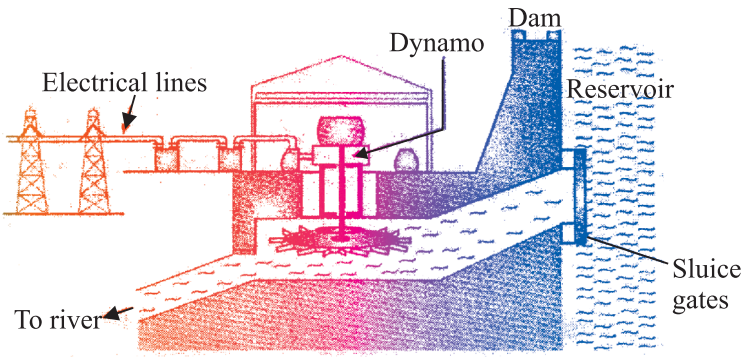
Disadvantages :

(i) Large areas of agricultural land, a vast variety of flora and fauna, human settlements get submerged in the water reservoir formed by the dam.

(ii) Large ecosystems are destroyed.

(iii) Vegetation that submerge under water rots in anaerobic conditions and produces large amount of methane which is a green house gas.

(iv) Creates the problems of satisfactory rehabilitation of displaced people.



Production of hydroelectricity using water energy

Improvements in the Technology for Using Conventional Sources of Energy

I. BIOMASS :

The dead parts of plants and trees and the waste materials of animals and man is called **Biomass.**

(1) Wood : It is a biomass and used as a fuel since long time.

Disadvantages :

- Produces a lot of smoke on burning which is harmful for health and environment.
- Do not produce much heat.
- Thus by improvement in technology we can improve the efficiency of traditional sources of energy.

For *e.g.,* wood can be converted into better fuel called charcoal.

(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 higher calorific value than wood.

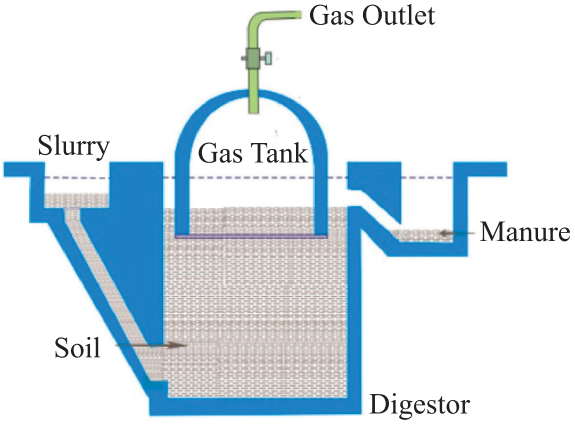
(ii) It burns without producing smoke

(iii) It is a compact fuel, easy to handle and convenient to use.

(3) Cowdung : It is biomass yet it is not good to burn cowdung directly as fuel because :

- produces less heat
- produces lot of smoke.
- cowdung does not burn completely, produces lot of ash as residue.
- low calorific value.
- By making bio gas (or gobar gas) from cow dung, we get a smokeless fuel.

(4) Bio gas : It is produced in a biogas plant. Anaerobic micro organisms decomposes the complex compound present in slurry of cattle dung and water. It takes a few days for the decomposition process and generate gases like methane, CO_2, hydrogen and hydrogen sulphide. Bio gas is stored in the gas tank above the digester from which they are drawn through pipes for use.



Bio gas Plant

Advantages of Bio gas :

(i) It is an excellent fuel as it contains upto 75% methane (CH_4).
(ii) It burns without smoke.
(iii) Leaves no residue like ash in wood & coal burning.
(iv) Heating capacity is high.
(v) It is also used for lighting.
(vi) Slurry left behind is used as excellent manure rich in nitrogen and phosphorus.
(vii) Safe and efficient method of waste disposal.

Limitations of bio gas plant:

(i) High initial cost
(ii) Large amount of cattle dung is required.
(iii) High maintenance cost.

(5) Wind energy :

- Unequal heating of the landmass and water bodies by solar radiations generate air movement and causes wind to blow.
- Kinetic energy of the wind can be used :

  (i) to generate electricity by turning the rotor of the turbine.

  (ii) to lift water from the well.

  (iii) to run the flour mills.
- But the output of a single wind mill is quite small so a number of windmills are erected over a large area called wind energy farm.
- The minimum wind speed for wind mill to serve as a source of energy is 15-20 Kmph

Advantages :

(i) Eco-friendly.

(ii) Efficient source of renewable energy.

(iii) No recurring expenses for production of electricity.

Disadvantages :

(i) Wind energy farms need large area of land.

(ii) Difficulty in getting regular wind speed of 15-20 Kmph.

(iii) Initial cost of establishing wind energy farm is very high.

(iv) High level of maintenance of blades of wind mill.

- Denmark is called the 'Country of Winds'.
- India is ranked among top 10 countries in harnessing wind energy for the production of electricity.
- In India largest wind energy farm has been established near Kanyakumari in Tamil Nadu and it generates no less than 380 MW of electricity.

Alternate or Non-conventional Sources of Energy

Day by day, our demand for energy has increased, os there is a need for exploring other source of energy.

Reasons for alternate sources of energy

(i) Fossil fuel reserves in the earth are limited which may get exhausted soon if we use them at the current rate.

(ii) Reduce the pressure on fossil fuels making them last for a longer time.

(iii) To reduce the pollution level and to save environment.

I. SOLAR ENERGY :

- Sun is the ultimate source of energy.
- Energy obtained from the sun is called solar energy.

$$\text{Solar constant} = 1.4 \text{ KJ/s/m}^2$$

Outer edge of the earth receives solar energy equal to 1.4 KJ/s/m^2 or 1.4 KW/m^2 [... 1 KJ/s = 1 KW]

Solar energy devices : Devices using solar energy are :

(i) Solar cooker
(ii) Solar water heater
(iii) Solar cells

} to collect solar energy and use it in the form of heat energy

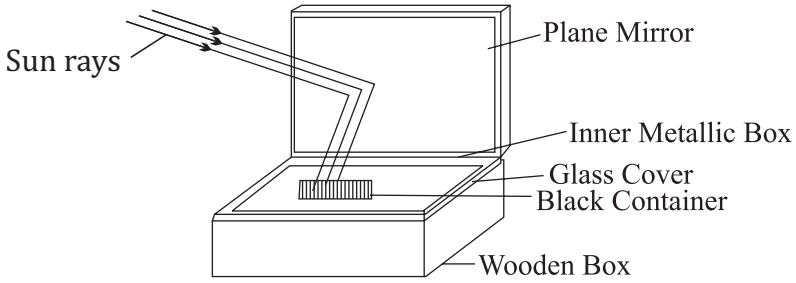
Solar heating devices :

- Use black painted surface because black surface absorbs more heat as compared to white or other surface.
- Use of glass plate because it allows in frared radiations to enter through it but does not allow the radiations to exitthrough it, causing more greenhouse effect that result in increase in temperature.

(i) SOLAR COOKER

Box Type Solar Cooker : It consists of a rectangular box which is made up of wood or plastic which is painted black.

- Inner walls of the box are painted black to increase heat absorption.
- Solar cookers are covered with glass plate and have mirror to focus the rays of the sun and achieve higher temperature.
- Temperature inside the box increases 100ºC-140ºC in 2-3 hours.



Solar Cooker (Box Type)

Advantages :

(a) Save precious fuel like coal, LPG, kerosene.

(b) Does not produce smoke.

(c) Nutrients of food do not get destroyed while cooking.

Disadvantages :

(a) Solar cookers cannot be used during night.

(b) If the day sky is covered with clouds, solar cooker cannot be used.

(c) Direction of reflector of solar cooker changes from time to time to keep it facing the sun.

(d) Cannot be used for frying or baking purposes.

II. SOLAR CELL :

- Solar cells convert solar energy into electricity.
- A solar cell develops a voltage of 0.5-1 V and can produce about 0.7 W of electricity.
- A large number of solar cell are combined in an arrangement called solar panel

Advantages :

(a) Have no moving parts.

(b) Require little maintenance.

(c) Can work without any focusing device.

(d) Can be set up in remote and inacessible areas.

Limitations:

(a) Manufacturing is expensive.

(b) Availability of special grade silicon for making solar cells is limited.

(c) Silver wire for interconnection of cells is expensive.

Uses of Solar Cell :

(a) Artificial satellites and space probes use solar cells as the main source of energy.

(b) Radio, TV relay stations in remote locations use solar cell panels.

(c) Traffic signals, calculators and many toys are fitted with solar cells.

III. ENERGY FROM THE SEA

Tidal Energy Wave Energy Ocean Thermal Energy

	Tidal Energy	Wave Energy	Ocean Thermal Energy
Working : (i)	The phenomenon of high and low tide give us tidal energy.	Kinetic energy of huge waves near sea shore is trapped to generate electricity.	The difference in the temperature of water at the surface and deeper section of ocean is used to obtain energy in ocean thermal energy conversion plants. (OTEC)

(ii)	It is harnessed by constructing a dam across the narrow opening of the sea.	Wave energy is used for rotation of turbine and production of electricity.	The warm surface water is used to boil volatile liquid ammonia. The vapours of the liquid are used to run the turbine of generator to produce electricity.
Limitations	The location where such dams can be built are limited.	Wave energy is viable only where waves are very strong.	Efficient commercial exploitation is very difficult.

GEOTHERMAL ENERGY

- 'Geo' means 'earth' and 'thermal' means 'heat'.
- Geothermal energy is the heat energy from hot rocks present inside the earth.
- When underground water comes in contact with 'hot spot', steam is generated. Steam trapped in rocks is routed through pipes to a turbine and used to generate electricity.

Advantages :

(a) Economical to use geothermal energy.

(b) Does not cause any pollution.

Limitations :

(a) Geothermal energy is not available everywhere.

(b) Deep drilling in the earth to obtain geothermal energy is very difficult and expensive.

- In New Zealand and USA, there are several power plants based on geothermal energy are operational.

NUCLEAR ENERGY

- The energy released during a nuclear reaction is called nuclear energy.
- It can be obtained by two types of nuclear reactions :

(i) Nuclear fission

(ii) Nuclear fusion

(i) Nuclear Fission :

- 'Fission' means split up.
- The process in which the heavy nucleus of a radioactive atom (such as uranium, plutonium or thorium) split up into smaller nuclei when bombarded with low energy neutrons, is called nuclear fission.
- A tremendous amount of energy is produced.
- U-235 is used as a fuel in nuclear reactor in form of uranium rods.

Working : In a nuclear reactor self sustaining chain reaction releases energy at a controlled rate, which is used to produce steam and further generate electricity.

Major Nuclear Power Plants :

(a) Tarapur (Maharashtra)

(b) Rana Pratap Sagar (Rajasthan)

(c) Kalpakkam (Tamil Nadu)

(d) Narora (U. P.)

(e) Kakrapar (Gujrat)

(f) Kaiga (Karnataka)

(ii) Nuclear Fusion :

In nuclear fusion, two nuclei of light elements (lke hydrogen) combine to form heavy nucleus (like helium). Enormous amount of energy is released.

$$ {}_{1}^{2}H\,(\text{deuterium}) + {}_{1}^{2}H \xrightarrow{\text{fusion}} {}_{2}^{3}He + {}_{0}^{1}n + Heat $$

- Extremely high temperature and pressure is needed for fusion.
- Hydrogen bomb is based on this phenomenon.
- Nuclear fusion is the source of energy all the stars including sun.

Advantage :

(a) Production of large amount of useful energy from a very small amount of nuclear fuel.

(b) Does not produce green house gases like CO_2.

Limitations :

(a) Environmental contamination due to improper nuclear waste storage and its disposal.

(b) Risk of accidental leakage of harmful radiations. *e.g.,* chernobyl accident

(c) High cost of installation.

(d) Limited availability of nuclear fuel.

Environmental Consequences

Exploiting any source of energy disturbs the environment in some way or the other. Thus, the source we would choose depends upon following the factors :

(a) Ease of extracting energy from the source.

(b) Cost of extracting energy from the source.

(c) Efficiency of technology available to extract energy.

(d) The environmental damage caused by using that source.

In other words, no source of energy is said to be pollution free. Some source are cleaner than the other.

For example, solar cells may be pollution free but the assembly of the device cause some environmental damage.

How long will an energy resource last ?

Sources of Energy

Non-renewable Sources of Energy	**Renewable Sources of Energy**
Sources that will get depleted some day. For example : Fossil fuel	Energy sources that can be regenerated and that will last for ever. For example : Wind energy, water energy.

QUESTIONS

Multiple Choice Questions (1 mark)

1. Which of the following is the ultimate source of energy?
   a. CNG b. Coal
   c. LPG d. Sun
2. In which of the following kinetic energy is converted into electrical energy?
   a. Tidal energy b. Hydro-electricity
   c. Wind energy d. In all the above
3. In which process maximum amount of energy is released?
   a. Nuclear fusion b. Nuclear fission
   c. Reaction of sodium with water d. Respiration
4. Which of the following acts as reflector in a solar cooker?
   a. Solar panel b. Mirror
   c. Glass lid d. Silicon ceil
5. Along with nitrogen which other element is in rich amount in slurry inside a biogas plant?
   a. Oxygen b. Sulphur
   c. Iodine d. Phosphorus
6. On the basis of use of various sources of energy, choose the correct option in increasing order
   a. Nuclear < Water < Petroleum and Natural Gas< Coal
   b. Coal < Water < Nuclear< Wind
   c. Nuclear < Petroleum and Natural Gas < Water < Coal
   d. Solar < Water < Wind < Ocean Thermal Energy
7. On which principle is the hydrogen bomb based:
   a. Controlled fission b. Uncontrolled fission
   c. Controlled fusion d. Uncontrolled fusion
8. Main constituent of biogas is
   a. Hydrogen b. Carbon dioxide
   c. Methane d. Hydrogen sulphide

MCQ correct options:

1	2	3	4	5	6	7	8
D	D	A	B	D	C	D	C

1. What process is the source of sun's energy?
2. Name two elements used in solar cells
3. Cow dung is not a good fuel. Why?
4. How is charcoal different from wood?
5. Expand CNG.
6. Name the fuel used in thermal power plant.
7. How is hydroelectric power generated?
8. Which two types of energy don't relate to solar energy?
9. What are the two advantages of nuclear energy?

In the following questions , two statements are given- one labeled Assertion (A) and the other labeled 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: Methane and hydrogen sulphide gases are produced in digester of bio-gas plant.
   Reason: Aerobic respiration occurs in digester.
2. Assertion: Thermal power plants are established near coal and oil fields.
   Reason: The transmission of electricity is more efficient than transporting coal or petroleum over the same distance

Read the following passage and answer the questions:

Oceans are huge reservoirs of water and energy. The energy from oceans is available in different forms Of total surface of our planet, about 70.8% is covered by oceans, which are the largest source of water for living organisms. They act as energy storehouse because of the large volume of water present in them. Wave energy is one

of such forms. Due to limitations, developing technology to tap these forms of energy is a challenge.

i) The generation of electricity from water energy
   a. will not cause pollution
   b. is renewable source of energy
   c. will always be available
   d. all the above are correct

ii) Which is not a form of ocean energy that can be harnessed easily?
   a. Ocean thermal energy
   b. Wave energy
   c. Wind energy
   d. Tidal energy

iii) What is the use of ammonia in OTEC plant?

iv) How many times does the rise and fall of tidal waves occur daily?

2 Marks

1. Compare wind energy and water energy.
2. What is the cause of ocean thermal energy?
3. Enlist the limitations of a solar cooker.
4. Why are several thermal power plants set up near coal or oil fields?
5. Describe how electricity is generated from geothermal energy.
6. Forests get replenished, still wood should not be used as a fuel. Why?

3 Marks

1. What are the limitation of using energy from the wind, tides and waves.
2. Enlist the advantages and disadvantages of building dams on rivers.
3. How can you reduce pollution caused by burning fossil fuels?
4. Write four features of ideal source of energy. Examine nuclear energy as an ideal source of energy.
5. Correlate burning of fossil fuels with acid rain and green-house effect.
6. Name any six places where nuclear reactors have been established in India.

5 Marks

1. a) Draw a labelled diagram of solar cooker.
   b) Write the functions of the following in a solar cooker * Mirror * Glass lid
   c) Why is the inner surface of a solar cooker painted with black colour?
2. a) What is meant by bio-mass?
   b) How is the biogas plant helpful in reducing the pollution?
   c) Write any two components of biogas.

HINTS FOR 5 MARK QUESTIONS

1. Mirror- reflector, to concentrate solar energy Glass lid: green house effect inside the box Black absorbs heat better.
2. Organic matter including waste material from living beings like cattle dung and dead parts of living beings like plants, trees, animals, wood, agricultural wastes, bagasse.

   Burning dung cakes cause pollution, while biogas combustion is not. The slurry left in digester is rich in nitrogen and phosphorus, can be used in fields.

   Methane, hydrogen sulphide, carbon dioxide and hydrogen

Chapter - 15

Our Environment

Our Environment

Ecosystem
All the interacting organisms in an area together with the living and non-living things depend directly or indirectly

Components

- Biotic Components
- Abiotic Components

Natural Ecosystem
Which exist in nature on its own.
Eg-forest, lake, ocean

Artificial Ecosystem
Man made Ecosystem
Eg-Cropfield, aquarium, garden.

Producer
Produce their own food

Consumer
Cannot Make their own food.
Primary
Secondary
Tertiary

Decomposer
Decompose dead plants and animals

Biodegradable Wastes
Organic Wastes which can be broken into simpler form by microbes.

Non-Biodegradable Wastes
Cannot be broken down by natural organisms and mostly the source of pollution.

Wastes
Unwanted, unusable, discarded things are waste.

Disposal Methods
There are–
Landfills
Incineration
Composting
Sewage Treatment
Recycling

Food Web
In nature large number of food chains are inter connected forming a feed web.

Energy Flow
i. Unidirectional
ii. 1% of total solar energy is absorbed by plants.
iii. Transfer of energy through various trophic level is in accordance with 10% law.

Food Chain
The unidirectional, sequential events by which nutrients and energy are transferred from are group of organisms to the next.
- Bio magnification is the accumulation of chemicals at the successive trophic level.
- Each step in the food chain is called trophic level.

- Everything that surrounds us is environment. It includes both living (biotic) and non-living (abiotic) components.
- Interaction between these biotic and abiotic components form an ecosystem.
- In an ecosystem living components depend on each other for their food which give 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.

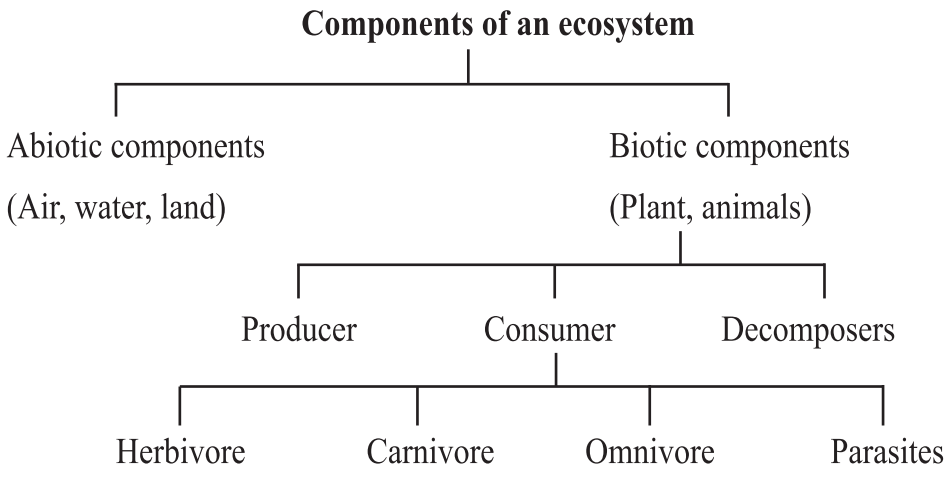
Ecosystem

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 exist in nature on its own. *E.g.,* forest, lake, ocean.

(b) Artifical ecosystem : Man-made ecosystems are called artificial ecosystem. *E.g.,* crop field, aquarium, garden.



(a) **Abiotic Components :** All the non-living components such as air, water, land, light, temperature etc. form the abiotic components.

(b) **Biotic Components :** All the living components such as plants, animals, bacteria, fungi etc. form the biotic components.

On the basis of nutrition biotic components are further divided into :

Producers : All green plants and blue-green algae can produce their own food using abiotic components (photosynthesis), hence called producers.

Consumers : Include all animals which depend on producers directly or indirectly for their food.

Consumers are further divided into :

(i) **Herbivores :** Plant eaters *e.g.,* goat, deer.

(ii) **Carnivores :** Flash eaters *e.g.,* tiger, crocodile.

(iii) **Omnivores :** Eats both plants and animals *e.g.,* human.

(iv) **Parasites :** Live on the body of host and take food from it *e.g.,* lice, cascuta.

Decomposers : Include organisms which decompose the dead plants and animals *e.g.,* bacteria, fungi. These help in the replenishment of natural resources.

FOOD CHAIN

- Food chain is a series of organisms in which one organism eats another organism as food. For *e.g.,*

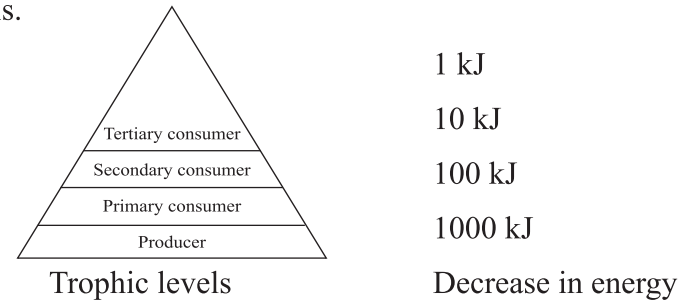
  Grass → Deer → Lion

- In a food chain various steps where transfer of energy takes place is called a trophic level.

Flow of energy between trophic levels

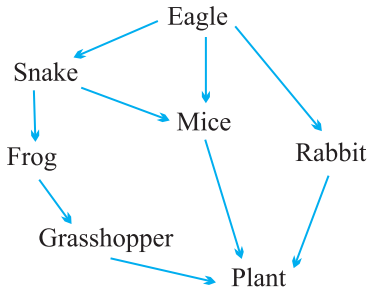
- Flow of energy in a food chain is unidirectional.
- Green plants capture 1% of sunlight and convert it into food energy.
- **10 percent law :** Only 10% of energy is transferred to the next trophic level. The remaining 90% energy is used in life processes (digestion, growth, reproduction etc.) by present trophic level.

- Due to this gradual decrease in energy, food chains contain 3-4 trophic levels.



- **Biological magnification :** The concentration of harmful chemicals increases with every next trophic level in a food chain. This is called biological magnification.
- Maximum concentration of such chemicals get accumulated in human bodies as human occupy the top level in any food chain.

Food web : In nature large numbers of food chains are interconnected forming a food web.



Food web

Environmental problems : Changes in the environment affect us and our activities change the environment around us. Human activities leads to pollution, deforestation etc.

Ozone layer

- Ozone layer is a protective blanket around the earth which absorbs most of the harmful UV (ultraviolet) radiations of the sunlight, thus protecting living beings from many health hazards such as skin cancer, cataract, destruction of plants etc.
- Ozone (O_3) layer is present at higher levels of atmosphere (*i.e.,* stratosphere). It is a deadly poison at ground level.

Formation of ozone molecule

(i) The high energy UV radiations break down the O_2 molecules into free oxygen (O) atoms.

$$O \xrightarrow{UV} O + O \text{ (atoms)}$$

(ii) These oxygen atoms then combine with oxygen (O_2) molecule to form the ozone molecule.

$$O_2 + O \rightarrow O_3 \text{ (ozone)}$$

Depletion of ozone layer

- The decrease in the thickness of ozone layer over Antarctica was first observed in 1985 and was termed as ozone hole.
- This decrease was linked to excessive use of synthetic chemicals like chlorofluorocarbons (CFCs) which are used in refrigerators, ACs, fire-extinguishers, aerosols sprays etc.
- United Nations Environment Programme (UNEP) succeeded in forging an agreement to stop CFC production at 1986 levels (KYOTO PROTOCOL) by all countries.

Garbage disposal

Improvements in lifestyle have resulted in accumulation of large amounts of waste materials.

Garbage contains following type of materials :

(a) **Biodegradable :** Substances which can be decomposed by the action of micro-organisms are called 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 non-biodegradable wastes.

E.g., plastic, polythenes, metals, synthetic fibres, radioactive wastes, pesticides etc.

Micro-organisms release enzymes which decompose the materials but these enzymes are specific in their action that's why enzymes cannot decompose all the materials.

Some 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 wastes are recycled to make new items.

(f) **Reuse :** It is a conventional technique to use an item again *e.g.,* newspaper for making envelops.

(g) **Incineration:** It is a waste treatment process that are described as themal treatment, it converts the waste into ash mainly it is used to transforms medical wastes.

QUESTIONS

Mutiple Choice Question

1. Which pollutant released into the air during refrigeration and airconditioning is the greatest contribute to the depletion of ozone layer?
   (a) BHC (b) DDT
   (c) CFC (d) NEP
2. What percentage of sun's energy falling on the leaves of green plants is utilised by the plants in the process of photosynthesis and stored as chemical energy of food?
   (a) 99% (b) 10%
   (c) 1% (d) 20%
3. The flow of energy is an ecosystem is always
   (a) Unidirectional (b) Bidirectional
   (c) Cyclic (d) Multidirectional
4. If the energy transformed to a tertiary consumer in a feed chain is 10J. How much enegy was available to the primary consumer?

(a) 100J (b) 500J

(c) 1000J (d) 5000J

5. The ten percent law is associated with

(a) Transfer of energy from various trophic to decomposers in a foodchain.

(b) Transfer of ATP energy into muscular enerrgy

(c) Transfer of chemical energy from one organism to another

(d) Transfer of sun's energy to the organisms called producers.

6. O_2 converted into O_3 by the action of

(a) Infrared radiations (b) Ultraviolet radiations

(c) Gamma radiations (d) Cosmic radiations

7. As human being occupy the top level in any food chain, the maximum concentration of insecticides get accumulated in our bodies. This phenomeon is known as.

(a) Pollution (b) Eutrophication

(c) Biological magnification (d) None of these

8. Which one of the following is as artificial ecosystem?

(a) Pond (b) Crop field

(c) Lake (d) Forest

9. What provides the energy which then flows through a food chain?

(a) Glucose (b) Oxygen

(c) Respiration (d) Sunlight

10. Which of the following is the best method to dispose of biological wastes from hospitals?

(a) Landfill (b) recycling

(c) incineration (d) composting

Answers

1. (c) 2. (c) 3. (a) 4. (c) 5. (c) 6. (b) 7. (c) 8. (b) 9. (d) 10. (c)

II Read the following Passage & Answer the Given Questions:

Ultraviolet radiation could destroy the organic matter Plants and planktons cannot thrive, both act as food for and sea animals respectively. For humans excessive exposure to ultraviolet radition leads to higher risk of skin cancer and

cataracts. it is calculated that 1% decreases in ozone layer results in a 2–5 percent increase in the occurrence of skin cancer. other ill-effects of the reduction of protective ozone layer include-increase and suppression of the immune system.

a. How is ozone formed in the atmosphere?

b. What damages ozone layer?

(a) Cholorofluro carbons (b) Nitric oxide

(c) Free radicals of chlorine (d) All of them

c. Which of the following is global step that has been taken by the world to reduce ozone depletion?

(a) KYOTO protocol (b) Gothenberg protocol

(c) Montreal protocol (d) Aarhus protocol

d. In which layer of the atmosphere ozone layer is delpleting?

(a) Ionospehere (b) Stratosphere

(c) Lithosphere (d) Thermosphere

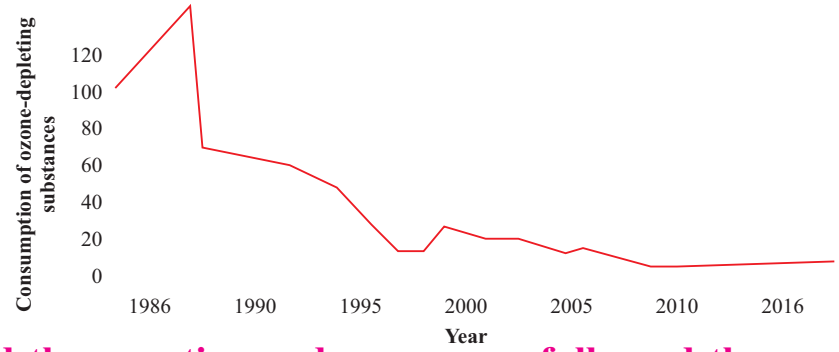
e. In the following graph shown, the magnitude of global decline in consumption of ozone deplecting substances (ODS) is shown. Study the graph and state during which period there is a sharp rise and a rapid decline seen in their consumption.

(a) During 1986–87 and 2000–2005

(b) During 1987–88 and 2016–2017

(c) During 2000–2001 and 2010

(d) During 1990–91 and 2016



Read the assertion and reason carefully and then mark the correct option out of the options given below :

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

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

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

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

1. Asseration (A) : Decomposers act as cleaning system of envioronment

   Reason (R) : The decomposers cycle waste material only in hydrosphere.

2. Asseration (A) : Human beings occupy the tap chain is unidirectional

   Reason (R) : The flow of energy in a food chain is unidirectional.

3. Asseration (A) : Some substances in nature are biodegradable while some are non-biodegradable.

   Reason (R) : The bacteria acting on the substances breakdown only the substances made from natural materials.

4. Asseration (A) : All green plants and certain blue-green algae can produce food by photosynthesis.

   Reason (R) : Due Presence of cholorophyll.

5. Asseration (A) : The disposal of waste we generate in occuring is causing serious environment problems.

   Reason (R) : We should reduce the waste generated.

1 Maker Question

1. Classify the following into biotic and abiotic components: Water, air, animals, Temperature, Plants, Soil.
2. Make a food chain with following organism-

   Snake, Grass, Eagle, Frog, Grass Hopper.

3. How much energy is transferred to the next trophic level

   (a) 1% (b) 90%

   (c) 10% (d) 100%

4. CFC Causes depletion of

   (a) Ozone (b) Oxygen

   (c) Nitrogen (d) None of these

5. The concentration of harmful chemicals increases with energy next trophic level in a food chain. Name this process.
6. Name two materials which can be recyled.

7. Define trophic level.
8. What is the full form of CFC and UNEP?
9. Name the radiations that are absorbed by the ozone layer.
10. Which will get more energy secondary consumers or tertiary consumers?
11. What is the functional unit of environment.
12. Which of the following are not biodegradable.

    Wool, Glass, Silver foil, Leather
13. Name any two parasites
14. What is KYOTO protocol?

Answers

1. Abiotic-Soil air, water temperature Biotic- Plants, animals
2. Grass → grasshopper → frog → snakes → eagle
3. 3.10%
4. a
5. Biological magnification
6. Paper, Plastic

2 Marks

1. Explain how does making of Kulhads affects ourt environment?

   (CBSE 2013)
2. What will happen if all the phytoplanktons are eliminated from pond?
3. State two differences between a consumer and producer.
4. Draw the line diagram showing flow of energy is an ecosystem.
5. Define a food web. State its significance for ecosystem.
6. What are phytoplanktons.
7. Name two natural ecosystem.
8. What is an ecosystem? List its two main components.
9. We do not clean ponds or lakes, but an aquarium. needs to be cleaned regularly explain.
10. In the following food chain 20J of energy was available to the hawks. How much would have been present in the plants?

    Plants → Rats → Snakes → hawks.

SHORT ANSWER TYPER QUESTIONS

1. Why are green plants called producers?
2. Name two matrerials which can be recyled.
3. What will happen if we kill all the organisms of a trophical level?
4. Why only 10% energy is transferred to the next trophic level?
5. Which bag will you prefer for shopping and why?
   (a) Jute bag (b) Polythene bag
6. Why is ozone layer important for the existence of life on earth?
7. What is the role of decomposers in ecosystem?
8. Draw an energy pyramid showing different trophic level.
9. Differentiate betweem biodegradable waste and non-biodegradable waste.
10. How ozone molecule is formed in the atmosphere?
11. Define consumers. What are its further divisions?
12. Why natural ecosystem is more stable than artificial ecosystem?
13. Why some materials are not decomposed by the action of micro-organisms?
14. What is a food web? Explain with example.
15. Give any two ways in which non-biodegradable wastes would affect the environment.
16. How the components of an ecosystem are dependent on each other?

LONG ANSWER TYPE QUESTIONS

1. What are different methods for disposal of garbage?
2. What is food chain? Give its characteistics. Explain how energy flows through different trophic levels a food chain.
3. Explain how harmful chemicals enter our body.

Hints to Long Answer Type Questions

1. Methods for Garbage disposal :

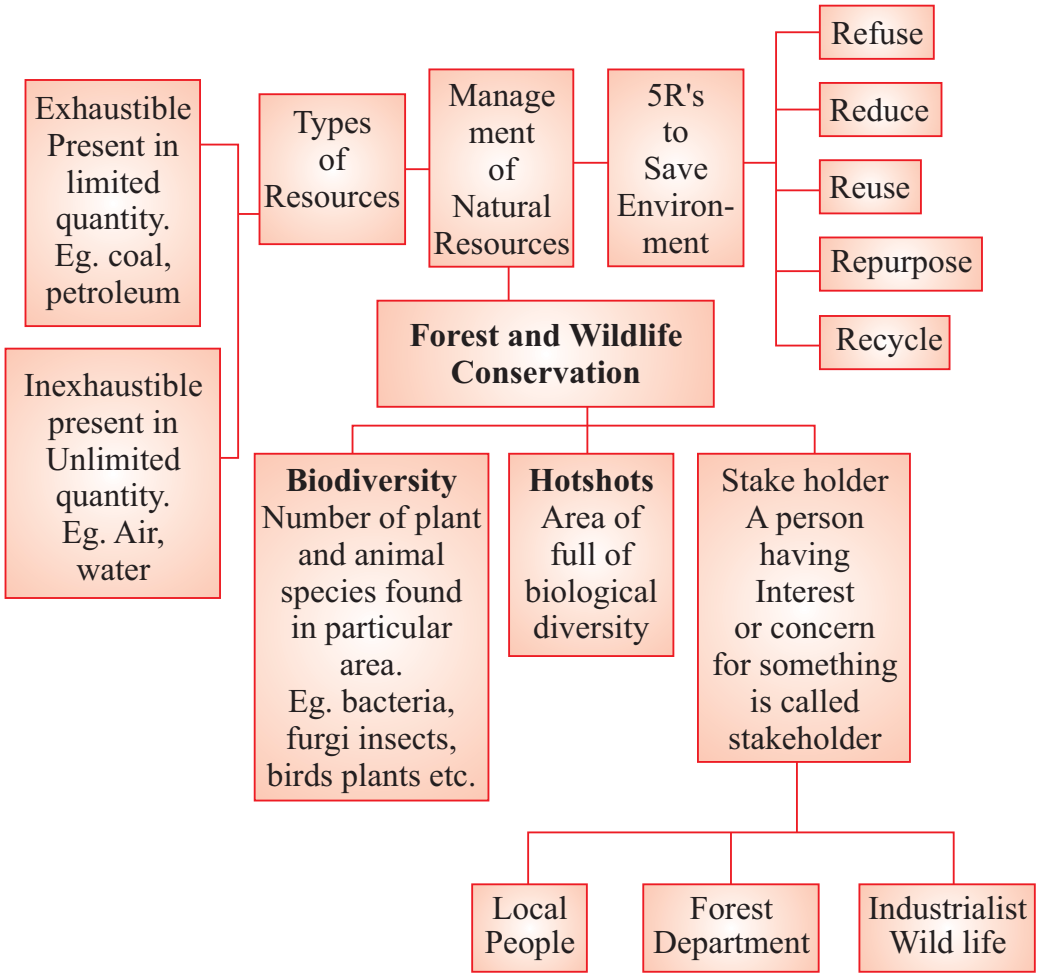
Land filling	Compositing
Recycling	Resuse
Biogas plant	Sewage treatment plant

2. **Food Chain :** Trannsfer of energy through various trophic level in an ecosystem.

   Characteristics : (i) Unidirectional

Chapter - 16

Management of Natural Resources



Natural Resources : Anything in the environment 'which can be used' is called natural resource. For example, soil, air, water, forests, wildlife, coal and petroleum.

Types of Resources

Exhaustible	Inexhaustible
These are present in limited quantity. *E.g.,*Coal, petroleum.	These are present in unlimited quantity. *E.g.,* Air, water.

Management of Natural Resources : It is the use of natural resources in such a way so as to avoid wastage and conserve them for future.

There are national and international laws and acts to protect the environment.

GANGA ACTION PLAN (GAP) : Multi crore project came in 1985 to improve the quality of Ganga.

Contamination of river water is indicated by :

(i) The presence of coliform (a group of bacteria found in human intestine) whose presence indicate contamination by disease causing bacteria.

(ii) The pH of water that can be easily checked by using universal indicator.

Management of Natural Resources

5 R's to Save the Enivronment

Refuse	Reduce	Reuse	Repurpose	Recycle
To say 'No' to things you don't need.	Use less	Use Again	To use a product for some other useful purpose	Segregate waste that can be recycled.
For example: Say 'No' to single use plastic carry bags.	**For example:** (i) Switching off unnecessary lights and fans. (ii) Repairing leaky taps (iii) Not wasting food	**For example:** (i) Instead of throwing things away they can be used again. Water after washing dal etc. can be used for watering plants.	**For example:** Cracked crockery can be used to grow plants.	**For example:** Plastic, glass, metal items can be recycled.

Reuse is better than recycling as it saves energy.

We need to use our resources carefully because

(a) they are limited.

(b) demand for all resources is increasing as human population is increasing at a tremendous rate due to improvement in health care.

Sustainable Management

Management of resource wisely so that they meet current basic human needs while preserving them for the needs of future generations.

The management of natural resources require :

(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.

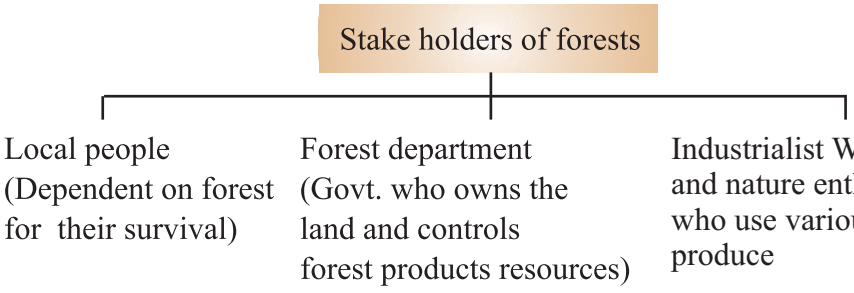
Forest and Wildlife Conservation

Forest are biodiversity hot spots. Main aim of conservation is to preserve the biodiversity as loss of diversity may lead to ecological instability.

Biodiversity : Biodiversity of an area is the number of plant and animal species found in that particular area like bacteria, fungi, insects, birds, plants etc.

Hot spots : It means an area full of biological diversity.

Stake holder : A person having interest or concern for something is called stake holder.



Instances where various people has played an important role in conservation of forests

(i) **Khejri Trees :** Amrita Devi Bishnoi, in 1731, sacrificed her life along with 363 others for the protection of Khejri trees in a village in Rajasthan.

Govt. of India instituted 'Amrita Devi Bishnoi' National award for wildlife conservation in her memory.

(ii) **Chipko Andolan :** This movement originated in a remote village in Garhwal. Women of the village reached the forest when contractor's men came to cut the trees. Women clasped the tree trunk thus preventing the workers from felling the trees. The Chipko Movement quickly spread across communities and forced govt. to rethink their priorities in the use of forest products.

(iii) West Bengal Forest Department revived the degraded SAL forest of Arabari.

Water for all

- Water is the basic necessity for all terrestrial forms of life.
- Rain is an important source of water.
- Irrigation methods like dams, 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

Interesting facts :

Hirakud Dam built across Narmada river is the longest man-made dam in the world – 26 km in length.

Tehri Dam is Asia's highest dam – 261 m high.

Bhakra Nangal Dam is Asia's second highest dam at 225.5 m.

Advantages of Dams

(a) Ensures adequate water for irrigation.

(b) To generate electricity.

(c) Continuous supply of 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.

(b) Environmental problems :

(i) Deforestation

(ii) Loss of biodiversity

(iii) Disturb 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'.

- Rain water harvesting is an age old practice in India.
- Various ancient methods of water harvesting :

Method	State
Khadin, tanks, nadis	Rajasthan
Bandharas, tals	Maharastra
Bundhis	Madhya Pradesh, UP
Pynes, ahars	Bihar
Kulhs	Himachal Pradesh
Ponds	Jammu region
Eris (tanks)	Tamil Nadu
Bawlis	Delhi

Advantages of storing water in the ground

(a) It does not evaporate.

(b) It spreads out to recharge wells.

(c) It provides moisture for vegetation over a wide area.

(d) It does not provide breeding grounds for mosquitoes.

(e) It is protected from contamination by human and animal waste.

Coal and Petroleum

- Coal and Petroleum are **non-renewable** natural resources.
- Coal and Petroleum are called **Fossil Fuels.**
- **Formation :**

Coal : Coal was formed from the remains of trees buried deep inside the earth some 300 million years ago.

Petroleum : 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.

- Coal and petroleum will exhaust very soon.
  (a) **Coal :** At present rate, coal will last another 200 years.
  (b) **Petroleum :** At present rate of usage, it will last for about 40 years.

Harmful effects of using fossil fuels

Air pollution : Combustion of coal and hydrocarbons release a large amount of carbon monoxide, carbon dioxide, oxides of nitrogen etc. which cause air pollution.

Diseases : This polluted air causes various diseases like respiratory and throat problems, congestion etc.

Global Warming : Excessive emission of green house gases like carbondioxide cause a rise in atmospheric temperature leading to global warming.

- Fossil fuels should be used judiciously.
  (a) Because they are limited and exhaustible.
  (b) Once exhausted they will not be available in near future because they are formed very slowly over a period of many years.
- **Steps taken to conserve energy resources (like coal and petroleum)**
  (a) Switch off electric appliances when not in use.

(b) Use electric appliances that are energy efficient like CFL at home.
(c) Use public transport like bus or metro instead of private vehicles.
(d) Use stairs to climb instead of lift.
(e) Whenever possible, use solar cookers.

1. Which of the following bacteria contaminates river water and is found in river Ganga.
   a) Streptocoreus b) Coliform
   c) Diplococus d) Stapylococcus.
2. 'Kulhs' System of irrigation is common in
   a) Himachal Pradesh b) Rajasthan
   c) Bihar d) Madhya Pradesh
3. Large Scale deforestation causes
   a) Rainfall b) Soil erosson
   c) Global Warming d) Drought
4. 'Amrita Devi Bishnoi National Award' is given in memory for her work in -
   a) Protection of Ganga from pollution
   b) Protection of trees in Reni Village of Garhwal
   c) Protection of Khejri trees in Khejarli village near jodhpur is Rajasthan
   d) Protection of sal forest
5. Ground water will not be depleted due to
   a) Afforestation b) Thermal power plants
   c) Less of forest d) Cropping of high water demanding crops.
6. Opposition to the construction of large dams is due to
   (a) Social reasons (b) Economic reasons
   (c) Environmental reasons (d) All of the above
7. Which on of the following is green house gas?
   (a) Nitrogen dioxide (b) Carbon dioxide
   (c) Sulphur dioxide (d) Carbon monoxide
8. Hoods can be prevented by
   (a) afforestation (b) Removing the top soil
   (c) Cutting the forest (d) Tilling the land

9. Which of the following is the best method from environment point of view?

(a) Recycle (b) Reduce

(c) Reuse (d) None of the above

10. To keep air pollution in control, we should

(a) Plast more trees (b) Use CNG in vehicles

(c) Use plastic bottles (d) Construct more buildings

Answer

1. (b) 2. (a)
3. (d) 4. (c)
5. (a) 6. (d)
7. (b) 8. (a)
9. (c) 10. (c)

ASSERTION REASON QUESTIONS

Read the assertion and reason carefully and then mark the correct option out of the options given below :-

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

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

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

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

1. Asseration (A) : About 70% of earth's volume is water.

Reason (R) : Water is easily available for all the population living on the earth.

Answer - (b)

2. Asseration (A) : Vast tracts of forests have been cleared and converted to monocultures.

Reason (R) : There monocultures are important source of revenue for the fortest department.

Answer - (b)

3. Asseration (A) : Coal is one of the source for the production of electricity.

Reason (R) : Coal is a non-renewable source of energy.

Answere - (a)

4. Asseration (A) : Water harvesting is as age-old concept in India.

   Reason (R) : Khadin, tanks, nadis, Kulhs, bandharas etc some ancient water harvesting structure of India.

Answer - (a)

5. Asseration (A) : Forest cover balances the temperature level of the area.

   Reason (R) : Forest reduces atmosphere pollution abosorbing carbon dioxide from the atmosphere.

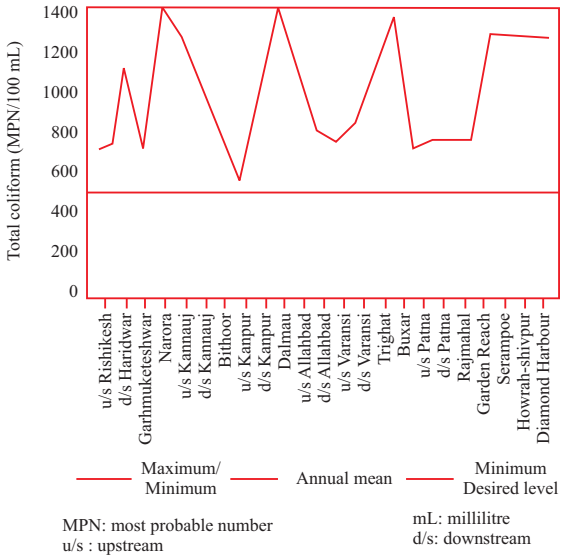
Answer - (a)

Read the following and answer the given questions :

A recent report Uttar Pradesh pollution control board (UPPCB) has reported extreme level of pollution in the two most mportant rivers of the country the Ganga and the Yamuna.

Against maximum permissible limit of 2500 MPN (most probable number) the bacteria for faecal coliform bacteria, a staggering 220 lakh MPN/100 ml of was delected in Varuna river in Varanasi before meeting Ganga followed by Hindon river in Noida having second highest court of 1.40 lakh MPN/100ml of the bacteria. the third highest court of 98000 MPN/100ml of the deadly bacteria which causes water borne pathogenic disease resulting in ear infections dyserty, typhoid,

fever, viral and bacteria gastroenteritis besides hepatitis A was found in the Yamuna in Mathura.



1. What is coliform and where it is found?
   (a) A group of bacteria in human intestine
   (b) A group of virus in water
   (c) A group of decomposers in humans
   (d) A group of bacteria is animals
2. Two factors which can be used to final whether river water has been contaminated or not are
   (a) Presece of chloride and pH value.
   (b) Sweet taste of water and pH value.
   (c) Alkalinity and acidity of water.
   (d) Presence of coliform bacteria and pH value.
3. What could be the cause of such high coliform count in rivers?
4. A disease caused by polluted water is
   (a) Cholera (b) T.B
   (c) Pneumonia (d) Malaria
5. The adjacent graph shows total coliform count levels in the Ganga river, state at which place the river water is
   (1) Cleanest
   (b) Highly contaminated

QUESTIONS

VERY SHORT ANSWE TYPE QUIESTIONS

1. Name a clean fuel other than LPG natural gas.
2. Name two fossil fuels.
3. Name the most common practice used to recharge ground water.
4. Name any two inexhaustible resources.
5. Name any bacteria whose presence in water indicate contamination of water.
6. Write full form of CFC.
7. What is biodiversity.
8. Why is resus better than recycle.
9. Name the person who is remembered for protection of Khejri trees in Rajasthan.
10. Who are called stake holders.

Question

1. State the advantages of storing water in the ground.
2. What are steps talkes to conserve energy where as.
3. Suggest any two ways to strike a balance between environment and development.
4. What is coliform and where it is found.
5. What do you understand by pH of water.
6. Explain why, despite good rains we are not able to meet the demand for water of all the people in our country.

SHORT ANSWER TYPE QUESTIONS

1. What is meant by sustainable development.
2. Name two measures you would take to conserve electricity in your house.
3. Why should fossil fuels be used judiciously.
4. List three advantage of water harvesting.
5. List three disvantage of building dams.
6. Why should we conserve forest and wild life.
7. What are the 5R's to save our affecting our environment.
8. How is burning of fossil fuels affecting our environmenr?
9. What are the uses coal and petroleum products?
10. Name the rivers with which following dams are associated :

    (a) Tehri Dam (b) Bhakra Dam

LONG ANSWER TYPE QUESTIONS

1. Write a short note on 'Chipko Adolan'.
2. (a) What is rain water harvesting?

    (b) What are the advantages of storing water in the ground?
3. Explain the four main stake holders in the management of forest resource.
4. (a) What is natural resource?

    (b) Why do we need to manage our natural resources?
5. List five methods that can be taken to conserve energy resources.
6. What is meant by inploitation of resources with short term aims? List its advantages.
7. State an instance where human intervention saved the forests from destruction.

Practice Paper-2021-22
Class-X
Science (086)

Time: 3 hours **Maximum Marks: 80**

General instructions:

(i) The question paper comprises four sections A,B,C and D. There are 36 questions in the question paper all questions are compulsory.

(ii) Section A- Question numbers 1 to 20 all questions and their parts are of one mark each. These questions contain multiple choice questions (MCQs), very short answer questions and assertion-reason type questions. Answers to these questions should be given in one word or one sentence.

(iii) Section B- Question numbers 21 to 26 are short answer type questions carrying 2 marks each. Answers to these questions should be in the range of 30 to 50 words.

(iv) Section C- Question numbers 27-33- are short answer type questions carrying 3 marks each. Answer to these questions should be in the range of 50 to 80 words.

(v) Section D- Question number 34 to 36 -are long answer type questions carrying 5 marks. Answer to these questions should be in the range of 80 to 120 words.

(vi) There is no overall choice .However, internal choices have been provided in some questions, a student has to attempt only one of the alternative in such questions.

(vii) Wherever necessary, neat and properly labelled diagrams should be drawn.

Section-A

1. How plaster of Paris is prepared from Gypsum?

OR

Define neutralisation reaction. 1

2. An element X is placed in group 14, What will be the formula and nature of bonding of its chloride? 1

3. Which of the following organism produces biogas from cow dung slurry in the biogas plant? 1

(a) aerobic bacteria (b) anaerobic bacteria

(c) protozoa (d) fungi

4. An ammeter is always connected in series across a circuit. What happens when it is connected in parallel with a circuit? 1

5. The refractive indices of glass and water are $\frac{3}{2}$ and $\frac{4}{3}$ respectively. In which medium will the speed of light be maximum? 1

6. Name any two forest products, each of which is the basis for some industry.

OR

Why must we conserve our forests? 1

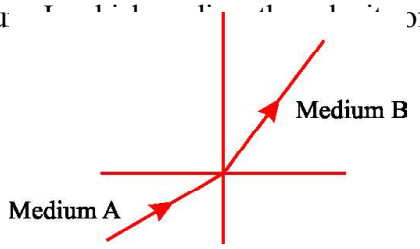
7. Name the physical quantities which are indicated by the direction of thumb and forefinger in the Fleming's right hand rule? 1

8. There are two solar cookers , one covered with plane glass and other kept open. Which of the two cooker would be more efficient and why? 1

9. The power of lens is -2D. What will be the focal length of the lens?

OR

A ray of light enters from medium A to medium B (going away from the normal) as shown in figu ... of light be more?



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10. What is the function of pancreas in digestion of food ? 1

11. Name the junction of two neurons.

OR

Name the two sets of nerves that constitute the peripheral nervous system. 1

12. Why coal is called a fossil fuel?

OR

Define recycling. Give one example also. 1

13. What are dominant genes? 1

For question number 14,15 and 16, two statements are given- one labeled Assertion (A) and the other labeled 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.

14. Attempt any one from 14(I) and 14(II).

(I) **Assertion(A) :** HC1, HNO_3, and H_2SO_4 show acidic characters in aqueous solutions

Reason (R) : H+ ions in aqueous solution are responsible for acidic character.

OR

(II) **Assertion(A) :** A solution "X" has more hydrogen ion concentration

Reason (R) : Solution X is a basic solution. 1

15. **Assertion(A) :** Lateral displacement is the distance between incident ray and the emergent ray.

Reason (R) : The wider the glass slab , the larger the lateral displacement.

16. **Assertion(A) :** Clones of sheep are carbon copy of each other except physical health

Reason(R) : It is a kind of genotypic variation.

Answer Q.No. 17-20 contain five (5) sub-parts each . You are expected to answer any FOUR sub-parts in these questions.

17. Read the following and answer any FOUR questions from 17 (i) to 17 (v)

The reproductive parts of angiosperms are located in the flower. You have already studied the different parts of a flower - sepals, petals, stamens and pistil. Stamens and pistil are the reproductive parts of a flower which contain the germ-cells. The flower may be unisexual ,when it contains either stamens or pistil or bisexual, when it contains both stamens and pistil.Stamen is male reproductive organ which produce pollen grains. Pistil is present in the centre of a flower and is the female reproductive part.. Pistil is present in the centre of a flower and is the female reproductive part. 1 x4

(i) A flower is unisexual if it has

(a) Stamen only (b) Pistil only

(c) Either Stamen or Pistil (d) Both Stamen and Pistil

(ii) The correct sequence of reproductive stages seen in flowering plants is

(a) seedling, zygote, embryo, gametes

(b) zygote, embryo, seedling, gametes

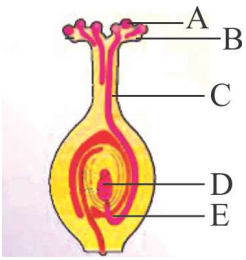
(c) gametes, zygote ,embryo, seedling

(d) embryo, gametes, zygote , seedling

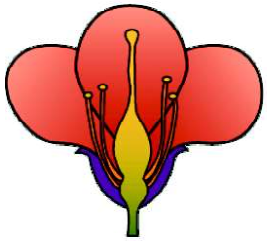
(iii) The diagram shows the cross section through the carpel of a flower just before fertilization.

Where will the male and female gamete be just before fertilization?

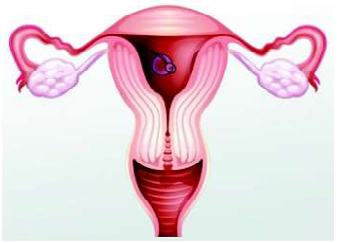
	Male gametes	Female gametes
(a)	A	D
(b)	C	E
(c)	D	E
(d)	E	D



(iv) Compare the given diagrams A and B and answer Pistil and Ovule of a flower resemble -



A



B

(a) Ovary and Oviduct

(b) Oviduct and Ovary .

(c) Ovule and Oviduct

(d) Ovary and Uterus

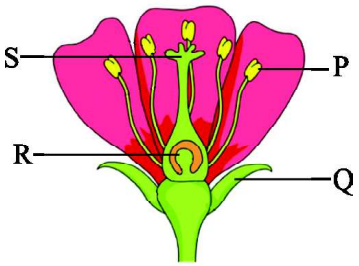
(v) In the given diagram , P,Q,R and S are

(a) Sepal, Stamen Ovary , Stigma

(b) Stamen , Sepal Ovary , Stigma

(c) Stigma ,Sepal, Stamen .Ovary

(d) Stigma ,Sepal, Stamen ,Ovary



18. Read the following and answer any FOUR questions from 18 (i) to 18 (v)

Alkanes are not very reactive hydrocarbons ; all alkanes are colourless and odourless non-polar compounds. Short carbon chains of alkanes are gaseous substances, moderate carbon chains are liquids and long carbon chains are solids. The differences in the physical states occurs because there is a direct relationship between the size and shape of molecules and the strength of the intermolecular forces (IMFs).

Boiling Points:

Given table describes some of the properties of the first 10 straight-chain alkanes. Because alkane molecules are nonpolar, they are insoluble in water, which is a polar solvent, but are soluble in nonpolar and slightly polar solvents. Consequently, alkanes themselves are commonly used as solvents for organic substances of low polarity, such as fats, oils, and waxes. Nearly all alkanes have densities less than 1.0 g/mL and are therefore less dense than water (the density of H_2O is 1.00 g/mL at 20°C). These properties explain why oil and grease do not mix with water but rather float on its surface.

Molecular name	**Formula**	**Melting Point (°C)**	**Boiling Point (°C)**	**Physical State (at 20°C)**
methane	CH_4	–182	–164	gas
ethane	C_2H_6	–183	–89	gas
propane	C_3H_8	–190	–42	gas
butane	C_4H_{10}	–138	–1	gas
pentane	C_5H_{12}	–130	36	liquid
hexane	C_6H_{14}	–95	69	liquid

The boiling points for the "straight chain" isomers and iso-alkanes isomers demonstrate that branching decreases the surfaces area, weakens the IMFs, and lowers the boiling point. The boiling points of the three isomers of C_5H_{12} are:

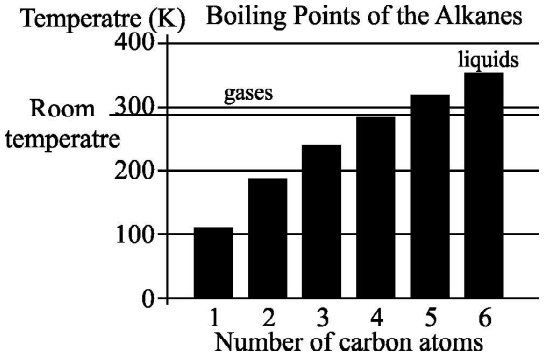
- pentane: 309.2 K
- 2-methylbutane: 301.0 K
- 2,2-dimethylpropane: 282.6 K

(i) The general formula of alkanes is

(a) C_nH_{2n} (b) C_nH_{2n+2}

(c) C_nH_{2n-i} (d) C_nH_{2n-2}

(ii) Look at the bar graph and then answer: The first four alkanes are -



(a) Solids (b) Liquids

(c) Gases (d) Plasma

(iii) Oil and grease do not mix with water but rather float on its surface because

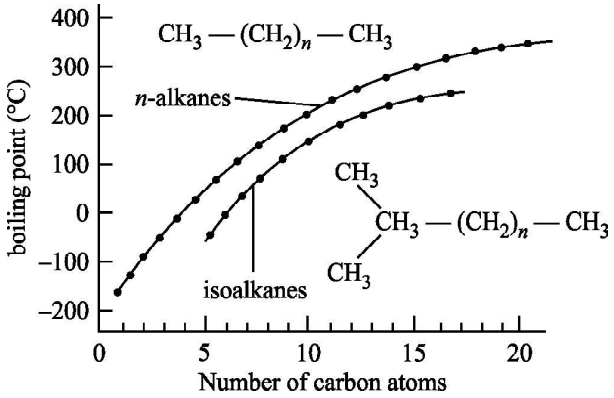
(a) all alkanes have densities more than 1.0 g/mL

(b) all alkanes have densities less than 1.0 g/mL

(c) all alkanes have densities equal to 1.0 g/mL

(d) all alkanes have densities less than 1.0 kg/mL

(iv) The iso-alkanes have lower boiling point than straight chain because-



(a) branching increases the surfaces area and strengthen the intermolecular force.

(b) branching increases the surfaces area and weakens the intermolecular force.

(c) branching decreases the surfaces area and weakens the intermolecular force.

(d) branching decreases the surfaces area and strengthen the intermolecular force.

(v) Pentane has

(a) 2 isomers (b) 3 isomers

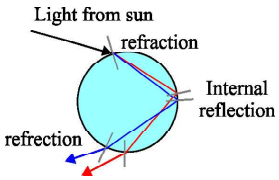
(c) 4 isomers (d) 5 isomers

19. Read the following and answer any FOUR questions from 19 (i) to 19 (v)

Light can be examined entirely from its source. When light passes from one medium to any other medium like air, a glass or water then a part of the light is absorbed by particles of the medium preceded (coming before) by its subsequent radiation in a particular direction. This phenomenon is termed as a scattering of light. The intensity of scattered light depends on the size of the particles and the wavelength of the light. Shorter wavelength and high frequency scatter more. Any light that gives a spectrum similar to that of sunlight is often referred to as white light. A rainbow is a natural spectrum appearing in the sky after a rain shower. It is caused by dispersion of sunlight by tiny water droplets, present in the atmosphere. A rainbow is always formed in a direction opposite to that of the Sun.

1x4

(i) Which natural phenomena is being shown here?



(a) Twinkling of stars

(b) Rainbow formation

(c) reddish appearance of the sun early in the morning

(d) blue colour of sky

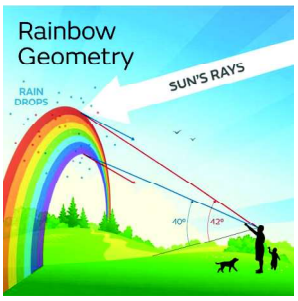
(ii) Which of the following conditions are necessary for this phenomenon?

(a) The Sun should be behind us.

(b) It should have rained and the Sun should be present.

(c) None of A and B

(d) Both A and B



(iii) What colour will be at no. 1 and 2-

(a) blue, red (b) blue, black

(c) violet, red (d) blue, violet

(iv) Dispersion of white light by the glass prism shows-

(a) Spectrum (b) Tyndall effect

(c) Twinkling of stars (d) Delayed sunset

(v) The phenomena which is/are responsible for such kind of formation are-

(a) Atmospheric refraction and Internal reflection

(b) Dispersion, and Internal reflection

(c) Refraction , Internal reflection and Dispersion

(d) Atmospheric refraction and reflection

20. Read the following and answer any four questions from 20 (i) to 20 (v)

The electrical energy (E) used can be reduced either by reducing the time of use or by reducing the power consumption of that appliance or fixture. This will not only reduce the cost, but it will also result in a reduced impact on the environment. Improvements to lighting are some of the fastest ways to reduce the electrical energy used in a home or business. About 20% of a home's use of energy goes to lighting, while the number for commercial establishments is closer to 40%. Fluorescent lights are about four times more efficient than incandescent lights-this is true for both the long tubes and the compact fluorescent lights (CFL). Thus, a 60-W incandescent bulb can be replaced by a 15-W CFL, which has the same brightness and color. CFLs have a bent tube inside a globe or a spiral-shaped tube, all connected to a standard screw-in base that fits standard incandescent light sockets. The heat transfer from these CFLs is less, and they last up to 10 times longer. 1×4

(i) Name a device which is a source of electrical energy

(a) battery (b) cell

(c) both cell and battery (d) none of the above

(ii) Energy supplied to the circuit by the source in time t

(a) P x t (b) Pxl

(c) I^2Rt (d) All the above

(iii) 60W incandescent bulb which has the same brightness and color can be replaced by a

(a) 60-W CFL (b) 15-W CFL

(c) 10-WCFL (d) 5-W CFL.

(iv) Heat produced in a resistor

(a) directly proportional to the square of current.

(b) directly proportional to the square of resistance

(c) directly proportional to the square of potential difference across the resistor.

(d) All the above

v. CFLs are better than traditional bulbs because,

(a) CFLs use less electricity than traditional lighLhulbs

(b) they reduce demand for electricity

(c) emissions of less greenhouse gas

(d) All the above

Section-B

21. If we touch a thorn accidently ,we move our hand away at once. What is the type of this response. Give its brief explanation.

OR

Which type of signals will get disrupted in case of spinal cord injury? 2

22. Justify the statement "Why is fertilization not possible without pollination?"* 2

23. How can ethanol and ethanoic acid be differentiated on the basis of their physical and chemical properties?

OR

Explain the nature of the covalent bond using the bond formation in CH_3CI. 2

24. Arrange the metals involved in the given reactions in increasing order of reactivity. Give reason for your answer. 2

(a) $Zn + CuS0_4 \longrightarrow ZnSO_4 + Cu$

(b) $Cu + Ag(N0_3)_2 \longrightarrow Cu(NO_3)_2 + Ag$

(c) $Zn + FeSO_4 \longrightarrow ZnSO_4 + Fe$

(d) $Fe + CuSO_4 \longrightarrow FeS0_4 + Cu$

25. Make a diagram to show how hypermetropia is corrected. The near point of a hypermetropic eye is lm. What is the power of the lens required to correct this defect? 2

26. State the different ways ,three resistors each having resistance 'r' Ω can be connected so that they will draw maximum and minimum current from the circuit. Give reason to your answer. 2

Section-C

27. If a trait A exists in 10% of a population of an asexually reproducing species and a trait B exists in 60% of the same population, which trait is likely to have arisen earlier?

OR

Will geographical isolation be a major factor in the speciation of an organism that reproduces asexually? Why or why not? 3

28. What is biological magnification? Will the levels of this magnification be different at different levels of the ecosystem? 3

29. Name two organs which shows dual function as exocrine and endocrine gland . Name the hormones secreted by them and their functions also. 3

30. Which gas is usually liberated when an acid reacts with a metal ? Illustrate with an example. How will you test for the presence of this gas? 3

31. Two elements P and Q belong to the 3rd period of the modern periodic table and are in Group-1 and Group -2 respectively. Compare their following characteristics in tabular form 3

    (i) The number of electrons in their atoms
    (ii) The size of their atoms
    (iii) The metallic characters
    (iv) Their tendencies to loose electrons
    (v) The formula of their oxides
    (vi) The formula of their halides

32. a. Explain the formation of Sodium chloride with the help of electron dot structure. (At. number : Na = 11 ;C1= 17)

    b. Draw a labelled diagram for electrolytic refining of copper metal.

33. The values of absolute refractive indices of different material mediums are given.Study the table and answer the questions that follow.

Material medium	Refractive index	Material medium	Refractive index
Air	1.0003	Canada Balsam	1.53
Ice	1.31	-------	-------
Water	1.33	Rock salt	1.54
Alcohol	1.36	-------	-------
Kerosene	1.44	Carbon disulphide	1.63
Fused quartz	1.46	Dense flint glass	1.65
Turpentine oil	1.47	Ruby	1.71
Benzene	1.5	Sapphire	1.77
Crown glass	1.52	Diamond	2.42

a. Name the medium having highest optical density.

b. Name the medium with lowest optical density.

c. You are given kerosene, turpentine and water. In which of these will the speed of light be maximum?

Section-D

31. (a) Can we place Silver nitrate solution in an iron bottle ?Why or why not ?

(b) Can oxidation or reduction take place alone? Justify your answer.

(c) Identify the substance oxidised and substance reduced in the given reaction.

$$ZnO_{(S)} + C_{(S)} \longrightarrow Zn_{(S)} + CO_{(g)}$$

OR

(a) Why is it essential to balance a chemical reaction?

(b) Why does milky colour disappear when carbon dioxide is passed through lime water in excess?

(c) Why cannot a chemical change be reversed?

35. (a) What is transpiration? Write its importance .

(b) Write two differences between xylem and phloem (One difference from their structures and second difference from their functions .)

(c) Draw a labelled diagram of the part of plant which helps in exchange of gases.

OR

(a) What advantage over an aquatic organism does a terrestrial organism have with regard to obtaining oxyge? for respiration?

(b) How is haemoglobin associated with respiration ? explain it.

(c) Veins and arteries carry blood .Which of these carry blood?

(i) Away from the heart.

(ii) Back to the heart.

36. (a) A coil of insulated copper wire is connected to a galvanometer. What will happen if a bar magnet is-

(i) pushed into the coil,

(ii) withdrawn from inside the coil

(iii) held stationary inside the coil?

(b) Draw a labelled diagram of an electric motor. Explain its principle and working. What is the function of a split ring in an electric motor?

Sample Question Paper (TERM-I) 2021-22

Class X

Science (086)

Time: 90 Minutes

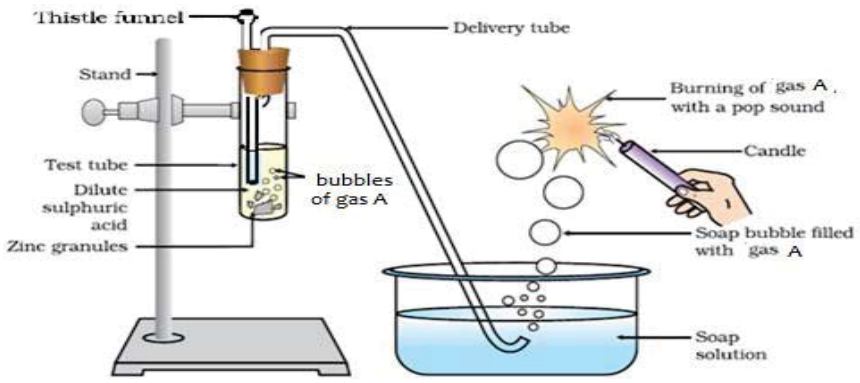
General Instructions:

1. The Question Paper contains three sections.
2. Section A has 24 questions. Attempt any 20 questions.
3. Section B has 24 questions. Attempt any 20 questions.
4. Section C has 12 questions. Attempt any 10 questions.
5. All questions carry equal marks.
6. There is no negative marking.

SECTION - A

Section – A consists of 24 questions. Attempt any 20 questions from this section.

The first attempted 20 questions would be evaluated.

1.	Reema took 5ml of Lead Nitrate solution in a beaker and added approximately 4ml of Potassium Iodide solution to it. What would she observe? A. The solution turned red. B. Yellow precipitate was formed. C. White precipitate was formed. D. The reaction mixture became hot.
2.	Identify gas A in the following experiment. 

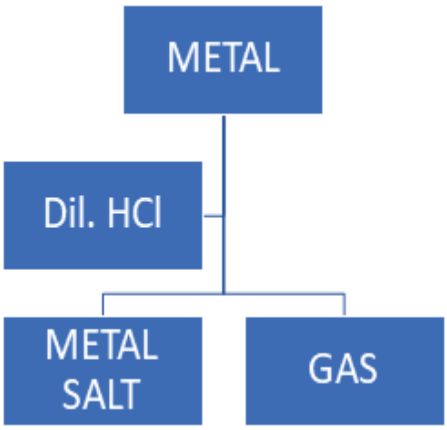
A. Nitrogen

B. Hydrogen

C. Oxygen

D. Carbon dioxide

3.



Which of the following two combinations are correct?

	Metal	Gas Evolved
(i)	Copper	Yes
(ii)	Iron	Yes
(iii)	Magnesium	No
(iv)	Zinc	Yes

A. i and iii

B. i and iv

C. ii and iii

D. ii and iv

4. Which of the following correctly represents a balanced chemical equation?

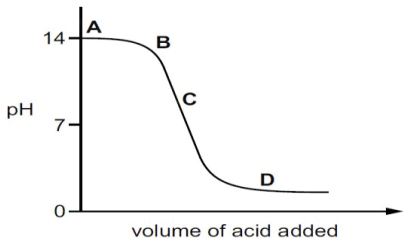
A. $Fe(s) + 4H_2O(g) \rightarrow Fe_3O_4(s) + 4H_2(g)$

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

C. $3Fe(s) + H_2O(g) \rightarrow Fe_3O_4(s) + H_2(g)$

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

5. The graph given below depicts a neutralization reaction (acid + alkali → salt + water). The pH of a solution changes as we add excess of acid to an alkali.



Which letter denotes the area of the graph where both acid and salt are present?

A. A
B. B
C. C
D. D

6. In the reaction of iron with copper sulphate solution:

$CuSO_4 + Fe \text{ ---> } Cu + FeSO_4$

Which option in the given table correctly represents the *substance oxidised* and the *reducing agent?*

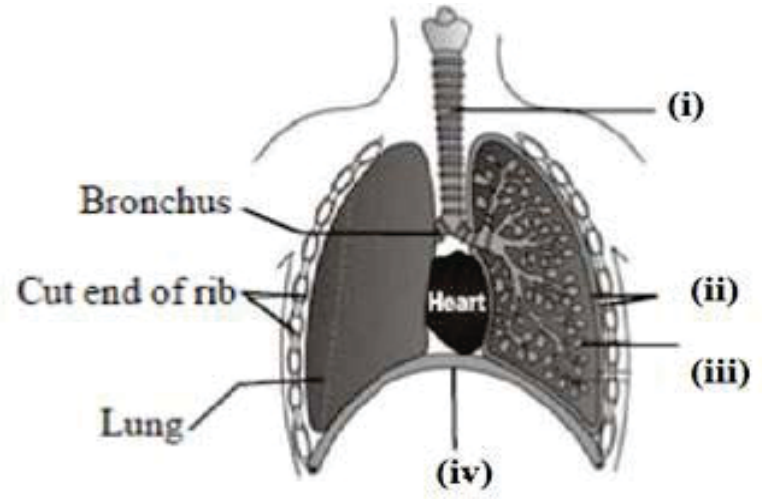
OPTION	Substance Oxidized	Reducing Agent
A	Fe	Fe
B	Fe	$FeSO_4$
C	Cu	Fe
D	$CuSO_4$	Fe

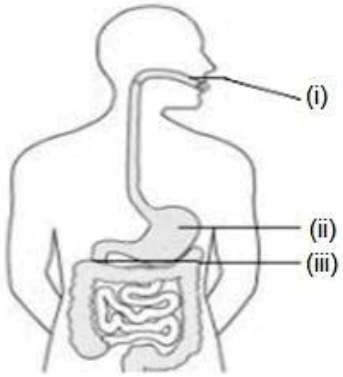
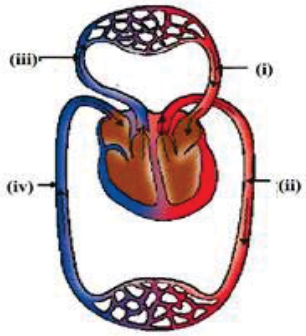
7. The chemical reaction between copper and oxygen can be categorized as:

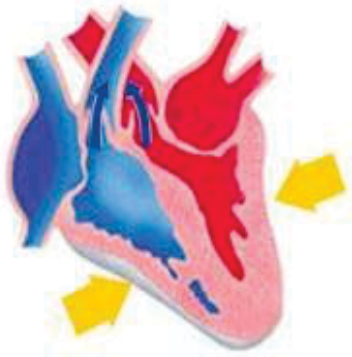
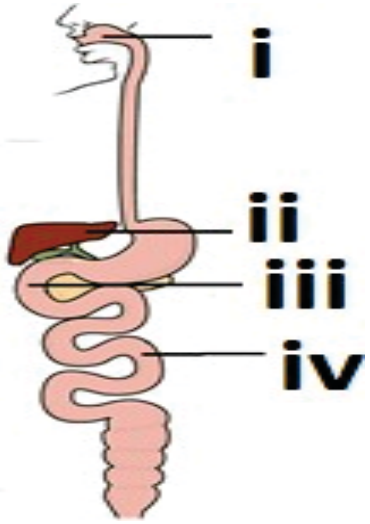
A. Displacement reaction
B. Decomposition reaction
C. Combination reaction
D. Double displacement reaction

8. Which of the given options correctly represents the*Parent acid* and *base* of Calcium Carbonate?

OPTION	PARENT ACID	PARENT BASE
A	HCl	NaOH
B	H_2CO_3	$Ca(OH)_2$
C	H_3PO_3	$CaSO_4$
D	H_2SO_4	$CaSO_4$

9.	How will you protect yourself from the heat generated while diluting a concentrated acid? A. By adding acid to water with constant stirring. B. By adding water to acid with constant stirring. C. By adding water to acid followed by base. D. By adding base to acid with constant stirring.
10.	Why is it important to balance a skeletal chemical equation? A. To verify law of conservation of energy. B. To verify the law of constant proportion. C. To verify the law of conservation of mass. D. To verify the l0aw of conservation of momentum.
11.	Carefully study the diagram of the human respiratory system with labels A, B, C and D. Select the option which gives correct identification and main function and /or characteristic.  A. (i) Trachea: It is supported by bony rings for conducting inspired air. B. (ii) Ribs: When we breathe out, ribs are lifted. C. (iii) Alveoli: Thin-walled sac like structures for exchange of gases. D. (iv) Diaphragm: It is pulled up when we breathe in.

12.	Identify the option that indicates the correct enzyme that is secreted in location A, B and C.  A. (i)-lipase, (ii)-trypsin, (iii)-pepsin B. (i)-amylase, (ii)-pepsin, (iii)-trypsin C. (i)-trypsin, (ii)-amylase, (iii)-carboxylase D. (i)-permease, (ii)-carboxylase, (iii)-oxidase
13.	Opening and closing of stomatal pore depends on: A. Atmospheric temperature B. oxygen concentration around stomata C. carbon dioxide concentration around stomata D. water content in the guard cells
14.	The figure given below shows a schematic plan of blood circulation in humans with labels (i) to (iv). Identify the correct label with its functions?  A. (i) Pulmonary vein - takes impure blood from body part. B. (ii) Pulmonary artery - takes blood from lung to heart. C. (iii) Aorta - takes blood from heart to body parts. D. (iv) Vena cava takes - blood from body parts to right auricle.

15.	Identify the phase of circulation which is represented in the diagram of heart given below. Arrows indicate contraction of the chambers shown.  A. Blood transferred to the right ventricle and left ventricle simultaneously. B. Blood is transferred to lungs for oxygenation and is pumped into various organs simultaneously. C. Blood transferred to the right auricle and left auricle simultaneously. D. Blood is received from lungs after oxygenation and is received from various organs of the body.
16.	Observe the diagram of Human digestive system.  Match the labeling referred in column I and correlate with the function in column II.

Column I	Column II
i.	a. The length of this depends on food the organism eats.
ii.	b. Initial phase of starch digestion
iii.	c. Increases the efficiency of lipase enzyme action
iv.	d. This is the site of the complete digestion of carbohydrates, proteins and fats.

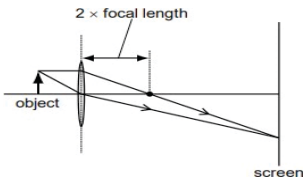
A. i.- a) ; ii – b) ; iii – c) ; iv- d)
B. i.- b) ; ii – c) ; iii – d) ; iv- a)
C. i.- b) ; ii – d) ; iii – c) ; iv- a)
D. i.- d) ; ii – a) ; iii – b) ; iv- c)

17. Which of the following mirror is used by a dentist to examine a small cavity in a patient's teeth?

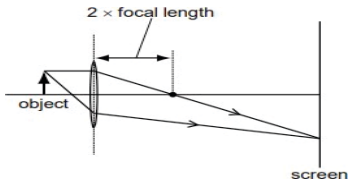
A. Convex mirror
B. Plane mirror
C. Concave mirror
D. Any spherical mirror

18. Which diagram shows image formation of an object on a screen by a converging lens?

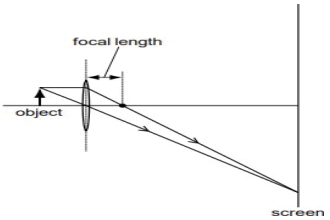
A.



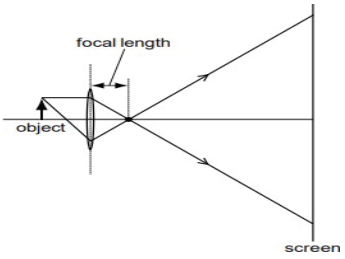
B.

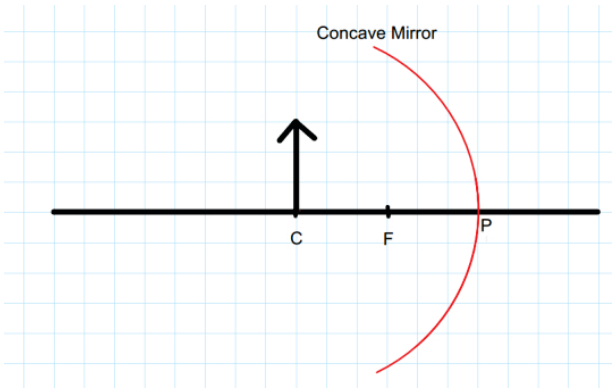


C.

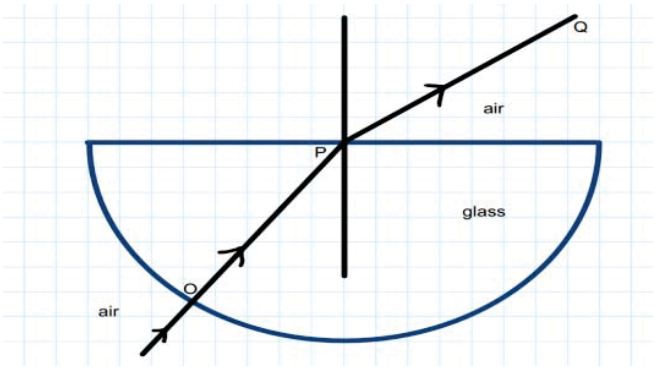


D.



19	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 others. D. Concave mirror as well as concave lens.
20.	Consider these indices of refraction: glass: 1.52; air: 1.0003; water: 1.333. Based on the refractive indices of three materials, arrange the speed of light through them in decreasing order. A. The speed of light in water > the speed of light in air > the speed of light in glass. B. The speed of light in glass > the speed of light in water > the speed of light in air. C. The speed of light in air > the speed of light in water > the speed of light in glass. D. The speed of light in glass > the speed of light in air > the speed of light in water.
21.	If a beam of red light and a beam of violet light are incident at the same angle on the inclined surface of a prism from air medium and produce angles of refraction r and v respectively, which of the following is correct? A. r = v B. r > v C. r = 1/v D. r < v
22.	 Examine the above figure and state which of the following option is correct? [one small box in the figure is equal to 1 cm] A. The mirror has a focal length of -6 cm and will produce an image of magnification +1. B. The mirror has a focal length of -3 cm and will produce an image of magnification -1. C. The mirror has a focal length of -3 cm and will produce an image of magnification +1. D. The mirror has a focal length of -6 cm and will produce an image of magnification -1.

23.



The angle of incidence from air to glass at the point O on the hemispherical glass slab is.

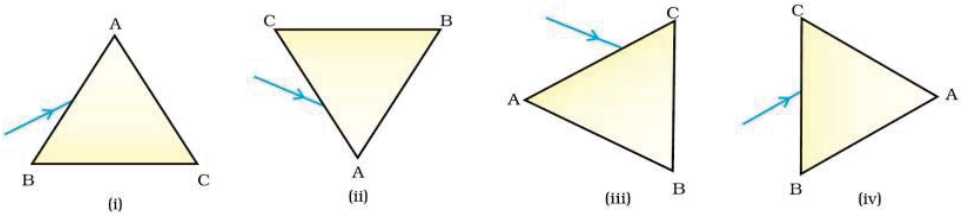
A. 45°

B. 0°

C. 90°

D. 180°

24. A prism ABC (with BC as base) is placed in different orientations. A narrow beam of white light is incident on the prism as shown in below Figure. In which of the following diagrams, after dispersion, the third colour from the top of the spectrum corresponds to the colour of the sky?



A. (i)

B. (ii)

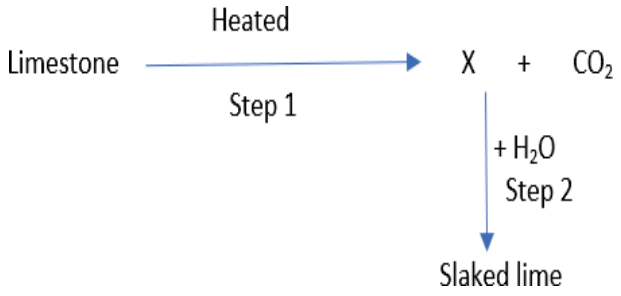
C. (iii)

D. (iv)

SECTION - B

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

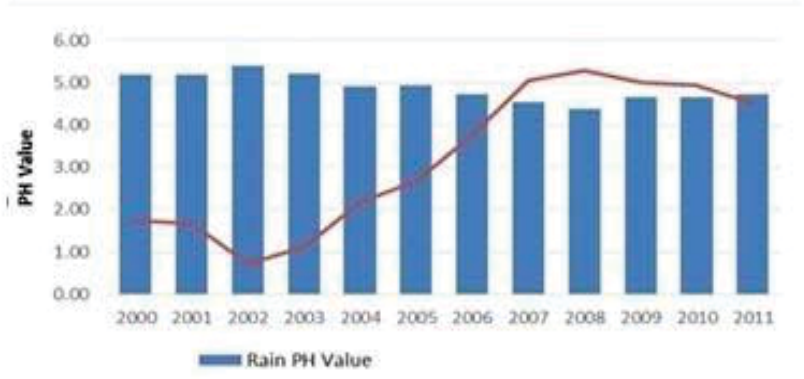
25.



Identify the correct option from the given table which represents the type of reactions occurring in step 1 and step 2.

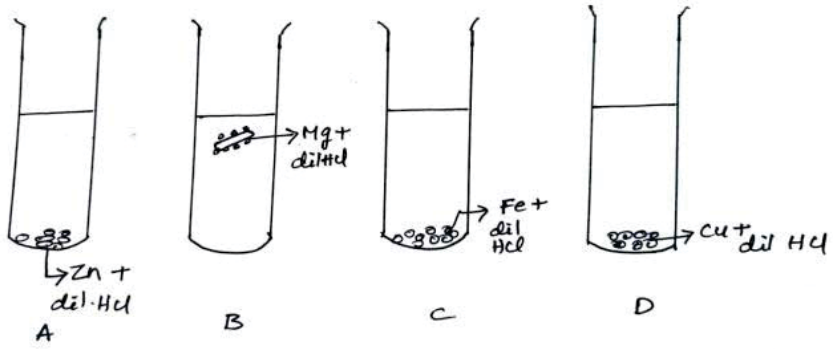
	endothermic	exothermic
A	×	✓
B	✓	×
C	✓	✓
D	×	×

26. In which year is concentration of hydrogen ion the highest?



A. 2002
B. 2008
C. 2011
D. 2005

27. The diagram shows the reaction between metal and dil. acid.



What is the reason for different behaviour of Mg in test tube B?

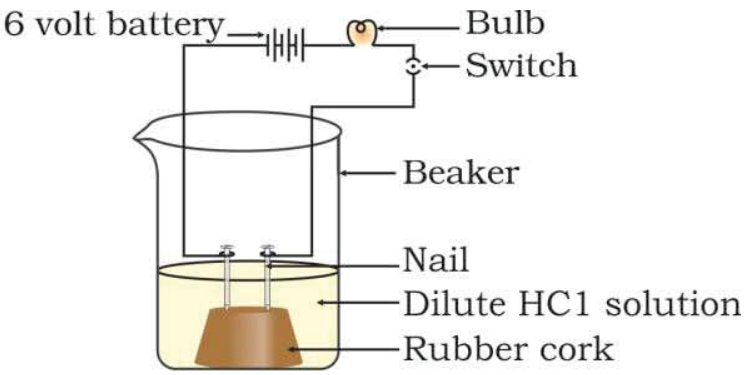
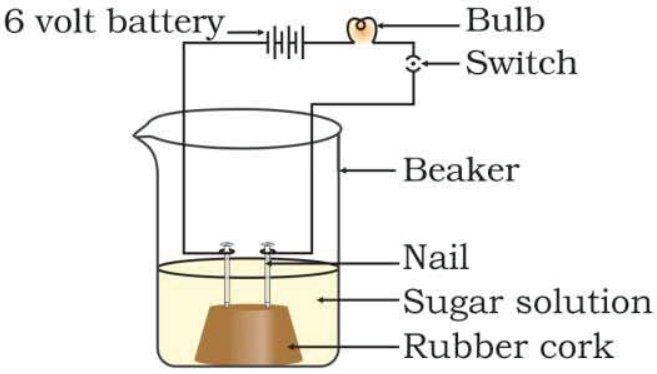
A. Mg is lighter element than dil. HCl
B. Mg reacts with dil. HCl to produce H_2 gas which helps in floating
C. Mg reacts with dil. HCl to produce N_2 gas which helps in floating
D. Mg reacts with dil. HCl to produce CO_2 gas which helps in floating

28. The table shown below gives information about four substances: A, B, C and D.

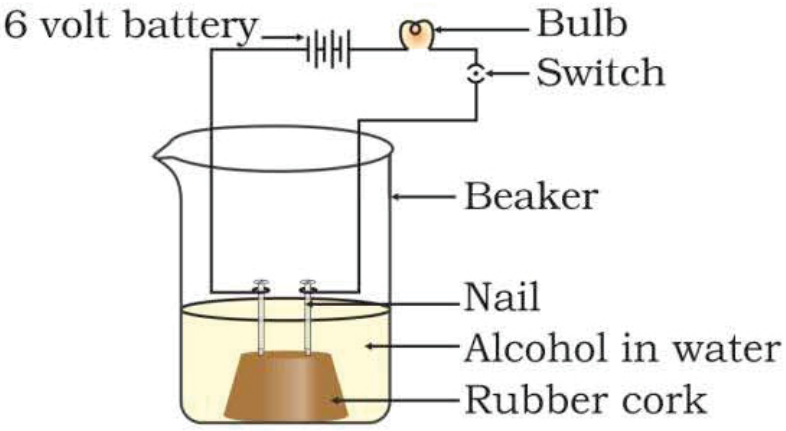
SUBSTANCE	MELTING POINT (K)	ELECTRICAL CONDUCTIVITY	
		SOLID	LIQUID/ AQUEOUS
A	295	Good	Good
B	1210	Poor	Good
C	1890	Poor	Good
D	1160	Poor	Poor

Identify Ionic compounds from the above given substances.

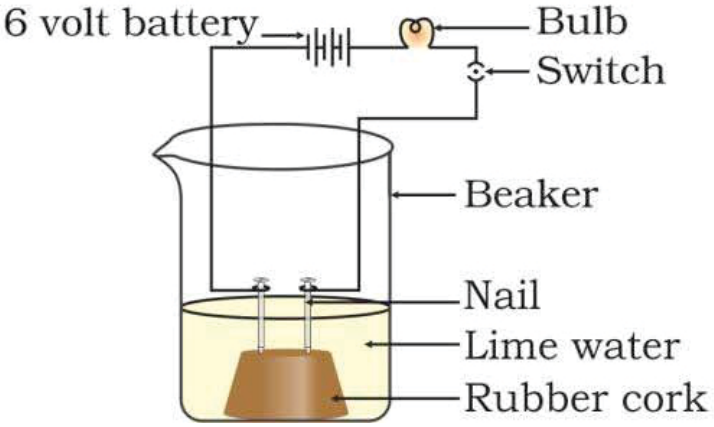
A. A, B
B. B, C
C. A, B, D
D. A, C, D

29.	Vinay observed that the stain of curry on a white shirt becomes reddish-brown when soap is scrubbed on it, but it turns yellow again when the shirt is washed with plenty of water. What might be the reason for his observation? i. Soap is acidic in nature ii. Soap is basic in nature iii. Turmeric is a natural indicator which gives reddish tinge in bases iv. Turmeric is a natural indicator which gives reddish tinge in acids A. i and ii B. ii and iii C. i and iv D. ii and iv
30.	In which of the following setups would the bulb glow?
	(i)  (ii) 

(iii)



(iv)



A. i and ii
B. i and iv
C. ii, iii and iv
D. i, ii and iv

Question No. 31 to 35 consist 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 and 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:** Fresh milk in which baking soda is added, takes a longer time to set as curd.
Reason: Baking soda decreases the pH value of fresh milk to below 6.

32. **Assertion:** Decomposition of vegetable matter into compost is an endothermic reaction.
Reason: Decomposition reaction involves breakdown of a single reactant into simpler products.

33. **Assertion:** Resins and gums are stored in old xylem tissue in plants.
Reason: Resins and gums facilitate transport of water molecules.

34. **Assertion**: Sky appears blue in the day time.
Reason: White light is composed of seven colours.

35. The table given below shows the reaction of a few elements with acids and bases to evolve Hydrogen gas.

Element	Acid	Base
A	×	×
B	✓	✓
C	✓	×
D	✓	✓

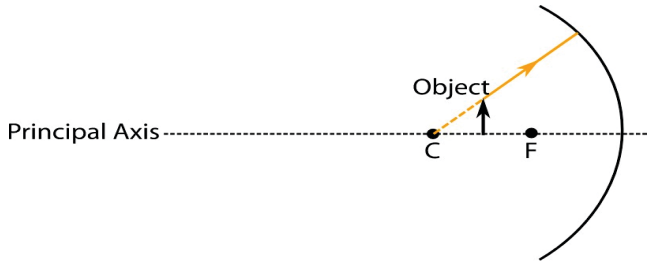
Which of these elements form amphoteric oxides?

A. A and D
B. B and D
C. A and C
D. B and D

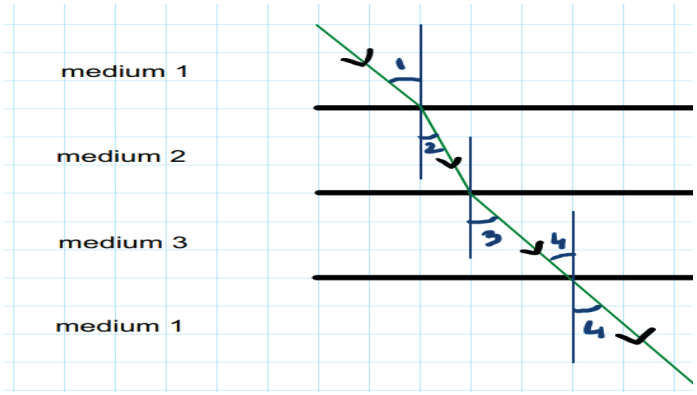
36. In which of the following groups of organisms, blood flows through the heart only once during one cycle of passage through the body?

A. Rabbit, Parrot, Turtle
B. Frog, crocodile, Pigeon
C. Whale, Labeo, Penguin
D. Shark, dog fish, sting ray

37.	What is common between extensive network of blood vessels around walls of alveoli and in glomerulus of nephron? A. Thick walled arteries richly supplied with blood B. Thin walled veins poorly supplied with blood C. Thick walled capillaries poorly supplied with blood. D. Thin walled capillaries richly supplied with blood
38.	Plants use completely different process for excretion as compared to animals. Which one of the following processes is **NOT** followed by plants for excretion? A. They can get rid of excess water by transpiration. B. They selectively filter toxic substances through their leaves. C. Waste products are stored as resins and gums in old xylem. D. They excrete waste substances into the soil around them.
39.	If the power of a lens is - 4.0 D, then it means that the lens is a A. concave lens of focal length -50 m B. convex lens of focal length +50 cm C. concave lens of focal length -25 cm D. convex lens of focal length -25 m
40.	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. 30 cm in front of the mirror B. 15 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
41.	In which of the following groups of organisms, food material is broken down outside the body and then absorbed in? A. mushroom, green plants, amoeba B. yeast, mushroom, bread mould C. paramecium, amoeba, cuscuta D. cuscuta, lice, tapeworm
42.	In a person the tubule part of the nephron is not functioning at all. What will its effect be on urine formation? A. The urine will not be formed. B. Quality and quantity of urine is unaffected. C. Urine is more concentrated. D. Urine is more diluted.
43.	If the real image of a candle flame formed by a lens is three times the size of the flame and the distance between lens and image is 80 cm, at what distance should the candle

	be placed from the lens? A. -80cm B. -40 cm C. -40/3 cm D. -80/3 cm
44.	 While looking at the above diagram, Nalini concluded the following- i. the image of the object will be a virtual one. ii. the reflected ray will travel along the same path as the incident ray but in opposite direction. iii. the image of the object will be inverted. iv. this is a concave mirror and hence the focal length will be negative. Which one of the above statements are **correct**? A. i and ii B. i and iii C. ii, iii and iv D. i, ii, iii and iv

45.



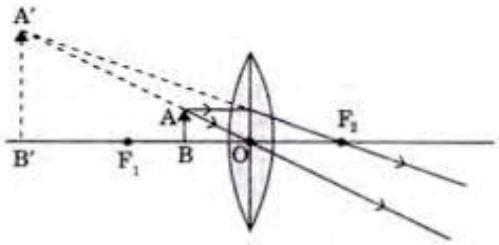
In the above diagram light is travelling through different media. It is noted by a scientist that ∠1= ∠3= ∠4 but ∠2 <∠1. Which of the following statement would be correct?

A. Medium 1 is the denser than medium 3 but it's density is equal to medium 2.
B. Medium 2 is the rarest medium.
C. Medium 3 is denser than medium 1.
D. Medium 1 and 3 are essentially the same medium, but medium 2 is denser than 1 and 3.

46. The refractive index of flint glass is 1.65 and that for alcohol is 1.36 with respect to air. What is the refractive index of the flint glass with respect to alcohol ?

A. 0.82
B. 1.21
C. 1.11
D. 1.01

47.



The above lens has a focal length of 10 cm. The object of height 2 mm is placed at a distance of 5 cm from the pole. Find the height of the image.

A. 4 cm
B. 6.67 mm
C. 4 mm
D. 3.33 mm

48. A cable manufacturing unit tested few elements on the basis of their physical properties.

Properties	W	X	Y	Z
Malleable	Yes	No	No	Yes
Ductile	Yes	No	No	Yes
Electrical conductivity	Yes	Yes	Yes	No
Melting Point	High	Low	Low	High

Which of the above elements were dicarded for usage by the company?

A. W, X, Y
B. X, Y, Z
C. W, X, Z
D. W, X, Z

SECTION – C

Section- C consists of three Cases followed by questions. There are a total of 12 questions in this section. Attempt any 10 questions from this section.

The first attempted 10 questions would be evaluated.

Case **The Salt Story**

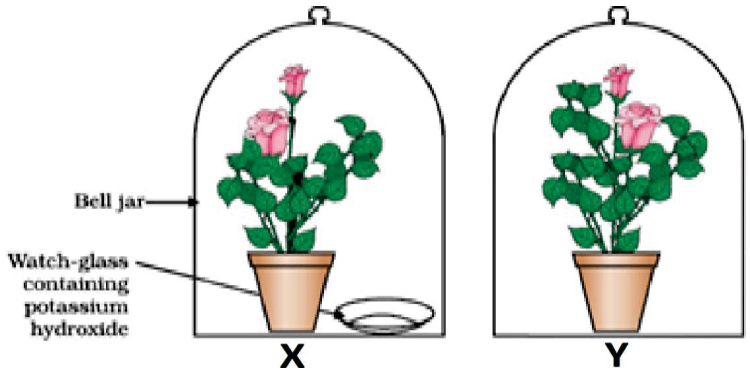
From: The New Indian Express 9 March 2021

The salt pans in Marakkanam, a port town about 120 km from Chennai are the third largest producer of salt in Tamil Nadu. Separation of salt from water is a laborious process and the salt obtained is used as raw materials for manufacture of various sodium compounds.

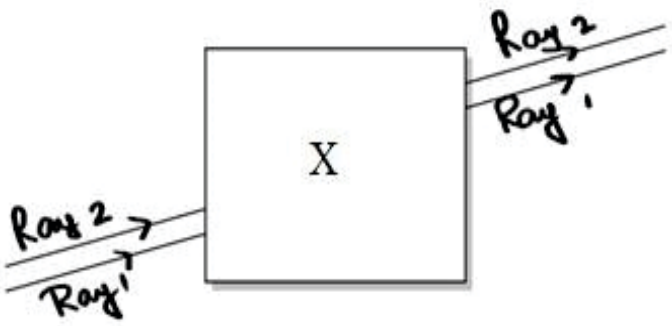
One such compound is Sodium hydrogen carbonate, used in baking, as an antacid and in soda acid fire extinguishers.

The table shows the mass of various compounds obtained when 1litre of sea water is evaporated

COMPOUND	FORMULA	MASS OF SOLID PRESENT /g
Sodium Chloride	NaCl	28.0
Magnesium Chloride	$MgCl_2$	8.0
Magnesium Sulphate	$MgSO_4$	6.0
Calcium Sulphate	$CaSO_4$	2.0
Calcium Carbonate	$CaCO_3$	1.0
TOTAL AMOUNT OF SALT OBTAINED		45.0

49.	Which compound in the table reacts with acids to release carbon dioxide? A. NaCl B. $CaSO_4$ C. $CaCO_3$ D. $MgSO_4$
50.	How many grams of Magnesium Sulphate are present in 135g of solid left by evaporation of sea water? A. 6g B. 12g C. 18g D. 24g
51.	What is the saturated solution of Sodium Chloride called? A. Brine B. Lime water C. Slaked lime D. Soda water
52.	What is the pH of the acid which is used in the formation of common salt? A. Between 1 to 3 B. Between 6 to 8 C. Between 8 to 10 D. Between 11 to 13
Case	The Figure shown below represents an activity to prove the requirements for photosynthesis. During this activity, two healthy potted plants were kept in the dark for 72 hours. After 72 hours, KOH is kept in the watch glass in setup X and not in setup Y. Both these setups are air tight and have been kept in light for 6 hours. Then, Iodine Test is performed with one leaf from each of the two plants X and Y. 

53.	This experimental set up is used to prove essentiality of which of the following requirements of photosynthesis? A. Chlorophyll B. Oxygen C. Carbon dioxide D. Sunlight
54.	The function of KOH is to absorb A. Oxygen. B. Carbon dioxide. C. Moisture. D. Sunlight.
55.	Which of the following statements shows the correct results of Iodine Test performed on the leaf from plant X and Y respectively? A. Blue - black colour would be obtained on the leaf of plant Xand no change in colour on leaf of plant Y. B. Blue - black colour would be obtained on the leaf of plant Y and no change in colour onleaf of plant X. C. Red colour would be obtained on the leaf of plant X and brown colour on the leaf of plant Y. D. Red colour would be obtained on the leaf of plant Y and brown colour on the leaf of plant X.
56.	Which of the following steps can be followed for making the apparatus air tight? i. placing the plants on glass plate ii. using a suction pump. iii. applying aseline to seal the bottom of jar. iv. creating vacuum A. i and ii B. ii. and iii C. i. and iii D. ii. and iv
Case	Noor, a young student, was trying to demonstrate some properties of light in her Science project work. She kept 'X' inside the box (as shown in the figure) and with the help of a laser pointer made light rays pass through the holes on one side of the box. She had a small butter-paper screen to see the spots of light being cast as they emerged.

	
57.	What could be the 'X' that she placed inside the box to make the rays behave as shown? A. a converging lens B. a parallel-sided glass block C. a plane mirror D. a triangular prism
58.	She measured the angles of incidence for both the rays on the left side of the box to be 48.6^0. She knew the refractive index of the material 'X' inside the box was 1.5. What will be the approximate value of angle of refraction? A. 45^0 B. 40^0 C. 30^0 D. 60^0 (use the value: sin $48.6^0 \approx 0.75$)
59.	Her friend noted the following observations from this demonstration: i. Glass is optically rarer than air. ii. Air and glass allow light to pass through them with the same velocity. iii. Air is optically rarer than glass. iv. Speed of light through a denser medium is faster than that of a rarer medium. v. The ratio: sin of angle of incidence in the first medium to the ratio of sin of angle of refraction in the second medium, gives the refractive index of the second material with respect to the first one. Which one of the combination of the above statements given below is correct. A. ii, iv and v are correct. B. iii and iv are correct. C. i, iv and v are correct. D. iii and v are correct.

60	If the object inside the box was made of a material with a refractive index less than 1.5 then the A. lateral shift of the rays would have been less. B. lateral shift of the rays would have been more. C. lateral shift of the rays would remain the same as before. D. there is not enough information to comment on any of the above statements

***

<table>
<tr><th colspan="2">Questions in lieu of diagram based questions for VI candidates
Total Alternative Questions – 26</th></tr>
<tr><th colspan="2">Section – A</th></tr>
<tr><td>2.</td><td>A gas is evolved when Dil. Sulphuric Acid reacts with Zinc granules. It gives a pop sound when lit match stick is introduced near it. Identify the gas?
A. Nitrogen
B. Hydrogen
C. Oxygen
D. Carbon dioxide</td></tr>
<tr><td>3.</td><td>Metal X reacts with Dil. HCl to form Metal Salt and Gas. Identify X?
A. Copper
B. Mercury
C. Silver
D. Zinc</td></tr>
<tr><td>5.</td><td>In the neutralization reaction when excess of acid is added to an alkali, salt and water are produced. What is the nature of the solution after the reaction occurs?
A. Amphoteric
B. Acidic
C. Basic
D. Neutral</td></tr>
<tr><td>11</td><td>Select the option which gives correct function and /or characteristic: of the four parts of human respiratory system.
A. Alveoli: Thin-walled sac like structures for exchange of gases.
B. Diaphragm: It is pulled up when we breathe in.
C. Trachea: It is supported by bony rings for conducting inspired air.
D. Ribs: When we breathe out, ribs are lifted.</td></tr>
<tr><td>12</td><td>Identify the option that indicates the correct enzyme that is secreted in location L, M and N.L, M and N represent Mouth cavity, stomach and small intestine of the human being.
<table>
<tr><td></td><td>L</td><td>M</td><td>N</td></tr>
<tr><td>A</td><td>lipase</td><td>trypsin</td><td>pepsin</td></tr>
<tr><td>B</td><td>amylase</td><td>pepsin</td><td>trypsin</td></tr>
<tr><td>C</td><td>trypsin</td><td>amylase</td><td>lipase</td></tr>
<tr><td>D</td><td>lipase</td><td>amylase</td><td>pepsin</td></tr>
</table></td></tr>
<tr><td>14</td><td>Given below are the functions of some parts of human circulatory system. Identify the correct match.
A. Pulmonary vein – takes oxygenated blood from body partsto heart
B. Artery – takes oxygenated blood from heart to lung
C. Dorsal aorta – takes deoxygenated blood from heart to body parts
D. Vena cava – takes deoxygenated blood from body parts to right atrium</td></tr>
</table>

<table>
<tr><td>15</td><td>What happens when right and left ventricle contract during pumping of blood by human heart?
A. Blood transferred to the right ventricle and left ventricle simultaneously.
B. Blood is transferred to lungs for oxygenation and is pumped into various organs simultaneously.
C. Blood transferred to the right atrium and left atrium simultaneously.
D. Blood is received from lungs after oxygenation and is received from various organs of the body.</td></tr>
<tr><td>16</td><td>i, ii, iii and iv represent mouth cavity, liver, first part of small intestine and complete small intestine respectively of Human digestive system.
Match the labeling referred in column I and correlate with the function in column II.
<table>
<tr><th>Column I</th><th>Column II</th></tr>
<tr><td>i</td><td>a. The length of this depends of food the organism eats.</td></tr>
<tr><td>ii</td><td>b. Initial phase of starch digestion.</td></tr>
<tr><td>iii</td><td>c. Increase the efficiency of lipase enzyme action.</td></tr>
<tr><td>iv</td><td>d. This is the site of the complete digestion of carbohydrates, proteins and fats.</td></tr>
</table>
A. i.- c ; ii – d ; iii – a ; iv- d
B. i.- b ; ii – c ; iii – d ; iv- a
C. i.- a ; ii – c ; iii – d ; iv- c
D. i.- d ; ii – a ; iii – b ; iv- c</td></tr>
<tr><td>18</td><td>If a virtual, erect and enlarged image is formed by a lens, then which of the following options are correct?
A. It is a concave lens and the object is placed between pole and focus.
B. It is a convex lens and the object is placed between focus and centre of curvature.
C. It is a convex lens and the object is placed between pole and focus.
D. It is a concave lens and the object is placed between focus and centre of curvature.</td></tr>
<tr><td>22</td><td>Consider the situation where:
• An object is 3 cm (height)
• Mirror is concave with 6 cm focal length.
• Object is placed at the centre of curvature.
Which of the following options are correct?
A. The mirror will produce an image of magnification +1.5.
B. The mirror will produce an image of magnification -1.
C. The mirror will produce an image of magnification +1.
D. The mirror will produce an image of magnification -1.5.</td></tr>
</table>

23	If a ray passes from air to glass in a spherical glass slab and passes through the centre of the slab without deviation, then the angle of incidence from air to glass at the point on the glass slab is. A. 45° B. 0° C. 90° D. 180°
24	Out of all colours making the white light, which one will deviate the most while it passes through a prism? A. Red. B. Violet. C. Blue. D. Green.
	Section - B
26.	*Even though rain water is the purest form of water, it acts as an electrolyte. However, distilled water cannot be an electrolyte.* The reason for this is A. rain water consists of dissolved oxygen B. rain water consists of dissolved oxides of sulphur C. rain water consists of dissolved Nitrogen D. rain water consists of dissolved oxides of Hydrogen
27.	The reason for different behaviour (floating) of Mg in dil HCl is due to: A. Mg is lighter element than dil. HCl B. Mg reacts with dil. HCl to produce H_2 gas which helps in floating C. Mg reacts with dil. HCl to produce N_2 gas which helps in floating D. Mg reacts with dil. HCl to produce CO_2 gas which helps in floating
30.	Which of the following solutions are electrolytes? i. Dil. HCl ii. Sugar Solution iii. Alcohol in water iv. Lime water
	A. i and ii B. i and iv C. ii, iii and iv D. i, ii and iv
44.	NalinI draws a ray diagram for an object in front of a concave mirror. She draws a ray starting from the top of the object and falling on the mirror perpendicularly. The ray after reflection will A. pass through focus. B. pass through pole. C. pass through the centre of curvature. D. pass through any point on the principal axis.

45.	If the refractive index of water with respect to air is 1.33 and of that of glass with respect to air is 1.5 then A. water is optically denser than glass. B. air is optically densest of all the three media. C. air's optical density is between glass and air. D. glass is optically denser than water.
47.	A convex lens has a focal length of 10 cm. The object of height 2 mm is placed at a distance of 5 cm from the pole. Find the height of the image. A. 4 cm B. 6.67 mm C. 4 mm D. 3.33 mm
	Section - C
Case	A student was–performing an activity to prove the requirements for photosynthesis. During this activity, he kept two identical healthy potted plants A and B in dark for 72 hours. After 72 hours, he covered plant A and B by bell shaped jars separately. While covering the plants with separate bell jars, he kept KOH in the watch glass by the side of the plant in setup A and not in setup B. Both these setups were made air tight and were kept in light for 6 hours. Then, Iodine Test was performed with one leaf from each of the two plants A and B.
53.	This experimental set up is used to prove essentiality of which of the following requirements of photosynthesis? A. Chlorophyll B. Oxygen C. Carbon dioxide D. Sunlight
54.	The function of KOH is to absorb A. Oxygen. B. Carbon dioxide. C. Moisture. D. Sunlight.
55.	Which of the following statements shows the correct results of Iodine Test performed on the leaf from plant A and B respectively? A. Blue - black colour would be–obtained on the leaf of plant A B. Blue - black colour would be–obtained on the leaf of plant B C. Red colour would be obtained on the leaf of plant A D. Red colour would be obtained on the leaf of plant B
56.	Which of the following steps can be followed for making the apparatus air tight? i. placing the plants on glass plate ii. using a suction pump. iii. applying Vaseline to seal the bottom of jar. iv. creating vacuum

	A. i and ii B. ii. and iii C. i. and iii D. ii. And iv
Case	In an experiment, Pooja used a equilateral triangular glass prism and projected a narrow beam of white light source from one side of the surface of the prism. She placed a screen on the other side and saw many colours appearing as patches on the screen. But when she used a red light source, she could only see a red patch on the screen. Similarly she used a blue and green light source and could only see one colour patch on both occasions.
57.	The phenomenon that she was trying to demonstrate was: A. Dispersion B. Reflection C. Refraction D. Scattering.
58.	The reason why she could no see any other colour when the red light was used was because: A. Red colour does not refract in prism. B. Red colour is monochromatic. C. The prism was defective. D. The prism is opaque to red colour.
59.	Which of the following can be the correct explanation that Pooja can give to her friends to explain this phenomenon? A. Different lights travel faster in the glass prism at different rates. B. Any light would disperse in the prism. C. Enough data is not available to make a scientific explanation in this case. D. Different wavelengths travel at different speeds in the glass.
60.	She also could relate to another natural phenomenon that we observe on a rainy humid day as the sun comes out. What could be that phenomenon? A. Lightning. B. Blueness of the sky. C. Rainbow. D. Scattering of light.

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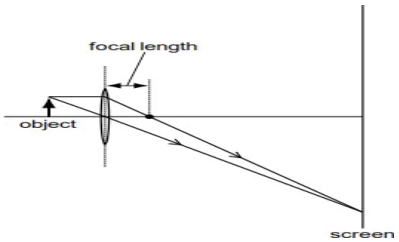
Sample Question Paper (TERM-I) 2021-22

Class X

Science (086)

Q.NO	ANSWERS
	Section - A
1.	B. Yellow precipitate is formed
2.	B. Hydrogen
3.	D. ii and iv
4.	B. $3Fe(s) + 4H_2O(g) \rightarrow Fe_3O_4(s) + 4H_2(g)$
5.	D. D
6.	A. Fe and Fe respectively.
7.	C. Combination reaction
8.	B | H_2CO_3 | $Ca(OH)_2$
9.	A. By adding acid to water with constant stirring.
10.	C. To verify the Law of conservation of mass
11.	C. (iii) Alveoli: Thin-walled sac like structures for exchange of gases.
12.	B. (i) - amylase, (ii) - pepsin, (iii) - trypsin
13.	D. water content in the guard cells
14.	D. (iv) Vena cava takes blood from body parts to right auricle
15.	B. Blood is transferred to lungs for oxygenation and is pumped into various organs simultaneously.
16.	B. i.- b) ; ii – c) ; iii – d) ; iv- a)
17.	C. Concave mirror
18.	C. 

19.	A. Concave mirror as well as convex lens
20.	C. The speed of light in air > the speed of light in water > the speed of light in glass.
21.	D. r < v
22.	B. The mirror has a focal length of -3 cm and will produce an image of magnification -1.
23.	B. 0°
24.	B. (ii)
Section - B	
25.	C. ✓ ✓
26.	A. 2002
27.	B. Mg reacts with dil. HCl to produce H_2 gas which helps in floating
28.	B. B, C
29.	B. ii and iii
30.	B. i and iv
31.	C. A is true but R is false
32.	D. A is False but R is true
33.	C. A is true but R is false.
34.	B. Both A and R are true and R is not the correct explanation of A.
35.	B. B and D
36.	D. Shark, dog fish, sting ray
37.	D. Thin walled capillaries richly supplied with blood.
38.	B. They selectively filter toxic substances through their leaves.
39.	C. concave lens of focal length -25 cm P = -4 D $P = \frac{100}{f \quad cm}$ $f(cm) = \frac{100}{p}$ $\frac{100}{4}$ = -25 cm. Negative focal length means concave lens. Concave lens of focal length -25cm.

40.	A. 30 cm in front of the mirror If rays converge at a point 15cm from the mirror, then, f = -15cm then, C = -30cm An object kept at C makes an image of the same size as object correct answer – (A) 30cm in front of mirror
41.	B. yeast, mushroom, bread mould
42.	D. Urine is more diluted.
43.	D. -80/3 cm m = -3 V = 80cm $m = \frac{v}{u}$ $-3 = \frac{80}{u}$ $u = \frac{80}{3} = \frac{80}{3}$cm. Correct answer = (D) $\frac{80}{3}$cm.
44.	C. ii, iii and iv
45.	D. Medium 1 and 3 are essentially the same medium, but medium 2 is denser than 1 and 3
46.	B. 1.21 Refractive index of flint glass w.r.t alcohol = $\frac{R.I\ of\ flint\ glass}{R.I\ of\ alcohol}$ $= \frac{1.65}{1.36} = 1.21$ Correct answer –(B)1.21
47.	C. 4 mm f = +10cm (Convex lens) $_1$= 2mm = 0.2cm. u = -5cm. $\frac{1}{f} \quad \frac{1}{v} \quad \frac{1}{5}$ $\frac{1}{v} \quad \frac{1}{10} \quad \frac{1}{5}$ $\frac{1\ 2}{10} = \frac{1}{10}$ V = -10cm. $m = \frac{v}{u} = \frac{2}{1}$ $m = \frac{10}{5} = \frac{2}{0.2}$ ⇨ $_2$ = 0.4cm. $_2$ = 4mm

	Correct answer (C) 4mm
48.	B. X, Y, Z
Section - C	
49.	C. $CaCO_3$
50.	C. 18 g
51.	A. Brine
52.	A. Between 1 to 3
53.	C. Carbon dioxide
54.	B. Carbon dioxide
55.	B. Blue - black colour would be obtained on the leaf of plant Y and no change in colour on leaf of plant X.
56.	C. i. and iii
57.	B. a parallel-sided glass block
58.	C. 30^0 Refractive index of medium = $\frac{\sin i}{\sin r}$ $1.5 = \frac{\sin 48.6^\circ}{\sin r}$ $1.5 = \frac{0.75}{\sin r}$ $\sin r = \frac{0.75}{0.5}$ $\sin r = 0.5$ r= $\sin^{1}$ 0.5 r= 30° Correct answer (C) 30°
59.	D. III and V are correct.
60.	A. lateral shift of the rays would have been less.

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<table>
<tr><th colspan="2">Marking Scheme in lieu of diagram based questions for VI candidates</th></tr>
<tr><th colspan="2">Section - A</th></tr>
<tr><td>2.</td><td>B. Hydrogen</td></tr>
<tr><td>3.</td><td>D. Zinc</td></tr>
<tr><td>5.</td><td>B. Acidic</td></tr>
<tr><td>11</td><td>A. Alveoli: Thin-walled sac like structures for exchange of gases.</td></tr>
<tr><td>12</td><td><table><tr><td></td><td>L</td><td>M</td><td>N</td></tr><tr><td>B</td><td>amylase</td><td>pepsin</td><td>trypsin</td></tr></table></td></tr>
<tr><td>14</td><td>D. Vena cava - takes deoxygenated blood from body parts to right atrium</td></tr>
<tr><td>15.</td><td>B. Blood is transferred to lungs for oxygenation and is pumped into various organs simultaneously.</td></tr>
<tr><td>16.</td><td>B. i.- b) ; ii – c) ; iii – d) ; iv- a)</td></tr>
<tr><td>18.</td><td>C. It is a convex lens and the object is placed between pole and focus.</td></tr>
<tr><td>22.</td><td>B. The mirror will produce an image of magnification -1.</td></tr>
<tr><td>23.</td><td>B. 0°</td></tr>
<tr><td>24.</td><td>B. Violet.</td></tr>
<tr><th colspan="2">Section - B</th></tr>
<tr><td>26.</td><td>B. Rain water consists of dissolved oxides of sulphur.</td></tr>
<tr><td>27.</td><td>B. Mg reacts with dil. HCL to produce H_2 gas which helps in floating.</td></tr>
<tr><td>30.</td><td>B. I and iv</td></tr>
<tr><td>44.</td><td>C. pass through the centre of curvature.</td></tr>
<tr><td>45.</td><td>D. glass is optically denser than water.</td></tr>
<tr><td>47.</td><td>C. 4 mm</td></tr>
<tr><th colspan="2">Section - C</th></tr>
<tr><td>53.</td><td>C. Carbon dioxide</td></tr>
<tr><td>54.</td><td>B. Carbon dioxide</td></tr>
<tr><td>55.</td><td>B. Blue - black colour would be obtained on the leaf of plant B</td></tr>
<tr><td>56.</td><td>C. i. and iii</td></tr>
<tr><td>57.</td><td>A. Dispersion</td></tr>
<tr><td>58.</td><td>B. Red colour is monochromatic.</td></tr>
<tr><td>59.</td><td>D. Different wavelengths travel at different speeds in the glass.</td></tr>
<tr><td>60.</td><td>C. Rainbow.</td></tr>
</table>