DIRECTORATE OF EDUCATION
Govt. of NCT, Delhi

SUPPORT MATERIAL
(2018-2019)

Class : X

SCIENCE

Under the Guidance of

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Secretary (Education)

Mr. Sanjay Goel
Director (Education)

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PREFACE

It gives me immense pleasure to present the Support Material for various subjects. The material prepared for students of classes IX to XII has been conceived and developed by a team comprising of the Subject Experts, Members of the Academic Core Unit and teachers of the Directorate of Education.

The subject wise Support Material is developed for the betterment and enhancement of the academic performance of the students. It will give them an insight into the subject leading to complete understanding. It is hoped that the teachers and students will make optimum use of this material. This will help us achieve academic excellence.

I commend the efforts of the team who have worked with complete dedication to develop this matter well within time. This is another endeavor of the Directorate to give complete support to the learners all over Delhi.

(SANDEEP KUMAR)
SECRETARY

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D.O. No. PS/DE/2018/343

Date : 8/8/2018

DIRECTOR'S MESSAGE

Dear Students,

Through this Support Material, I am getting an opportunity to communicate directly with you and I want to take full advantage of this opportunity.

In Delhi, there are approximately 1020 other government schools like yours, which are run by Directorate of Education. The Head Quarters of Directorate of Education is situated at Old Secretariat, Delhi-54.

All the teachers in your school and officers in the Directorate work day and night so that the standard of our govt. schools may be uplifted and the teachers may adopt new methods and techniques to teach in order to ensure a bright future for the students.

Dear students, the book in your hand is also one such initiative of your Directorate. This material has been prepared specially for you by the subject experts. A huge amount of money and time has been spent to prepare this material. Moreover, every year, this material is reviewed and updated as per the CBSE syllabus so that the students can be updated for the annual examination.

Last, but not the least, this is the perfect time for you to build the foundation of your future. I have full faith in you and the capabilities of your teachers. Please make the fullest and best use of this Support Material.

DIRECTOR (EDUCATION)

Dr. (Mrs.) Saroj Bala Sain
Addl. Director of Edn. (School)/Exam

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Date : 16/07/2018

It gives me immense pleasure and a sense of satisfaction to forward the support material for classes IX to XII in all subjects. The support material is continuously revised redesigned and updated by a team of subject experts, members of Core Academic Unit and teachers from various schools of DOE.

Consistent use of support material by the students and teachers will make the year long journey seemless and enjoyable. The purpose of providing support material has always been to make available ready to use material which is matchless and most appropriate.

My commendation for all the team members for their valuable contribution.

S. Sain

Dr. Saroj Bala Sain
Addl.DE (School)

DIRECTORATE OF EDUCATION
Govt. of NCT, Delhi

SUPPORT MATERIAL
(2018-2019)

SCIENCE
Class : X
(English Medium)

NOT FOR SALE

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SUPPORT MATERIAL

CLASS X

SCIENCE

(ENGLISH)

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CLASS X (2018-19)

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COURSE STRUCTURE
CLASS - X (2018-19)
(Annual Examination)

Marks : 80

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

Note : Above weightage includes the weightage of questions based on practical skills.

Theme : Materials (55 Periods)

Unit I : Chemical Substances – Nature and Behaviour

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

Acids, 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 in everyday life; preparation and uses of Sodium Hydrooxide, Bleaching powder, Baking soda, Washing soda and Plaster of Paris.

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

Carbon compounds : Covalent bonding in carbon compounds. Versatile nature of carbon. Homologous series. Nomenclature of carbon compounds containing functional groups (halogens, alcohol, ketones, aldehydes, alkanes and alkynes), difference between saturated hydrocarbons and unsaturated hydrocarbons. Chemical properties of carbon compounds (combustion,

oxidation, addition and substitution reaction). Ethanol and Ethanoic acid (only properties and uses), soaps and detergents.

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, graduation in properties, valency, atomic number, metallic and non-metallic properties.

Theme : The World of the Living

Unit II : World of Living (50 Periods)

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

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

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

Heredity and Evolution : Heredity; Mendel's contribution – Laws for inheritance of traits, Sex determination : Brief introduction; Basic concepts of evolution

Theme : Natural Phenomena

Unit III : Natural Phenomena (23 Periods)

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 lens; Lens formula (Derivation not required); Magnification. Power of lens.

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

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

Theme : How Things Work

Unit IV : Effects of Current (32 Periods)

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

Magnetic effects of current : Magnetic field, field lines, field due to a current carrying conductor, field due to current carrying coil or solenoid; Force on current carrying conductor, Fleming's Left Hand Rule, Electric Motor, Electromagnetic induction. Induced potential difference, Induced current. Fleming's Right Hand Rule, Electric Generator, Direct Current. Alternating current : frequency of AC. Advantage of AC over DC. Domestic electric circuits.

Theme : Natural Resources

Unit V : Natural Resources (20 Periods)

Sources of energy : Different forms of energy, conventional and non-conventional sources of energy : Fossil fuels, solar energy; biogas; wind, water and tidal energy; Nuclear energy. Renewable versus non-renewable sources of Energy.

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

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

PRACTICALS

Practical should be conducted alongside the concepts taught in theory classes

LIST OF EXPERIMENTS

1. Finding the pH of the following samples by using pH paper/universal indicator :
   (a) Dilute Hydrochloric Acid
   (b) Dilute NaOH Solution
   (c) Dilute Ethanoic Acid Solution
   (d) Lemon juice
   (e) Water
   (f) Dilute Hydrogen Carbonate Solution

   Study the properties of acids and bases (HCl & NaOH) by their reaction with :
   (a) Litmus solution (Blue/Red)
   (b) Zinc metal
   (c) Solid sodium carbonate
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 quick lime
   (ii) Action of heat on ferrous sulphate crystals.
   (iii) Iron nails kept in copper sulphate solution
   (iv) Reaction between sodium sulphate and barium chloride solutions.
3. Observing the action of Zn, Fe, Cu and Al metals on the following salt solutions :
   (a) $ZnSO_4$ (aq)
   (b) $FeSO_4$ (aq)
   (c) $CuSO_4$ (aq)
   (d) $Al_2 (SO_4)_3$ (aq)

   Arranging Zn, Fe, Cu and Al (metals) in the decreasing order of reactivity based on the above result.
4. Studying the dependence of potential difference (V) across a resistor on the current (I) passing through it and determine its resistance. Also plotting a graph between V and I.

5. Determination of the equivalent resistance of two resistors when connected in series and parallel.
6. Preparing a temporary mount of a leaf peel to show stomata.
7. Experimentally show that carbon dioxide is given out during respiration.
8. Study of the following properties of acetic acid (ethanoic acid) :
   (i) odour
   (ii) solubility in water
   (iii) effect on litmus
   (iv) reaction with sodium Hydrogen Carbonate
9. Study of the comparative cleaning capacity of a sample of soap in soft and hard water.
10. Determination of the focal length of :
    (i) Concave mirror
    (ii) Convex lens
    by obtaining the image of a distant object.
11. Tracing the path of a ray of light passing through a rectangular glass slab for different angles of incidence. Measure the angle of incidence, angle of refraction, angle of emergence and interpret the result.
12. Studying (a) binary fission in Amoeba, and (b) budding in yeast and hydra with the help of prepared slides.
13. Tracing the path of the rays of light through a glass prism.
14. Finding the image distance for varying object distances in case of a convex lens and drawing corresponding ray diagrams to show the nature of image formed.
15. Identification of the different parts of an embryo of a dicot seed (Pea, gram or red kidney bean).

PRESCRIBED BOOKS :

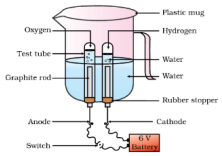
- ✯ Science – Textbook for Class IX – NCERT Publication
- ✯ Science – Textbook for Class X – NCERT Publication
- ✯ Assessment of Practical Skills in Science – Class IX – CBSE Publication
- ✯ Assessment of Practical Skills in Science – Class X – CBSE Publication
- ✯ Laboratory Manual – Science – Class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

QUESTION PAPER DESIGN FOR SCIENCE
(CODE NO. 086/090) CLASS-X (2018-19)

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

S. No.	Typology of Questions	Very Short Answer (VSA) 1 Mark	Short Answer-I (SAI) 2 Marks	Short Answer-II (SAII) 3 Marks	Long Answer (LA) 5 Marks	Total Marks	% Weigh tage
1.	**Remembering** (Knowledge based simple recall questions, to know specific facts, terms, concepts, principles or theories, identify, define or recite, information)	2	-	1	1	10	15%
2.	**Understanding** (Comprehension to be familiar with meaning and to understand conceptually, interpret, compare, contrast, explain, paraphrase or interpret information)	-	1	4	2	24	35%
3.	**Application** (Use abstract information in concrete situation, to apply knowledge to new situations, use given content to interpret a situation, provide an example, or solve a problem)	-	1	2	2	18	26%
4.	**High Order Thinking Skills** (Analysis & Synthesis : Classify, compare, contrast or differentiate between different pieces of information, organize and/or integrate unique pieces of information from a variety of sources)	-	-	1	1	8	12%
5.	**Inferential and Evaluate** (Appraise, judge, and/or justify the value or worth of a decision or outcome, or to predict outcomes based on values). Value Based Questions will be replaced by regular questions as per CBSE guidlines.	-	-	1 + 1*	-	8	12%
	Total (Theory Based Questions)	**2 × 1 = 2**	**3 × 2 = 6**	**10 × 3=30**	**6 × 5=30**	**68 (21)**	**100%**
	Practical Based Questions (PBQs)		**6 × 2 = 12**	**-**	**-**	**12 (6)**	
	Total	**2 × 1 = 2**	**9 × 2 =18**	**10 × 3 = 30**	**6 × 5=30**	**80 (27)**	

1. *Question paper will consist of 27 questions.*
2. *All questions would be compulsory. However, an internal choice will be provided in three questions of 3 marks each and two questions of five marks from Section A and and one question from PBQs of Section B.*



Chapter - 1 Chemical Reactions And Equations

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

$$\underbrace{\text{Zinc + Sulphuric Acid}}_{\substack{\text{LHS}\\ \text{(Reactant)}}} \rightarrow \underbrace{\text{Zinc sulphate + Hydrogen}}_{\substack{\text{RHS}\\ \text{(Product)}}}$$

Chemical Equation

$$\underbrace{Zn + H_2SO_4}_{\substack{\text{LHS}\\ \text{(Reactant)}}} \rightarrow \underbrace{ZnSO_4 + H_2}_{\substack{\text{RHS}\\ \text{(Product)}}}$$

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.

$$Mg + O_2 \rightarrow MgO$$

Balancing Chemical Equation

* Law of conservation of Mass : Matter can neither be created nor 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.

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

* 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 reactant 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

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

(ii) Respiration is also an exothermic reaction.

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

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)

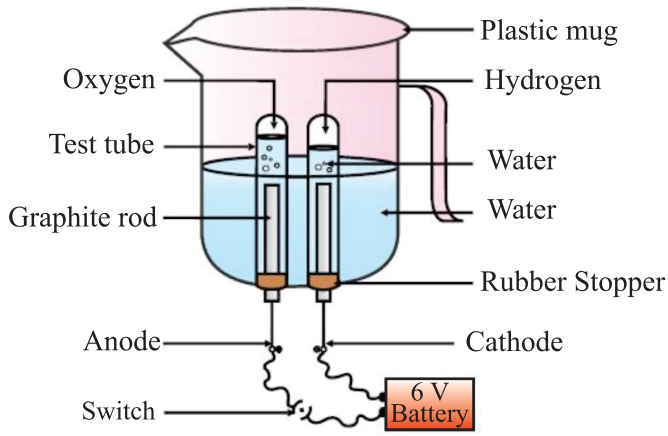
Green colour Red-brown colour

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

(Lime stone) (Quick lime)

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

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



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

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

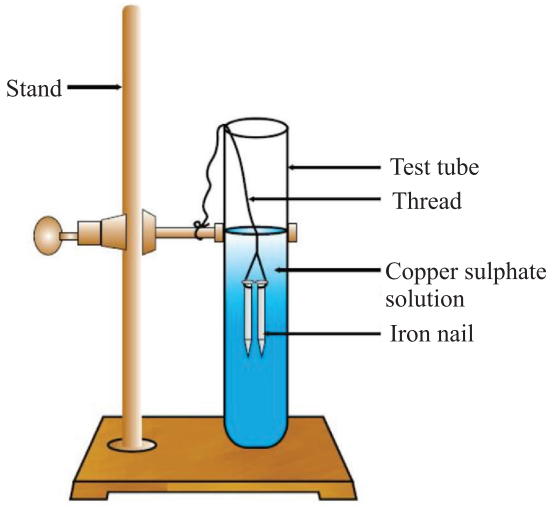
$2AgBr\ (s) \xrightarrow{Sunlight} 2Ag\ (s) + Br_2\ (g)$

* 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.

$$Fe\ (s) + CuSO_4\ (aq) \rightarrow FeSO_4\ (aq) + Cu\ (s)$$



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 $FeSO_4$.

$$Zn + CuSO_4 \rightarrow ZnSO_4 + Cu$$

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.

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

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

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

V. OXIDATION AND REDUCTION :

Oxidation : (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.

oxidation

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

Reduction

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)

1. What changes do you observe in the iron nails and colour of copper sulphate solution, if iron nails are dipped in $CuSO_4$ solution for 15 minutes ?

2. Identify the chemical change :

   Melting of ice or conversion of milk into curd.

3. Why is respiration considered an exothermic reaction ?

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

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

6. Why we store silver chloride in dark coloured bottles ?

7. Write a chemical equation of double displacement reaction.

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

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

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

SHORT TYPE QUESTIONS (2 Marks)

1. Define combination reaction. Give one example 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 substance's colour during a chemical reaction.

5. What is rancidity ? Write two ways by which it can be prevented.

6. What are two conditions which promotes 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.

8. What happens when Zn strip is dipped in $CuSO_4$ solution ?

SHORT TYPE QUESTIONS (3 Marks)

1. What is redox reaction ? Write down a chemical reaction representing it.

2. In electrolysis of water :

   (a) Name the gas collected at cathode and anode.

   (b) Why is volume of one gas collected at one electrode is double of another ?

   (c) Why are few drops of dil. H_2SO_4 added to water ?

3. 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.

4. Give reasons :

(a) White silver chloride turns grey in sunlight.

(b) Brown coloured copper powder on heating in air turns into black coloured substance.

5. 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.

6. 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.

7. 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.

LONG TYPE 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) What is utility of this reaction ?

2. What types of reactions are represented by following :

   (a) $CaCO_3 \rightarrow CaO + CO_2$

   (b) $2Ca + O_2 \rightarrow 2CaO$

   (c) $Pb + CuCl_2 \rightarrow PbCl_2 + Cu$

   (d) $2FeSO_4 \rightarrow Fe_2O_3 + SO_2 + SO_3$

   (e) $Na_2SO_4 + BaCl_2 \rightarrow BaCl_2 + 2NaCl$

3. Balance the following equations :

   (a) $H_2 + O_2 \rightarrow H_2O$

   (b) $MnO_2 + HCl \rightarrow MnCl_2 + H_2O + Cl_2$

   (c) $Pb(NO_3) \rightarrow PbO + NO_2 + O_2$

(d) $AgNO_3 + NaCl \rightarrow AgCl + NaNO_3$

(e) $Ca(OH)_2 + HNO_3 \rightarrow Ca(NO_3)_2 + H_2O$

4. 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.

Hints to Long Answer Type Questions

2. (a) Decomposition reaction

(b) Combination reaction

(c) Displacement reaction

(d) Decomposition reaction

(e) Double displacement reaction

3. (a) $2H_2 + O_2 \rightarrow 2H_2O$

(b) $MnO_2 + 4HCl \rightarrow MnCl_2 + 2H_2O + Cl_2$

(c) $2Pb(NO_3) \rightarrow 2PbO + NO_2 + O_2$

(d) $AgNO_3 + NaCl \rightarrow AgCl + NaNO_3$

(e) $Ca(OH)_2 + 2HNO_3 \rightarrow Ca(NO_3)_2 + 2H_2O$

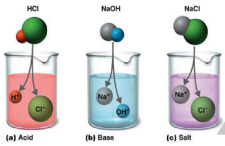
4. (a) $2AgCl \xrightarrow{Sunlight} 2Ag + Cl_2$

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

(c) $NaOH + HCl \rightarrow NaCl + H_2O$

(d) $CuO + 2HCl\ (dil.) \rightarrow CuCl_2 + H_2O$

(e) $BaCl_2 + Na_2SO_4 \rightarrow BaSO_4 + 2NaCl$



Chapter - 2

Acid, Bases And Salts

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.

$Ca(OH)_2 + CO_2 \rightarrow CaCO_3 + H_2O$ (Lime water turns milky.)

* When excess CO_2 is passed,

$CaCO_3 + CO_2 + H_2O \rightarrow Ca(HCO)_3$ (Milkiness disappears.)

Reaction of Acids and Bases With Each Other

Acid + Base → Salt + H_2O

Neutralisation Reaction : Reaction of acid with base is called as neutralization reaction.

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

IF :

Strong Acid + Weak Base → Acidic salt + H_2O

Weak Acid + Strong Base → Basic salt + H_2O

Strong Acid + Strong Base → Neutral salt + H_2O

Weak Acid + Weak Base → Neutral salt + H_2O

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-metallic Oxides with Bases

Non-metallic oxides are acidic in nature.

Non-metallic Oxide + Base $\rightarrow$ Salt + H_2O

$CO_2 + Ca(OH)_2 \rightarrow CaCO_3 + H_2O$

Reaction Of Acid

- + Metal Carbonate $\rightarrow$ Salt + CO_2 + Water
- + Metal $\rightarrow$ Salt + H_2
- + Metal Hydrogen Carbonate $\rightarrow$ Salt + CO_2 + H_2O
- + Metallic 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
- Acids $\rightarrow$ H^+ ions
- 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).

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

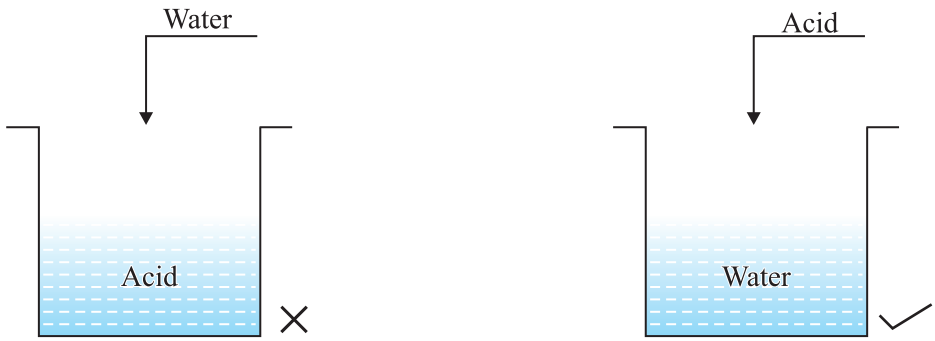
$$HCl + H_2O \rightarrow H_3O^+ + Cl^-$$

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.

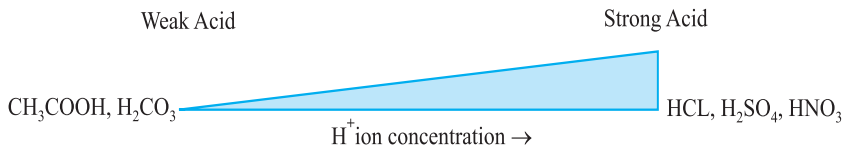
Universal indicator : is a mixture of several indicators. It shows different colours at different concentrations of H^+ ions in the solution.

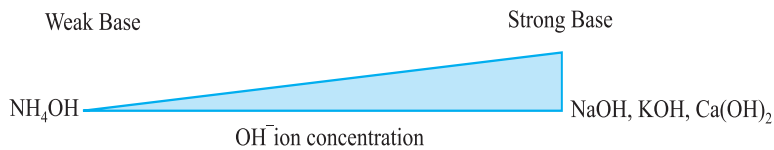
pH Scale : A scale for measuring H^+ ion concentration in a solution . p in pH stands for 'potenz' a German word which means power.

pH = 7 → neutral solution

pH less than 7 → acidic solution

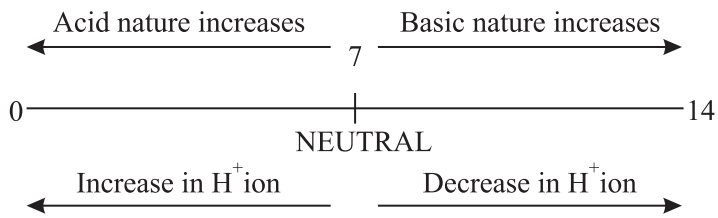
pH more than 7 → basic solution





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 $\rightarrow$ Neutral Salt : pH = 7

(ii) Salt of strong acid + Weak base $\rightarrow$ Acidic salt : pH < 7

(iii) Salt of strong base + Weak acid $\rightarrow$ Basic salt : pH > 7

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 ($CaSO_4.\frac{1}{2}H_2O$)

1. Sodium Hydroxide (NaOH) : When electricity is passed through an aqueous solution of NaCl (brine), it decompose to form NaOH. (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) ($NaHCO_3$) :

$$NaCl + H_2O + CO_2 + NH_3 \rightarrow NH_4Cl + NaHCO_3$$

Baking soda

- 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.

QUESTIONS

VERY SHORT QUESTIONS (1 Mark)

1. Name the acid present in ant sting.
2. What happens when egg shell is added to nitric acid ?
3. Name a salt which does not contain water of crystallization.
4. Name two constituents of baking powder.
5. What is the pH of gastric juices released during digestion ?
6. Which solution is used to dissolve gold ?
7. How will you test a gas which is liberated when HCl acid reacts with an active metal ?
8. Why does flow of acid rain water into a river make the survival of aquatic life in the river difficult ?
9. When conc. acid is added to water, whether the process is exothermic or endothermic ?
10. Which by-product of chlor-alkali process is used for manufacturing bleaching powder ?

SHORT TYPE QUESTIONS (2 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 ?

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 ?

SHORT TYPE QUESTIONS (3 Marks)

1. On passing excess CO_2 through lime water, it first turns milky and then becomes colourless. Explain why ? Write chemical equations.

2. How are bases different from alkalis ? Are all bases alkalis ?

3. 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 ?

4. Indicate with the help of a diagram the variation of pH with change in concentration of H^+ (aq) and OH^- (aq) ions.

5. Write the name and formulae of three hydrated salts.

6. What happens when calcium carbonate is made to react with hydrochloric acid ? Give the equation of reaction.

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

8. 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 ?

LONG ANSWER TYPE QUESTIONS (5 Marks)

1. What is water of crystallization ? Write the common name and chemical formula of a commercially important compound which has ten water molecules. How is this compound obtained ? Write chemical equations 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 chemical formulae ofA, B and C.

$$X + Zn \longrightarrow A + H_2\,(g)$$

$$X + HCl \longrightarrow B + H_2O$$

$$X + CH_3COOH \longrightarrow C + H_2O$$

3. An element P does not react with dil. H_2SO_4. If forms an oxide PO which turns red litmus into blue. Will you call P as a metal or a non-metal ? Give reason.

Hints to Long Answer Type Questions

1. Washing soda ($Na_2CO_3.10H_2O$)

$$Na_2CO_3\ (s) + 10H_2O\ (l) \rightarrow Na_2CO_3.10H_2O\ (s)$$

2. $$2NaOH + Zn \rightarrow Na_2ZnO_2 + H_2$$

(X) (A)

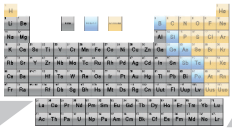
$$NaOH + HCl \rightarrow NaCl + H_2O$$

(B)

$$NaOH + CH_3COOH \rightarrow CH_3COONa + H_2O$$

(C)

3. 'P' is a metal.



Chapter - 3

Metals And Non-Metals

- Elements can be classified as metals and non-metals on the basis of their properties.
- Example of some metals are :

  Iron (Fe), Aluminium (Al), Silver (Ag), Copper (Cu)
- Examples of some non-metals are :

  Hydrogen (H), Nitrogen (N), Sulphur (S), Oxygen (O)

I. PHYSICAL PROPERTIES

PROPERTY	METALS	NON-METALS
1. Lustre	Metals have shining surface.	They do not have shining surface. • Except Iodine.
2. Hardness	They are generally hard. • Except Sodium, Lithium and Potassium which are soft and can be cut with knife.	Generally soft. • Except Diamond, a form of carbon which is the hardest natural substance.
3. State	Exist as solids. • Except Mercury.	Exist as solids or gaseous. • Except Bromine.
4. Malleability	Metals can be beaten into thin sheets. • Gold and Silver are the most malleable metals.	Non-metals are non-malleable.

5. Ductility	Metals can be drawn into thin wires.	They are non-ductile.
6. Conductor of heat & electricity	Metals are good conductors of heat and electricity. • Silver (Ag) and Copper (Cu) : Best conductors of heat. • Lead (Pb), Mercury (Hg) poor conductor of heat.	Non-metals are poor conductor of heat and electricity. • Except Graphite.
7. Density	Generally have high density and high melting point. • Except Sodium and Potassium.	Have low density and low melting point.
8. Sonorous	Metals produce a sound on striking a hard surface.	They are not sonorous.
9. Oxides	Metallic oxides are basic in nature.	Non-metallic oxides are acidic in nature.

II. CHEMICAL PROPERTIES OF METALS

(A) Reaction with Air :

Metals combine with oxygen to form metal oxide.

$$\text{Metal} + O_2 \rightarrow \text{Metal oxide}$$

Examples :

(i) $2Cu + O_2 \rightarrow 2CuO$

Copper oxide (black)

(ii) $4Al + 3O_2 \rightarrow 2Al_2O_3$

Aluminium oxide

(iii) $2Mg + O_2 \rightarrow 2MgO$

Different metals show different reactivities towards O_2.

- Na and K react so vigorously that they catch fire if kept in open so they are kept immersed in kerosene.
- Surfaces of Mg, Al, Zn, Pb are covered with a thin layer of oxide which prevent them from further oxidation.
- Fe does not burn on heating but iron fillings burn vigorously.
- Cu does not burn but is coated with black copper oxide.

- Au and Ag does not react with oxygen.

Amphoteric Oxides: Metal oxides which react with both acids as well as bases to produce salts and water are called amphoteric oxides.

Examples : $Al_2O_3 + 6HCl \rightarrow 2AlCl_3 + H_2O$

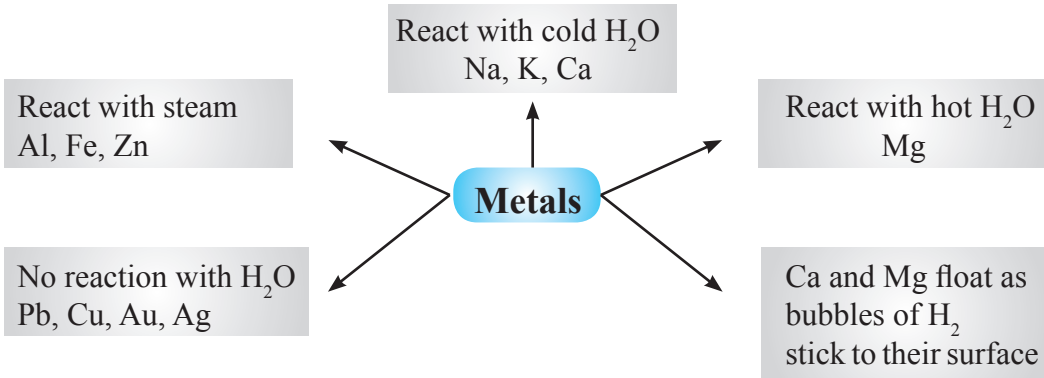
$Al_2O_3 + 2NaOH \rightarrow 2NaAlO_2 + H_2O$

Sodium Aluminate

(B) Reaction of Metals with Water :

Metal + Water → Metal oxide + Hydrogen

Metal oxide + Water → Metal hydroxide



Examples :

(i) $2Na + 2H_2O \rightarrow 2NaOH + H_2 + Heat$

(ii) $Ca + 2H_2O \rightarrow Ca(OH)_2 + H_2$

(iii) $Mg + 2H_2O \rightarrow Mg(OH)_2 + H_2$

(iv) $2Al + 3H_2O \rightarrow Al_2O_3 + 3H_2$

(v) $3Fe + 4H_2O \rightarrow Fe_3O_4 + 4H_2$

(C) Reaction of Metals with Acids (Dilute) :

Metal + Dilute acid → Salt + H_2

Cu, Ag, Hg do not react with dil. acids.

Examples :

(i) $Fe + 2HCl \rightarrow FeCl_2 + H_2$

(ii) $Mg + 2HCl \rightarrow MgCl_2 + H_2$

(iii) $Zn + 2HCl \rightarrow ZnCl_2 + H_2$

(iv) $2Al + 6HCl \rightarrow 2AlCl_3 + 3H_2$

(D) Reaction of Metals with Solutions of other Metal Salts :

Metal A + Salt solution B → Salt solution A + Metal B

- Reactive metals can displace less reactive metals from their compounds in solution form.

$$Fe + CuSO_4 \rightarrow FeSO_4 + Cu$$

REACTIVITY SERIES

The reactivity series is a list of metals arranged in the order of their decreasing activities.

K	Most reactive
Na	
Ca	
Mg	
Al	
Zn	Reactivity decreases
Fe	
Pb	
H	
Cu	
Hg	
Ag	
Au	Least reactive

Reaction of Metals with Non-metals

- Reactivity of elements is the tendency to attain a completely filled valence shell.
- Atoms of the metals lose electrons from their valence shell to form cation. Atom of the non-metals gain electrons in the valence shell to form anion.

E.g., Formation of NaCl

$$Na \rightarrow Na^+ + e^-$$

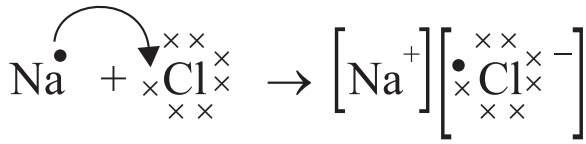
2, 8, 1 2, 8

Sodium cation

$$Cl + e^- \rightarrow Cl^-$$

2, 8, 7 2, 8, 8

Chloride anion



Ionic Compounds

The compounds formed by the transfer of electrons from a metal to a non-metal are called ionic compounds or electrovalent compounds.

Properties of Ionic Compounds

1. **Physical nature :** The are solid and hard, generally brittle.
2. **Melting and Boiling Point :** They have high melting and boiling point.
3. **Solubility :** Generally soluble in water and insoluble in solvents such as kerosene, petrol etc.
4. **Conduction of electricity :** Ionic compounds conduct electricity in molten and solution form but not in solid state.

Occurrence of Metals

Minerals : The elements or compounds which occur naturally in the earth's crust are called minerals.

Ores : Minerals that contain very high percentage of particular metal and the metal can be profitably extracted from it, such minerals are called ores.

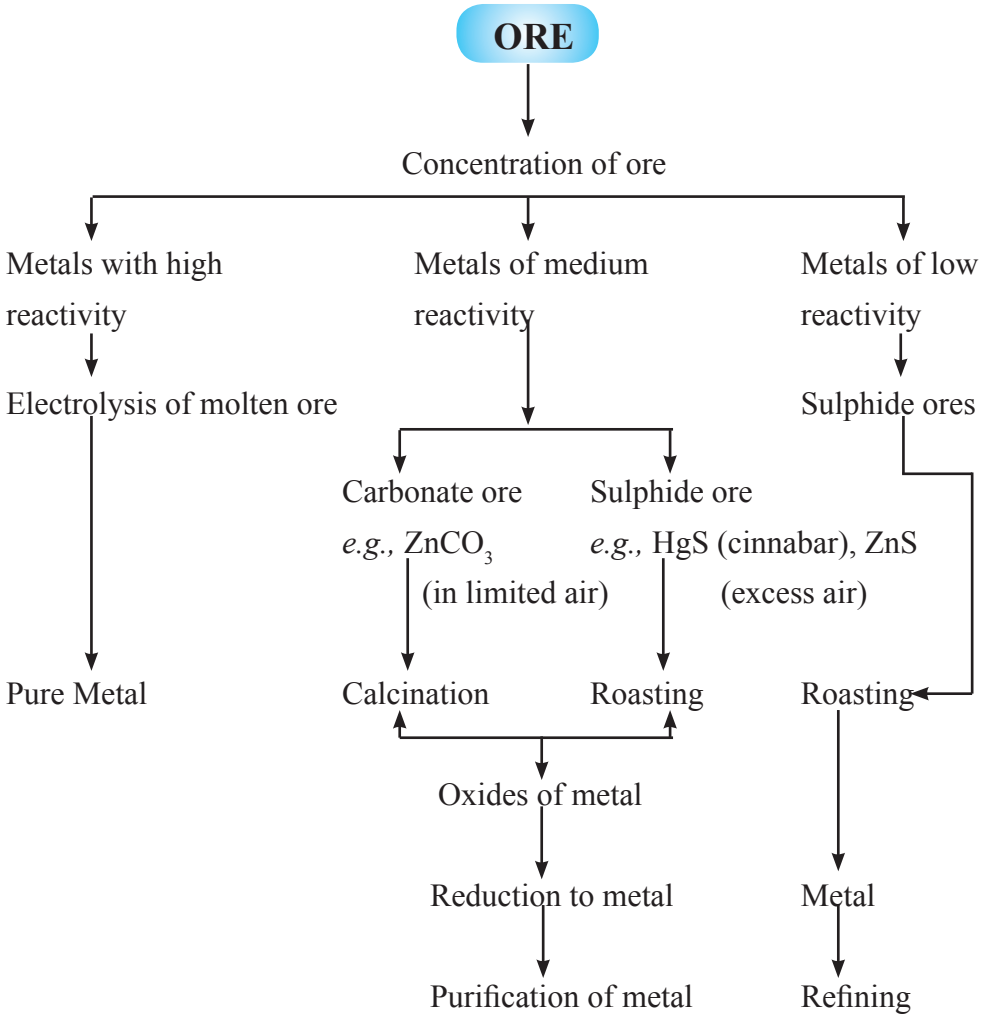
Very reactive metals	K, Na, Ca, Mg, Al	Not found in free state Extraction by electrolysis
Moderately reactive	Zn, Fe, Pb, Cu, Hg	Occur as sulphides, oxides, carbonates Reduction by using carbon
Least reactive	Ag, Au	Occur in native/free state

Extraction of Metals from Ores

Step 1. Enrichment of ores.

Step 2. Extraction of metals.

Step 3. Refining of metals.



Steps Involved in Extraction of Metals from Ores

Some Important Terms

(a) Gangue : Ores are usually contaminated with large amount of impurities such as soil, sand etc. called gangue.

(b) Roasting : The sulphide ores are converted into oxides by heating strongly in

the presence of excess air. This process is called roasting.

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

(c) Calcination : The carbonate ores are changed into oxides by heating strongly in limited air. This process is called calcination.

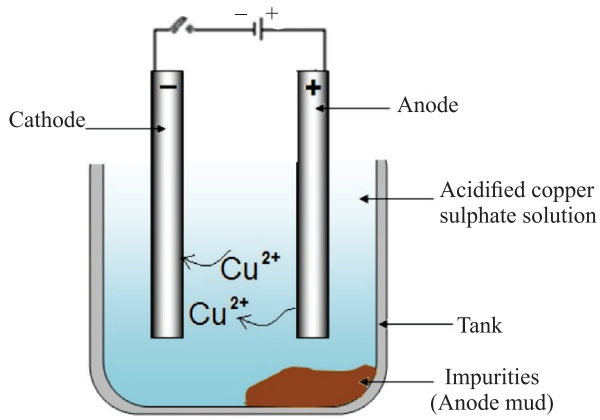
$$ZnCO_3 \xrightarrow{Heat} ZnO + CO_2$$

(d) Reduction : Metal oxides are reduced to corresponding metals by using reducing agent like carbon.

$$ZnO + C \rightarrow Zn + CO$$

Refining of Metals

The most widely used method for refining impure metal is electrolytic refining.



- Anode : Impure copper
- Cathode : Strip of pure copper
- Electrolyte : Solution of acidified copper sulphate

(a) On passing the current through electrolyte, the impure metal from anode dissolves into the electrolyte.

(b) An equivalent amount of pure metal from the electrolyte is deposited at the cathode.

(c) The insoluble impurities settle down at the bottom of the anode and is called anode mud.

Corrosion

The surface of some metals such as iron is corroded when they are exposed to moist air for a long period of time. This is called corrosion.

(i) Silver becomes black when exposed to air as it reacts with air to form a coating of silver sulphide.

(ii) Copper reacts with moist carbon dioxide in the air and gains a green coat of copper carbonate.

(iii) Iron when exposed to moist air acquires a coating of a brown flaky substance called rust.

Prevention of Corrosion

The rusting of iron can be prevented by painting, oiling, greasing, galvanizing, chrome plating, anodizing or making alloys.

Galvanization : It is a method of protecting steel and iron from rusting by coating them with a thin layer of zinc.

Alloy : An alloy is a homogenous mixture of two or more metals or a metal and a non-metal.

Iron : Mixed with small amount of carbon becomes hard and strong.

Steel : Iron + Nickel and chromium

Brass : Copper + Zinc

Bronze : Copper + Tin (Sn)

Solder : Lead + tin

Amalgam : If one of the metal is mercury (Hg).

QUESTIONS

VERY SHORT QUESTIONS (1 Mark)

1. Name one lustrous non-metal.
2. Name two metals that are soft and can be cut with a knife.
3. Number of electrons gained or lost by an element is called its…….. .
4. What are minerals ?
5. What is the process of depositing zinc on iron called ?
6. Which metal do not react with water at all ?
7. Name the ion made by non-metals – cation/anion.
8. Bronze is an alloy made by the combination of……..and…….. .
9. Name two metals that are stored in kerosene oil.
10. Arrange copper, silver and aluminium in increasing order of reactivity.

SHORT ANSWER TYPE QUESTIONS (2 Marks)

1. Give reasons :
   (a) Why is pure gold not suitable for making ornaments ?
   (b) Why calcium is found in the form of compound ?
   (c) Why electrical wires are coated with PVC (Poly Vinyl Chloride) ?
   (d) Why do we apply oil on iron tools kept in storage ?
   (e) Why sodium is stored in kerosene oil ?

SHORT ANSWER TYPE QUESTIONS (3 Marks)

1. Why caesium and gallium melt in our palm ?
2. Why magnesium ribbon starts floating in hot water ?
3. What are ionic compounds ?
4. Complete the following chemical reactions :
   (a) $3Fe + 4H_2O \rightarrow$
   (b) $Ca + H_2O \rightarrow$
   (c) $K + H_2O \rightarrow$
5. To obtain metal from their metal oxide, which chemical process is used ? Give the chemical equation as well.

LONG ANSWER TYPE QUESTIONS (5 Marks)

1. What is the difference between a mineral and an ore ?
2. Differentiate between roasting and calcinations process in metallurgy.
3. What is an alloy ? Name the alloy which has iron, nickel and chromium as its constituent. What is the chief use of this alloy ?
4. Explain any two ways to prevent rusting of iron.
5. Explain briefly electrolytic refining method.

Hints to Long Answer Type Questions

1. **Mineral**
   Natural occurring chemical substances obtained by mining

   Ore
   An ore is a mineral from which metal is obtained.

2. **Roasting**
   (a) Ore is heated in the presence of air.
   (b) Convert

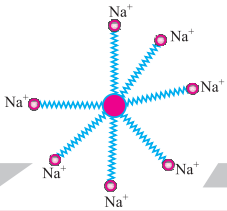
   Calcination
   (a) Ore is heated in absence of air.
   (b) Convert

   Sulphide ore $\xrightarrow{\textit{Roasting}}$ Oxide ore ‖ Carbonate ore $\xrightarrow{\textit{Calcination}}$ Oxide ore

3. **Alloy :** It is a homogenous solid solution of one metal with one or more metals or non-metals.

   Stainless steel, used for making utensils, equipments.

4. (a) By coating the surface with a thin film of oil or grease.
   (b) By painting the surface.
   (c) By the process of galvanization.
5. Refer Page no. 52 of NCERT



Chapter - 4

Carbon and its Compounds

Introduction :

- The element carbon is non-metal. Its symbol is C.
- Carbon is a versatile element the percentage of carbon present in earth crust in form of mineral is 0.02% and in atmosphere as CO_2 is 0.03%.
- All the living things, plants and animals are made up of carbon based compounds.

Carbon always form covalent bonds :

The atomic number of carbon is 6.

Electronic configuration :

	K	L
C (6)	2	4

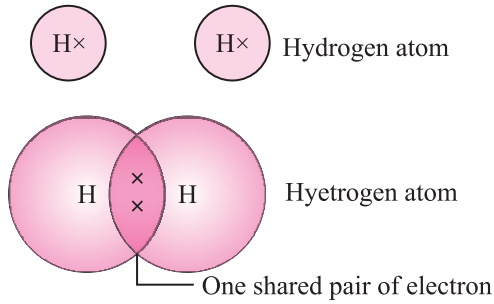
How carbon attain noble gas configuration ?

(i) Carbon is tetravalent, it does not form ionic bond by either losing four electrons (C^{4+}) or by gaining four electrons (C^{4-}). It is difficult to hold four extra electron and would require large amount of energy to remove four electrons. So, carbon can form bond by sharing of its electrons with the electrons of other carbon atom or with other element and attain noble gas configuration.

(ii) The atoms of other elements like hydrogen, oxygen and nitrogen, chlorine also form bonds by sharing of electrons.

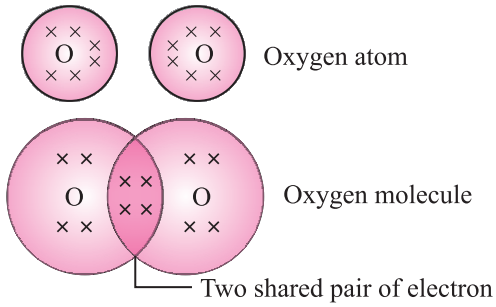
(iii) The bond formed by sharing of electrons between same or different atoms is covalent bond.

(i) H_2



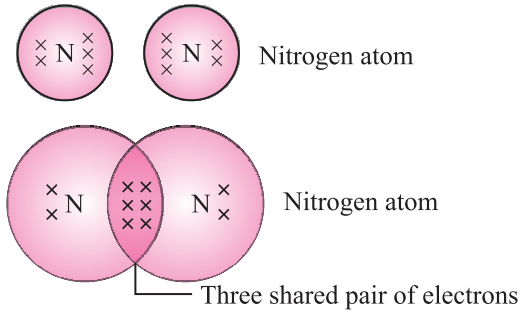
H – H single bond between hydrogen atoms

(ii) O_2



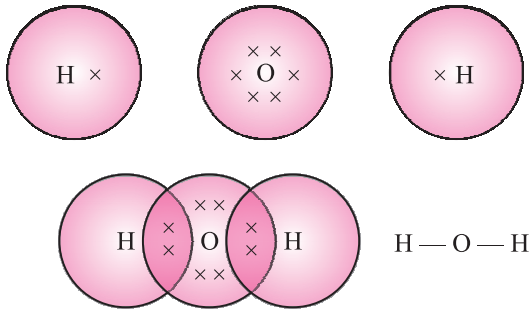
O = O double bond between oxygen atoms

(iii) N_2



N ≡ N triple bond between nitrogen atoms

Molecule of water has single covalent bond between one oxygen and two hydrogen atoms.



Physical Properties of Covalent Compounds

(a) Covalent compounds have low melting and boiling points as they have weak intermolecular force.

(b) They are generally poor conductor of electricity as electrons are shared between atoms and no charged particles are formed.

Versatile Nature of Carbon

The two characteristic properties of carbon element which lead to the formation of large number of compounds :

(i) Catenation : Carbon can link with carbon atoms by means of covalent bonds to form long chains, branched chains and closed ring compound. Carbon atoms may be linked by single, double or triple bonds.

(ii) Tetravalency : Carbon has 4 valence electrons. Carbon can bond with four carbon atoms, monovalent atoms, oxygen, nitrogen and sulphur.

Saturated and Unsaturated Carbon Compounds

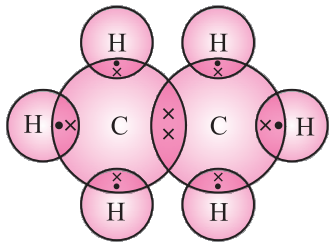
Compounds made up of hydrogen and carbon are called hydrocarbon.

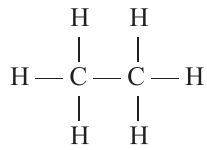
Hydrocarbon

Saturated	Unsaturated	
• Single bond between carbon atoms.	• Double or triple bond between carbon atoms.	
• – C – C –	• – C = C –	– C ≡ C –
• Alkanes	• Alkenes	Alkynes
General formulae		
C_nH_{2n+2}	C_nH_{2n}	C_nH_{2n-2}

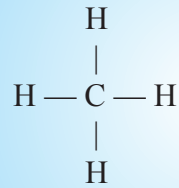
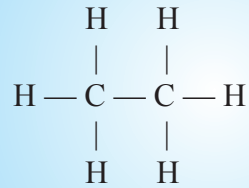
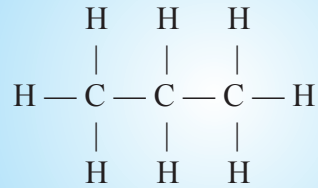
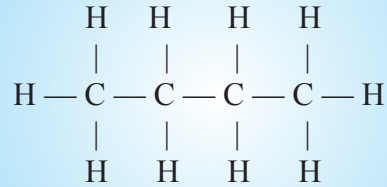
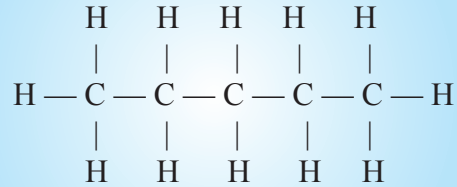
Electron Dot Structure of Saturated Hydrocarbons

Ethane C_2H_6



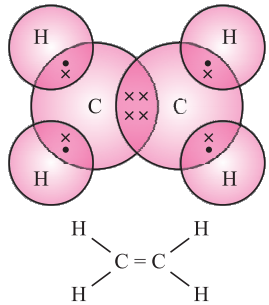


The names, molecular formulae and saturated formulae of saturated hydrocarbons (alkanes) are given below :

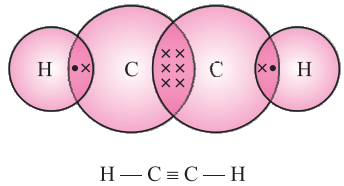
Name of Hydrocarbon	Mileculas formula	Structural Formula
1. Methane	CH_4	
2. Elhane	C_2H_6	
3. Propane	C_3H_8	
4. Butane	C_4H_{10}	
5. Pentane	C_5H_{12}	

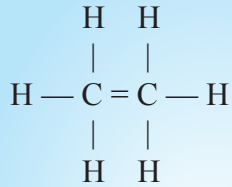
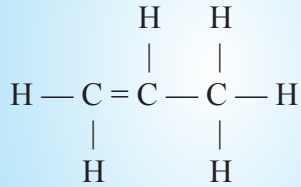
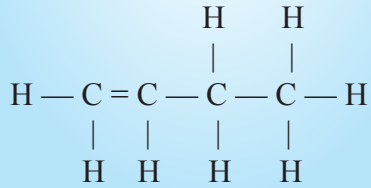
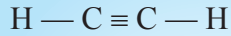
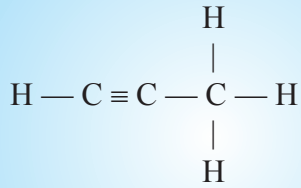
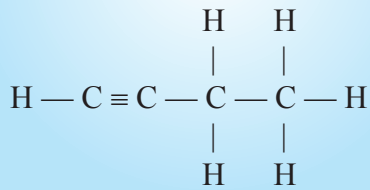
Electron Dot Structure of Unsaturated Hydrocarbons

Ethene C_2H_4



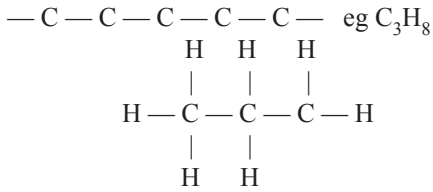
Ethyne C_2H_2



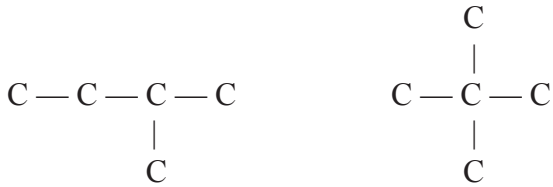
Name of Hydrocarbon	Mileculas formula	Structural Formula
Alkenes :		
1. Ethene	C_2H_4	
2. Propene	C_3H_6	
3. Butene	C_4H_8	
Alkynes :		
1. Ethyne	C_2H_2	
2. Propyne	C_3H_4	
3. Butyne	C_4H_6	

Carbon Compounds on the Basis of Structure

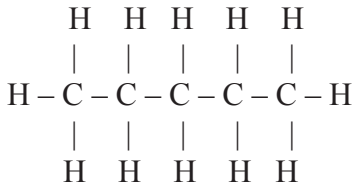
(i) Straight (unbranched) chain



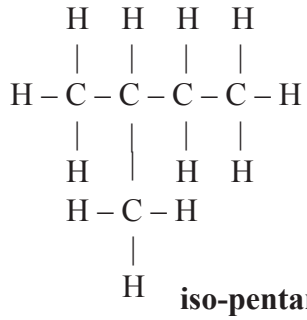
(ii) Branched



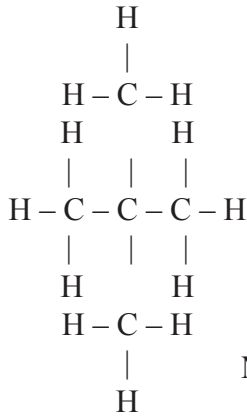
Isomerism of C_5H_{12} **(Pentane)**



n-pentane



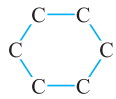
iso-pentane



Neo-pentane

These three above compounds has same molecular formula but different structures are called structural isomers and phenomenon is structural isomerism.

(iii) Cyclic

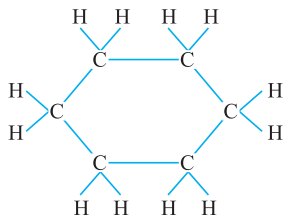


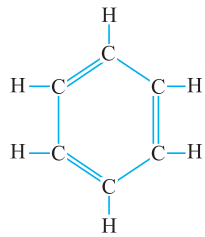
Cyclic Saturated

eg. C_6H_{12} (Hexane)

Cyclic unsaturated

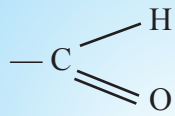
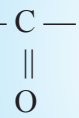
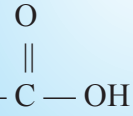
C_6H_6 (Benezene)





Functional Groups

- In hydrocarbon chain, one or more hydrogen atom is replaced by other atoms in accordance with their valancies. These are heteroatom.
- These heteroatom or group of atoms which make carbon compound reactive and decides its properties are called functional groups.

Hetero atom	Functional group	Formula of functional group
Cl/Br	Halo (Chloro/Bromo)	— Cl, — Br, — I
Oxygen	1. Alcohol	— OH
	2. Aldehyde	
	3. Ketone	
	4. Carboxylic acid	
Double bond	1. Alkene group	> C = C <
Triple bond	2. Alkyne group	— C ≡ C —

Homologous Series

It is series of compounds in which the some functional group substitutes for the hydrogen in a carbon chain.

E.g., Alcohols – CH_3OH, C_2H_5OH, C_3H_7OH, C_4H_9OH

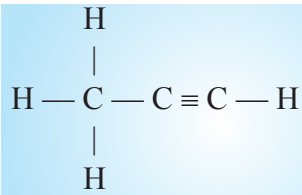
- Have same general formula.
- Any two homologues differ by – CH_2 group and difference in molecular mass is 14μ.
- Have same chemical properties but show gradual change in physical properties.

Nomenclature of Carbon Compounds

(i) Identify the number of carbon atoms in compounds.

(ii) Functional group is indicated by suffix or prefix.

Functional Group	Prefix/Suffix	Example
1. Halogen	Prefix – Chloro, Bromo, Iodo etc.	H — C(H) — C(H) — C(H) — Cl Chloro Propane
2. Alcohol	Suffix – ol	H — C(H) — C(H) — C(H) — OH Propanaol
3. Aldehyde	Suffix – al	H — C(H) — C(H) — C = O Propanal
4. Ketone	Suffix – one	H — C(H) — C(=O) — C(H) — H Propanone
5. Carboxylic acid	Suffix – oic acid	H — C(H) — C(H) — C(=O) — OH Propanoic acid
6. Alkene (– C = C –)	Suffix – ene	H — C(H) — C(H) — C(H) — H Propene

7. Alkyne (– C ≡ C –)	Suffix – yne	 Propyne

Chemical Properties of Carbon Compounds

(a) Combustion

$$CH_4 + 2O_2 \xrightarrow{\text{Combustion}} CO_2 + 2H_2O + \text{Heat} + \text{Light}$$

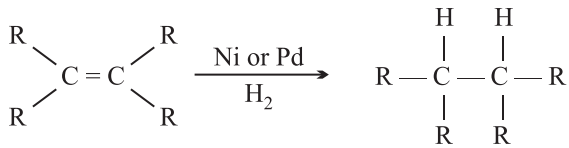
- Carbon and its compounds are used as fuels because they burn in air releasing lot of heat energy.
- Saturated hydrocarbon generally burn in air with blue and non-sooty flame.
- Unsaturated hydrocarbon burns in air with yellow sooty flame because percentage of carbon is higher than saturated hydrocarbon which does not get completely oxidized in air.

(b) Oxidation

Alcohols can be converted to carboxylic acid in presence of oxidizing agent alkaline $KMnO_4$ (potassium permangnate) or acidic potassium dichromate.

$$\underset{\text{Ethanol}}{CH_3CH_2OH} \xrightarrow[\text{Acidic } K_2Cr_2O_7]{\text{Alkaline } KMnO_4 \text{ Or}} \underset{\text{Ethanoic acid}}{CH_3COOH}$$

(c) Addition Reaction :



Unsaturated hydrocarbon add hydrogen in the presence of catalyst palladium or nickel. Vegetable oils are converted into vegetable ghee using this process. It is also called hydrogenation of vegetable oils.

(d) Substitution Reaction :

$$CH_4 + Cl_2 \xrightarrow{\text{Sunlight}} CH_3Cl + HCl$$

Important Carbon Compounds : Ethanol and Ethanoic acid

Physical Properties of Ethanol

- Colourless, pleasant smell and burning taste.

- Soluble in water.
- Volatile liquid with low boiling point of 351 K.
- Neutral compound.

Chemical Properties

(i) Reaction with Sodium :

$$2Na + CH_3CH_2OH \rightarrow 2CH_3CH_2O^-Na^+ + H_2$$

(Sodium ethoxide)

This reaction is used as a test for ethanol by evolution of H_2 gas (Burn with pop sound).

(ii) Dehydration :

$$CH_3CH_2OH \xrightarrow[H_2SO_4]{\text{Hot conc.}} CH_2 = CH_2 + H_2O$$

Physical Properties of Ethanoic acid

- Colourless liquid having sour taste and have smell of vinegar.
- Boiling point is 391 K.
- When pure CH_3COOH is freezed, it forms colourless ice like solid. So it is called glacial acetic acid.

Chemical Properties

(i) Esterification :

$$CH_3COOH + CH_3CH_2OH \xrightarrow{\text{Acid}} CH_3\underset{\underset{O}{\|}}{C}OCH_2CH_3 + H_2O$$

(Ethanoic acid) (Ethanol) Ester

Sweet smelling ester is formed.

$$CH_3\underset{\underset{O}{\|}}{C}OCH_2CH_3 + NaOH \rightarrow CH_3COONa + CH_3CH_2OH$$

This is saponification as soap is prepared by this.

(ii) Reaction with base :

$$NaOH + CH_3COOH \rightarrow CH_3COONa + H_2O$$

(Sod. acetate)

(iii) Reaction with carbonates and hydrogen carbonates :

$$2CH_3COOH + Na_2CO_3 \rightarrow 2CH_3COONa + H_2O + CO_2$$
$$CH_3COOH + NaHCO_3 \rightarrow CH_3COONa + H_2O + CO_2$$
(Sodium acetate)

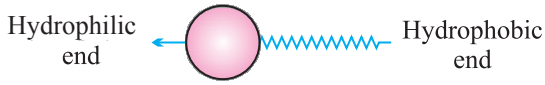
Soaps and Detergents

- Soap is sodium or potassium salt of long chain carboxylic acid. *E.g.,* $C_{17}H_{35}COO^{-}Na^{+}$
- Soaps are effective only in soft water.
- Detergents are ammonium or sulphonate salt of long chain of carboxylic acid.
- Detergents are effective in both hard and soft water.

Soap molecule has :

(i) Ionic (hydrophilic) part

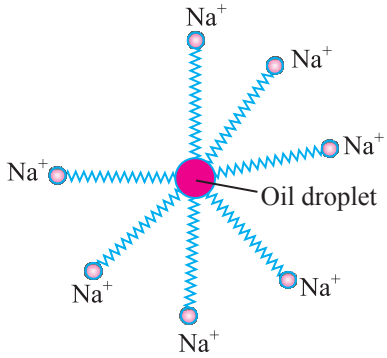
(ii) Long hydrocarbon chain (hydrophobic) part



Structure of soap molecule

Cleansing Action of Soap

- Most dirt is oily in nature and hydrophobic end attaches itself with dirt and the ionic end is surrounded with molecule of water. This result in formation of a radial structure called micelles.
- Soap micelles helps to dissolve dirt and grease in water and cloth gets cleaned.



- The magnesium and calcium salt present in hard water react with soap molecule to form insoluble product called scum. This scum create difficulty in cleansing action.
- By use of detergent, insoluble scum is not formed with hard water and cloths get cleaned effectively.

QUESTIONS

VERY SHORT ANSWER TYPE QUESTIONS (1 Mark)

1. How does carbon attain noble gas configuration ?
2. Draw electron dot structure of water molecule.
3. Write the name and formula of 2nd member of homologous series having general formula C_nH_{2n}.
4. Name the first member of ketones.
5. What is glacial acetic acid ?
6. Why carbon is tetravalent ?
7. An organic compound burns with blue clear flame. Is it saturated or unsaturated compound ?
8. Write the molecular formula of ethanol.
9. Which of the following will show addition reaction : C_4H_{10}, C_2H_6, C_2H_4, CH_4, C_3H_8 ?
10. Name the gas evolved when ethanoic acid is added to sodium carbonate ?
11. Write balanced chemical equation of dehydration of ethanol by hot conc. H_2SO_4.
12. Name organic acid present in vinegar.
13. What is catenation ?
14. Why soap is not suitable for washing cloth when water is hard ?
15. How many covalent bonds are present in pentane (C_5H_{12}) ?

SHORT ANSWER TYPE QUESTIONS (2 Marks)

1. What are hydrocarbons ? Give examples.
2. Why does carbon atom forms a large number of compounds ?
3. Write down two characteristics of the compounds of an homologous series.
4. Covalent compounds generally don't conduct electricity. Why ?
5. Write down structural formula of :

   (a) Propanone (b) Hexanal
6. Why carbon is unique in nature ?

7. Which is better for health butter or vegetable oil ? Why ?
8. Complete the following reactions :

   (a) $CH_4 + O_2 \rightarrow$ (b) $CH_4 + Cl_2 \xrightarrow{\text{Sunlight}}$
9. Identify the functional group in following :

   (a) HCHO (b) CH_3COOH

   (c) CH_3CH_2OH (d) CH_3COCH_3
10. (a) Why is ethanol used in making of tincture iodine, cough syrup, tonic etc.

    (b) What is the role of conc. H_2SO_4 in making ethane from ethanol ?

SHORT ANSWER TYPE QUESTIONS (3 Marks)

1. Differentiate between soap and detergents.
2. What is oxidizing agent ? Give two examples.
3. What is hydrogenation ? Write its industrial application.
4. What is homologous series ? Explain with the help of example.
5. Write IUPAC names of :

   (a) $HC \equiv CH$ (b) $CH_3CH_2CH_2OH$

   (c) CH_2CHO
6. What is structural isomerism ? Draw isomers of pentane (C_5H_{12}).
7. A boy sharpens a pencil at both the ends and connects them to the poles of the battery. Will the current flow through the circuit ? Give reason.
8. A neutral organic compound is warmed with some ethanoic acid and a little of conc. H_2SO_4 to form ester, vapours having sweet smell are evolved. Write the chemical equation and what type of functional group is present in this organic compound ?

LONG ANSWER TYPE QUESTIONS (5 Marks)

1. Explain the cleansing action of soap with the help of diagram.
2. When ethanoic acid reacts with sodium hydrogen carbonate, the salt 'X' is formed and gas 'Y' is evolved.

   (a) Identify 'X' and 'Y'.

   (b) Write balanced chemical equation of above reaction.

   (c) Describe a test to identify the gas 'Y' evolved.

Hints to Long Answer Type Questions

1. Page No. 74, Fig. 4.12 (Diagram of formation of micelles) of NCERT.
2. $2CH_3COOH + Na_2CO_3 \rightarrow 2CH_3COONa + H_2O + CO_2$

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. *E.g.,* 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.

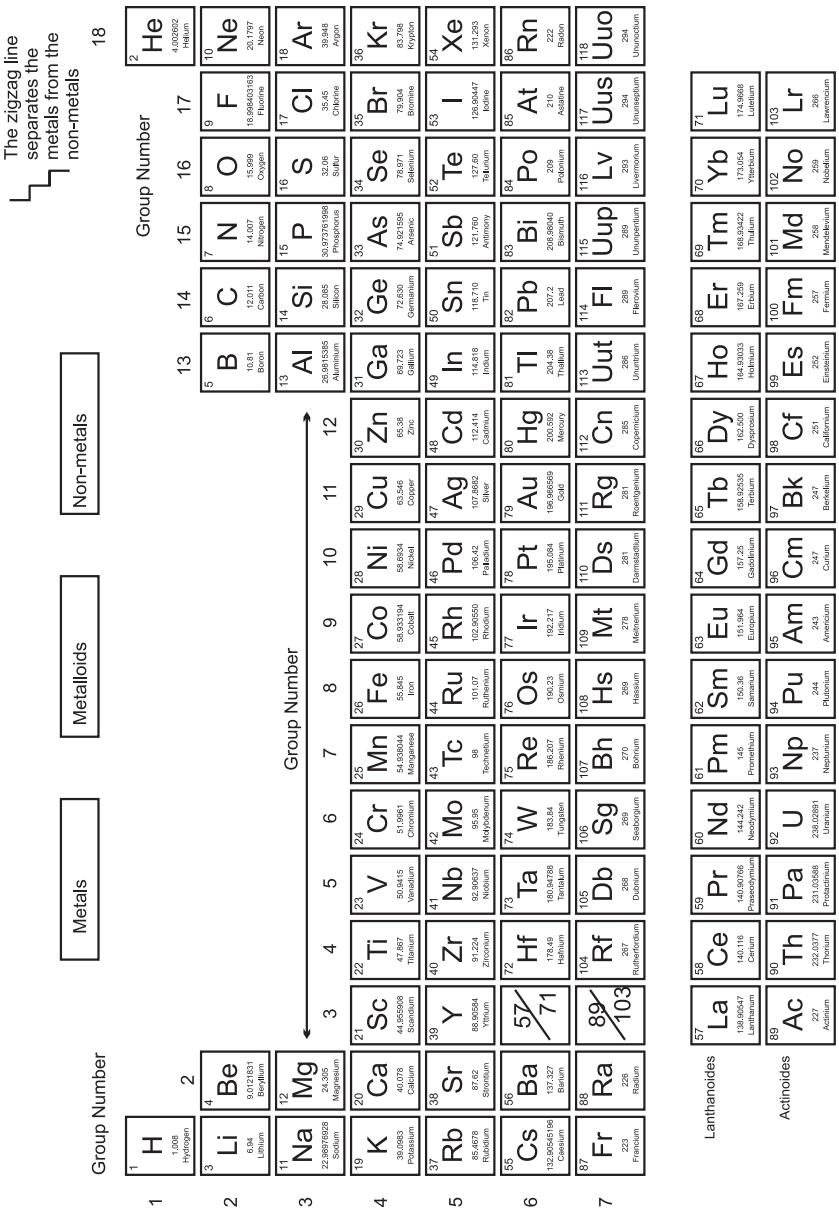
Mendeleev's periodic table is based on the chemical properties of elements. It contains 6 periods (horizontal rows) and 8 groups (vertical columns).

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 : No. of valence electrons present in the outermost shell of its atom.

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 QUESTIONS (1 Mark)

1. Write down three elements that show Dobereiner's triad.
2. Write down two drawbacks of Newland's law of octaves.
3. What was the need for classification of elements ?
4. Which important property did Mendeleev used to classify the elements in his periodic table ?
5. What do you mean by valency ?
6. How many elements are known till date ?
7. State Modern Periodic law.

8. Name the elements and its valency having electronic configuration 2, 8, 3.

9. How many rows and columns are there in modern periodic table ?

10. Why properties of elements are different of same period ?

SHORT ANSWER TYPE QUESTIONS (2 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.

SHORT ANSWER TYPE QUESTIONS (3 Marks)

1. 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 ?

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

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

3. 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 ?

4. What are metalloids ? Write two examples.

LONG ANSWER TYPE QUESTIONS (5 Marks)

1. Write down five major differences between Mendeleev's periodic table and Modern periodic table.

2. Element A has atomic no. 16.

(a) Name of the element

(b) Physical state

(c) Compound with hydrogen

(d) Metal or non-metal

(e) Nature and formula with oxides

Hints to Long Answer Type Questions

1.

	Medeleev's Periodic Table	Modern Periodic Table
(a)	Elements have been arranged in increasing order of atomic masses.	Elements have been arranged in increasing order of their atomic number.
(b)	It consist 8 groups.	It consist 18 groups.
(c)	All the groups from I to VIII are divided into two sub-groups.	No sub-groups.

2. Element A(16) = 2, 8, 6.

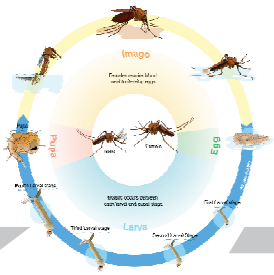
(a) Sulphur (S)

(b) Solid

(c) H_2S

(d) Non-metal

(e) Acidic in nature; oxide – SO_2



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 :

Life Processes

↓ **Growth** ↓ **Digestion** ↓ **Respiration** ↓ **Circulation** ↓ **Excretion**

I. Nutrition

(The whole process by which an organism obtain 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 food.

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 $\xrightarrow[ino]{Convert}$ 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 $\rightarrow$ Sunlight absorbed by chlorophyll
- $CO_2 \rightarrow$ Enters through stomata and oxygen (O_2) is released as by-product through stomata on leaf.
- Water $\rightarrow$ 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

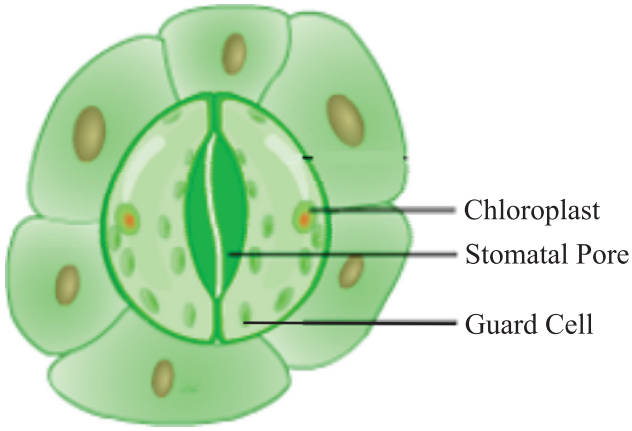
- Conversion of light energy into chemical energy + splitting (breaking) of water into hydrogen and oxygen
- Reduction of CO_2 to carbohydrates

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 etc.

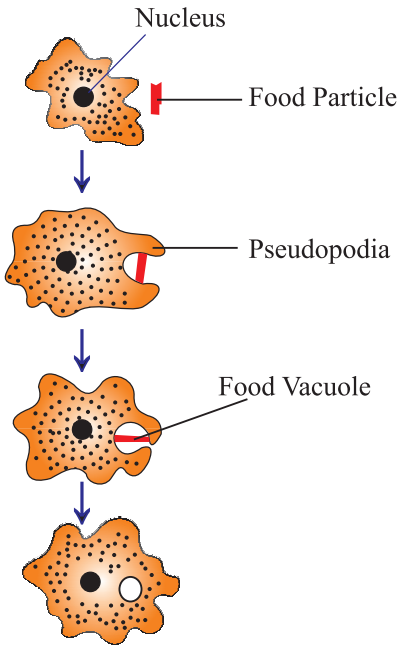
How do organisms obtain their food

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

Example : (i) Amoeba

(ii) Paramaecium

(i) Amoeba



Amoeba → Pseudopodia
↓ extension of cell membrane
Capture food
↓
Take in | food vacuole |
↓
Digestion of food in food vacuole → Diffusion (of simple substances in cytoplasm)
↓
Undigested food
↓
move to surface of cell and is thrown out.

Nutrition in Amoeba

(ii) Paramaecium

Paramaecium → Cilia (Present all over the body) → Take in food → At a specific spot

I. NUTRITION

NUTRITION

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)

Different organisms utilize different nutritional processes as it depends upon the source of carbon from where the food is taken.

Nutrition in Human Beings

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 $\xrightarrow[\text{amylase [Saliva]}]{\text{Salivay}}$ 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

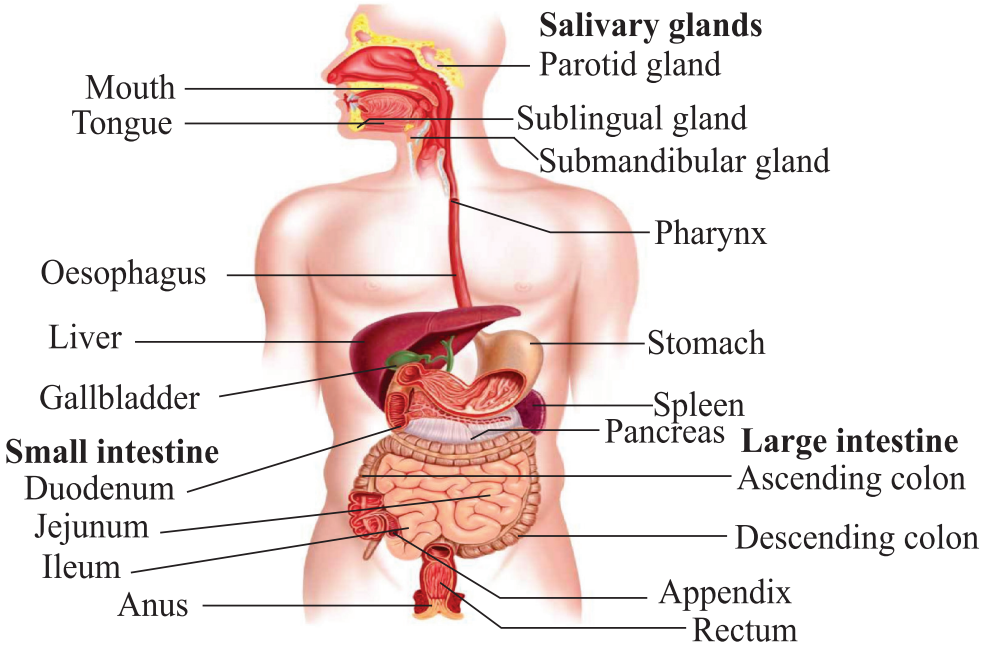
PEPSIN	**HCl**	**MUCUS**
(Enzyme that breaks down proteins)	(Makes medium acidic)	(Protects inner lining of the stomach)

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 food into the blood

Small Intestine →	(c) Receives secretion from → Liver → Bile ↓ Large fat Globules → Emulsifi small globules → 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.



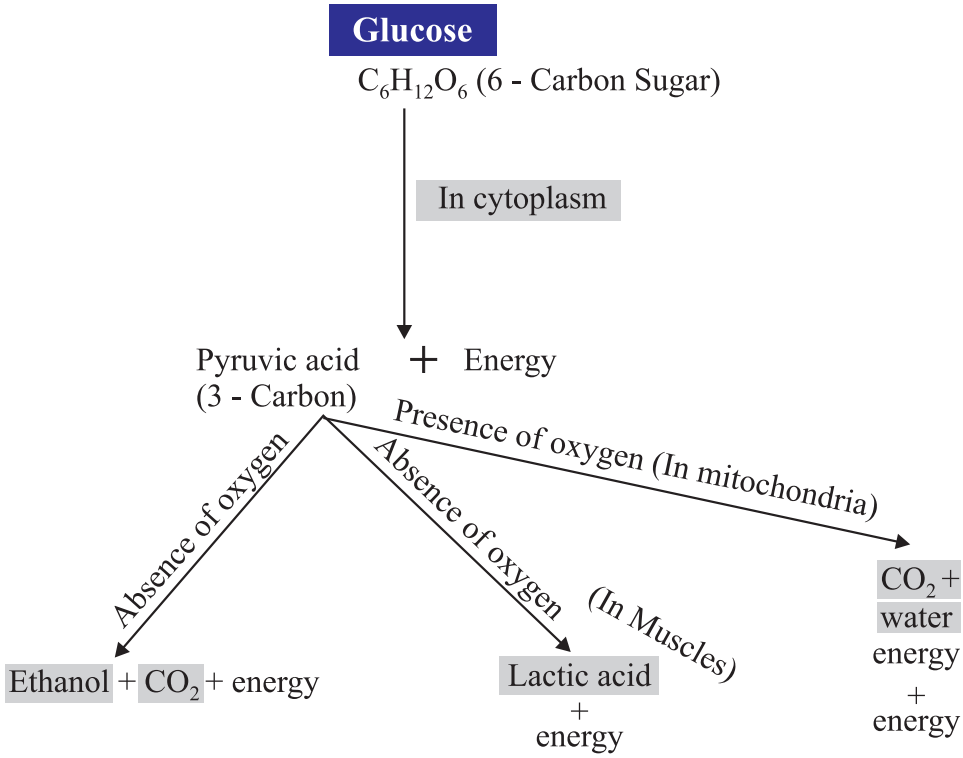
Human Digestive System

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

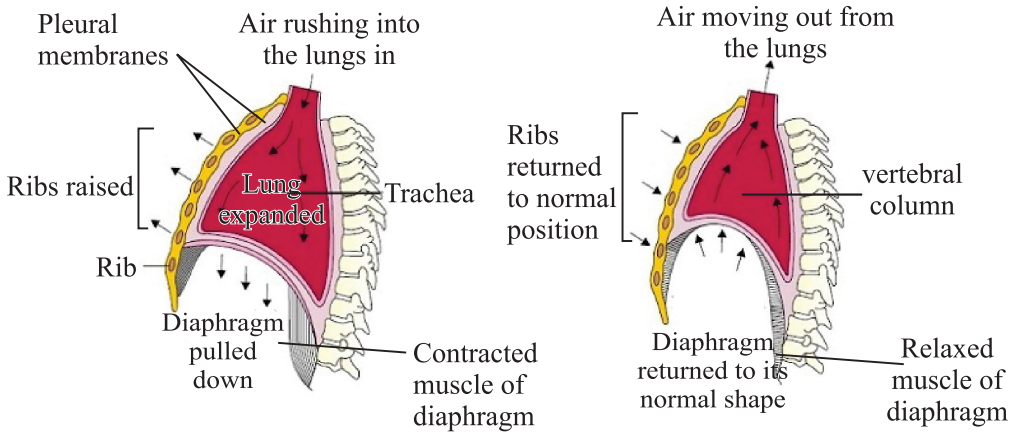
Passage of air through the respiratory system :

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) (in alveoli)

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)

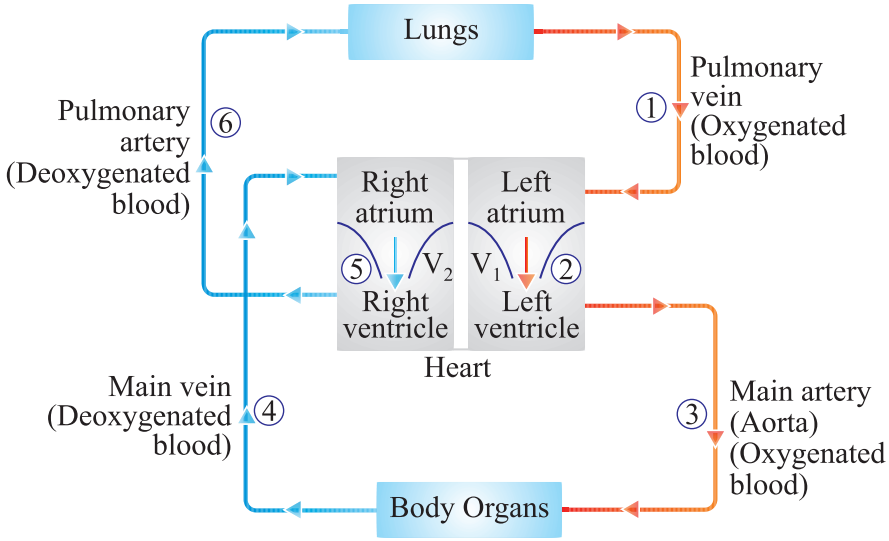
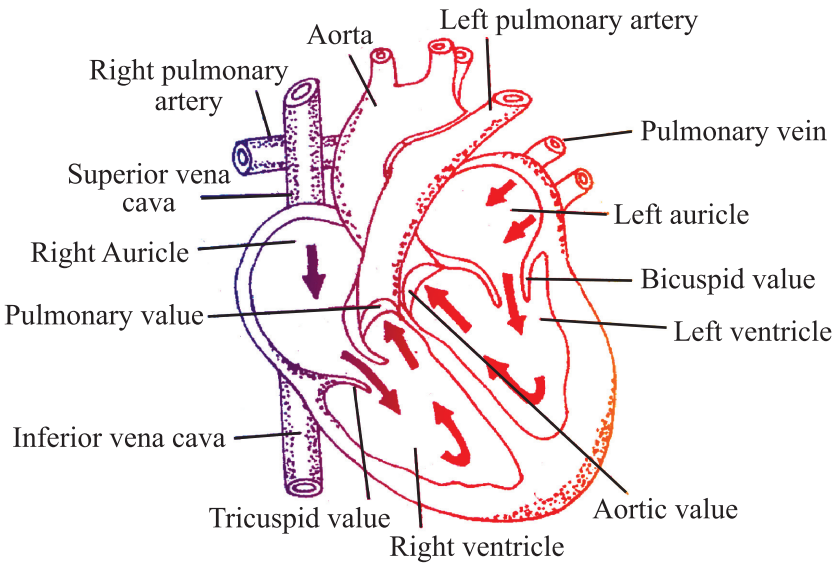


Diagram to show blood circulation in human body

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)

Solid Component			Liquid Component
Blood Corpuscles			Plasma
R. B. C.s	**Blood Platelets**	**W. B. C.**	A yellow colour fluid contain 90% water & 10% organic substances like - plasma, proteins viz. albumin, globulin, inorganic - mineral ions.
• 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	

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. Deepseated	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.

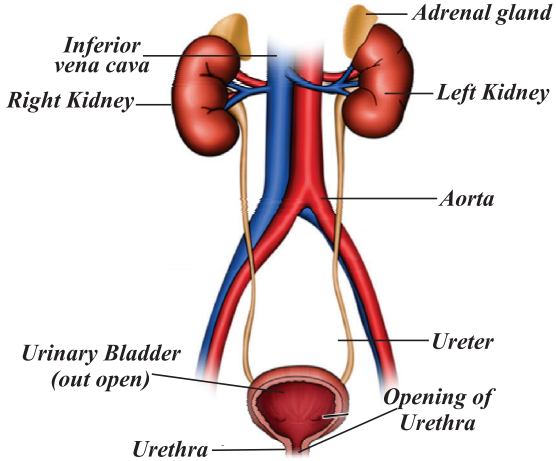
Function :

(a) Absorption and upward movement of water and minerals by creating 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 :

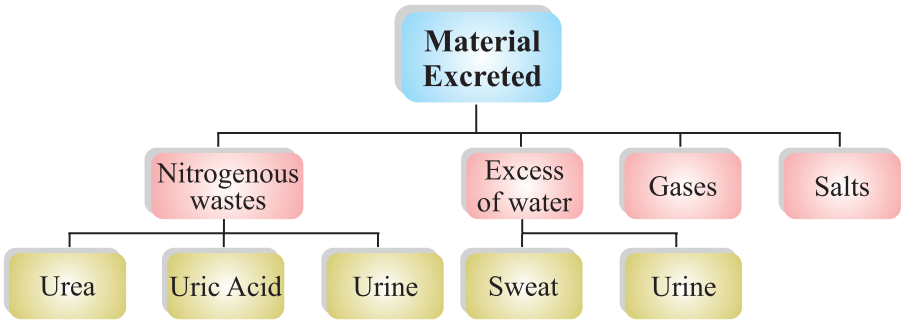
(1) The kidneys : The excretory organ
(2) The ureters : The ducts which drain out urine from the kidneys
(3) The urinary bladder : The urinary reservoir
(4) The urethra : The channel to the exterior



The human excretory system

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

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.

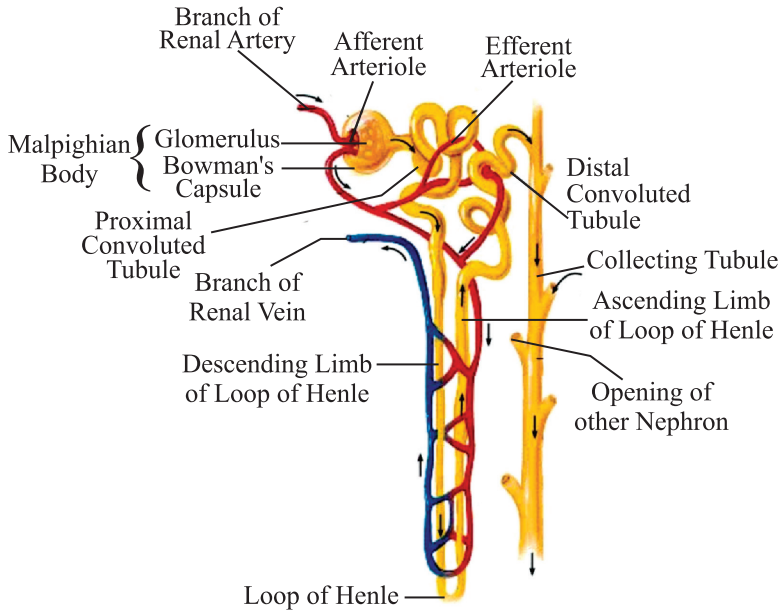
Functions of Nephron

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

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.



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.

QUESTIONS

VERY SHORT QUESTIONS (1 Mark)

1. State one difference between autotrophic and hetrotrophic mode of nutrition.
2. Define peristaltic movement.
3. What is the role of saliva in the digestion of food ?
4. Name the tissue that transports water and minerals in plants.
5. What is the role of acid in our stomach ?
6. What is emulsification ?
7. Name the cell organelle in which photosynthesis occur.
8. Name the largest artery in the human body.
9. Define transpiration.
10. What is the structural and functional unit of kidney called ?

SHORT ANSWER TYPE QUESTIONS (2 Marks)

1. How is small intestine designed to absorb digested food ?
2. What are stomata ? Draw a labeled diagram of stomata.
3. Write the equation for the process of breakdown of glucose in a cell :

   (a) in the presence of oxygen.

   (b) in the absence of oxygen.

4. Write the differences between inhalation and exhalation.
5. List the three events which occur during photosynthesis.
6. How does transpiration help in upward transport of substances.
7. Write the functions of the components of blood.
8. Why is small intestine longer in herbivores than in carnivores ?
9. Explain the cause of cramps after excessive physical exercise.
10. Why is the rate of breathing in aquatic organisms much faster than that seen in terrestrial organisms.

SHORT ANSWER TYPE QUESTIONS (3 Marks)

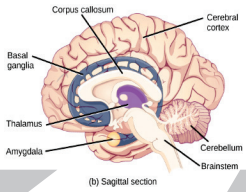
1. Describe the process of double circulation in human beings.
2. What are the methods used by plants to get rid of their waste products ?
3. Give reason for the following :
   (a) Arteries are thick walled blood vessels.
   (b) Veins are thin walled blood vessels.
   (c) Veins have valves in them.

LONG ANSWER TYPE QUESTIONS (5 Marks)

1. If you chew chapatti for long, after some time it taste sweet ? Why is this so?
2. What is the benefit of residual volume of air in the respiratory process ?
3. Why is the energy needs in plants is very less as compared to animals ? Explain.
4. Draw a well-labelled diagram of Nephron. Explain the process of formation of urine in the human kidney.
5. Draw a diagram showing Human Respiratory System. Label the following parts :
   (a) Alveolus (b) Trachea
   (c) Bronchus (d) Lungs

Hints to Long Answer Type Questions

1. Chapati will taste sweet as saliva breaks down starch which is a complex molecule to give sugar.
2. The lungs always contain a residual volume of air so that there is sufficient time for oxygen to be absorbed and for the carbon dioxide to be released.
3. Plant gets most of energy during photosynthesis.
4. See the given diagram.
5. See the given diagram.



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

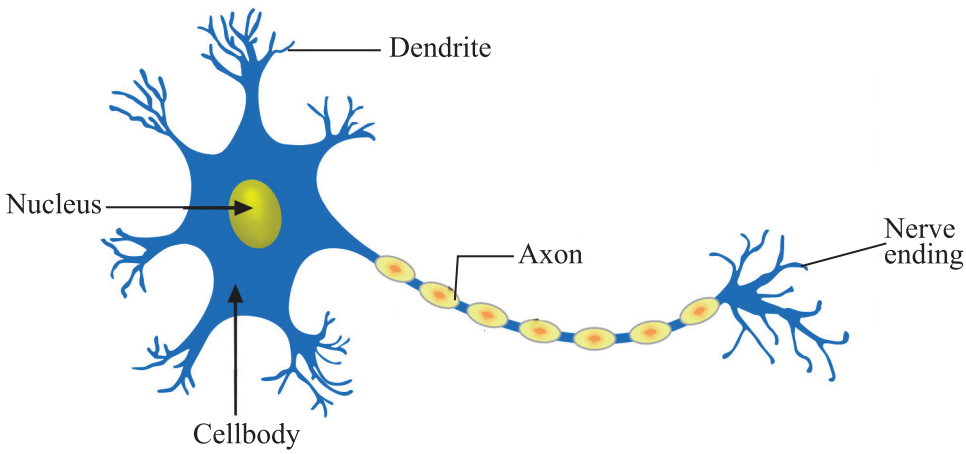
(b) Eyes :
- Photoreceptors
- Seeing

(c) Skin :
- Thermoreceptors
- 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.



Parts of Neuron :

(a) Dendrite : Acquires information.

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

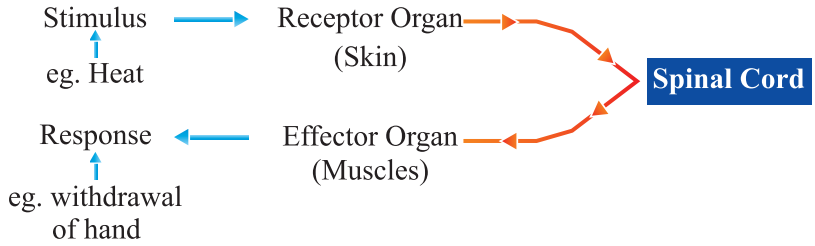
(c) Axon : Longest fibre on the cell body is called axon. It transmits electrical impulse from cell body to dendrite of next neuron.

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.



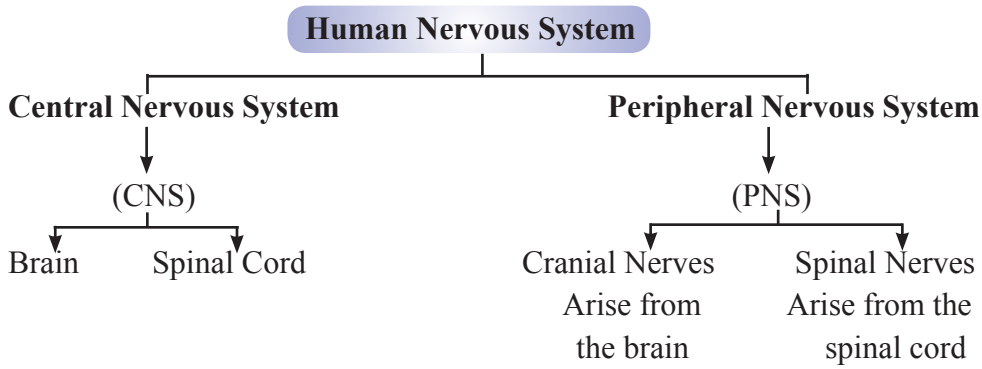
Response : Responses are of three main types :

(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 :

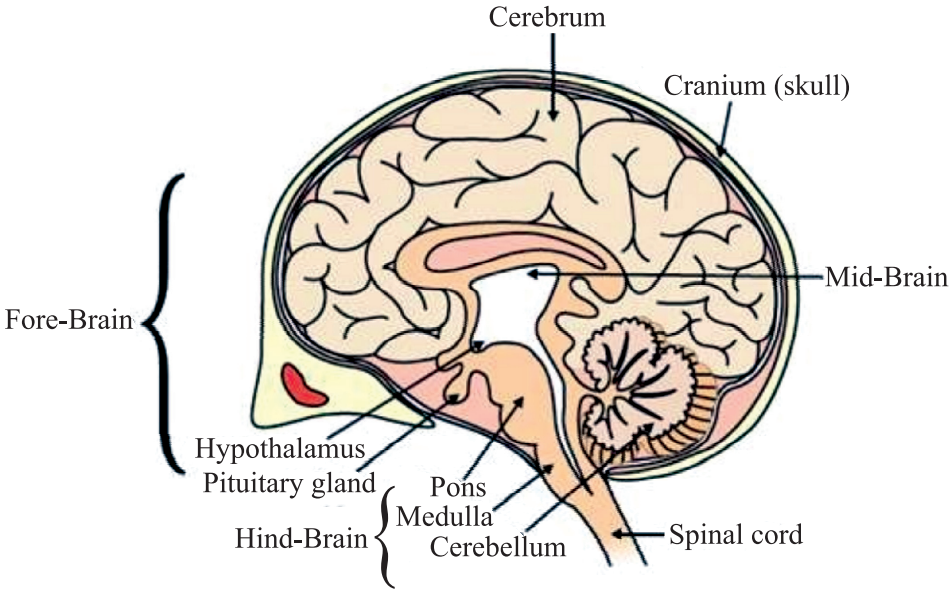
- Change in pupil size.
- Reflex movements of head, neck and trunk.

(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.



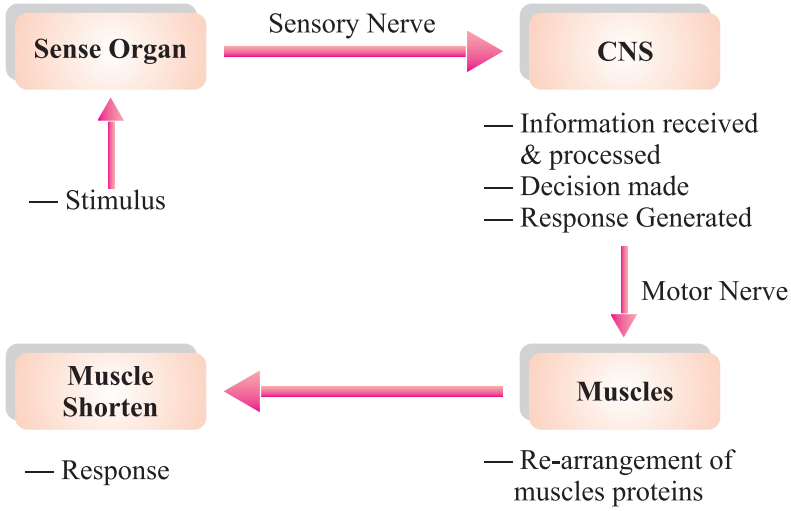
Human Brain

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.

- 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.
- **Geotropism :** Movement towards/away from gravity.
- **Chemotropism :** Growth of pollen tube towards ovule.
- **Hydrotropism :** Movement 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 :

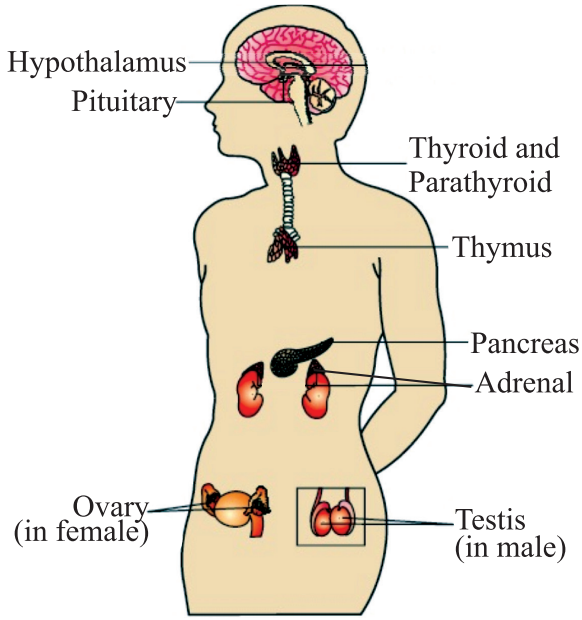
Hormones : Hormones are the chemical substances which coordinate the activities of living organisms and also their growth.

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 (b)Estrogen in females	Testis Ovaries	Genital/lower abdomen area	Changes associated with puberty (Sexual maturity)

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.

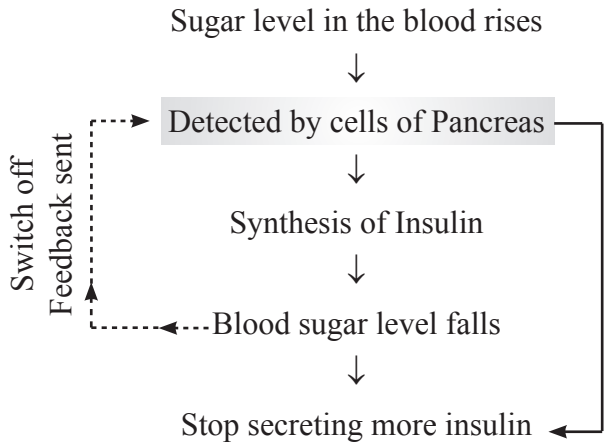
Cause : Due to the deficiency of insulin hormone secreted by pancreas that is responsible to control blood sugar levels.

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 :



QUESTIONS

VERY SHORT QUESTIONS (1 Mark)

1. Where is auxin synthesized in plants ?
2. Which gland is known as master gland ?
3. Name the hormone that regulates blood sugar level.
4. What is synapse ?
5. What are tropic movements ?
6. Which part of the brain is responsible for maintaining posture and balance of our body ?
7. Which hormone has inhibiting effects on growth of plants ?
8. What is phototropism ?

9. What are the components of central nervous system ?

10. What happens at synapse between two neurons ?

SHORT ANSWER TYPE QUESTIONS (2 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?

SHORT ANSWER TYPE QUESTIONS (3 Marks)

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

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

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

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

LONG ANSWER TYPE QUESTIONS (5 Marks)

1. Draw a labelled diagram of human brain and state the functions of its different parts.

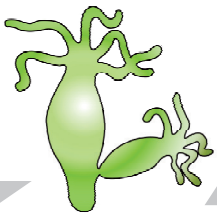
2. What are hormones ? Give the name of associated gland and functions of different animal hormones.

3. What is feedback mechanism ? Explain its working with the help of one example.

4. (a) How brain and spinal cord are protected ?

   (b) What are the different parts of human nervous system ?

   (c) What are the limitations of nervous system ?



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.

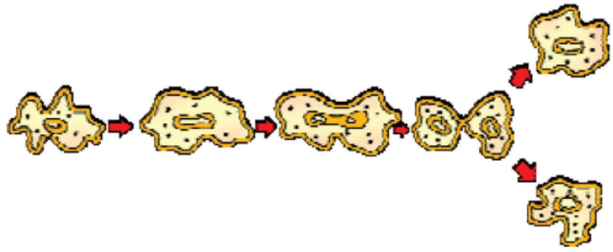
(b) Sexual Reproduction

- 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

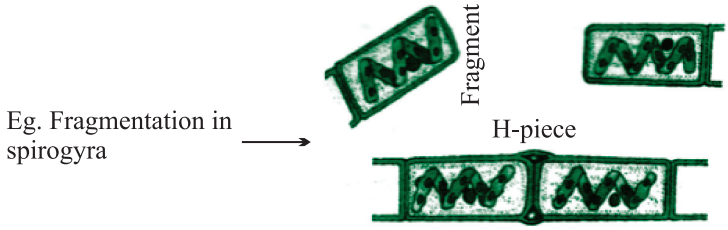
(i) Fission : The parent cell divides into daughter cells.

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



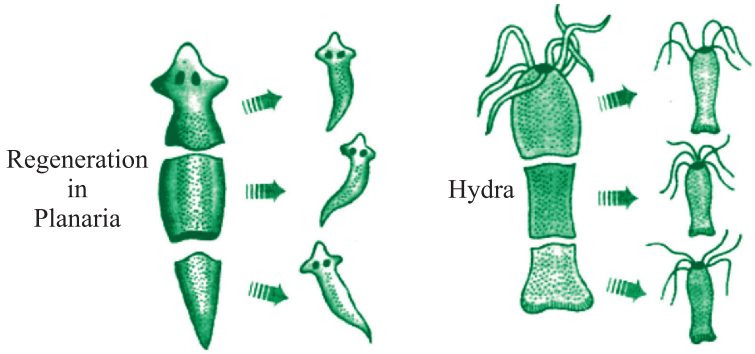
Binary fission in Amoeba

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



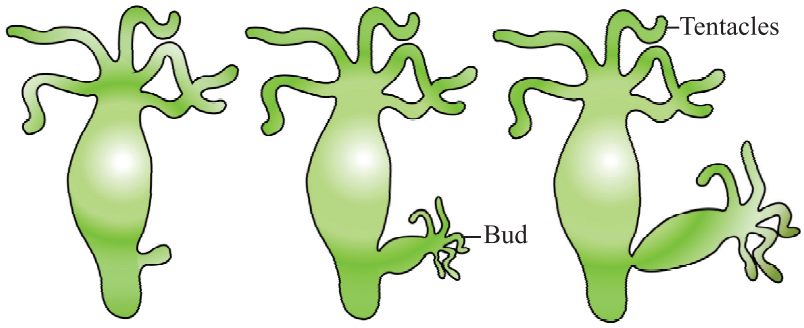
Fragmentation in Spirogyra

(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

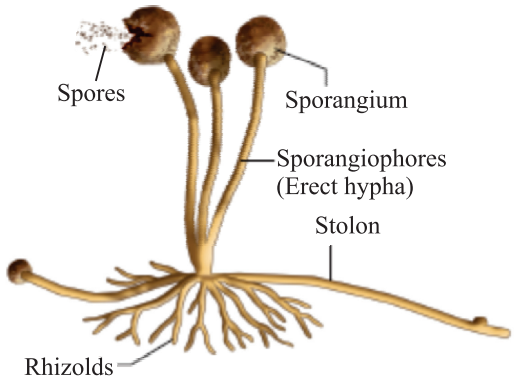
(c) Layering : *E.g.,* Jasmine

(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.

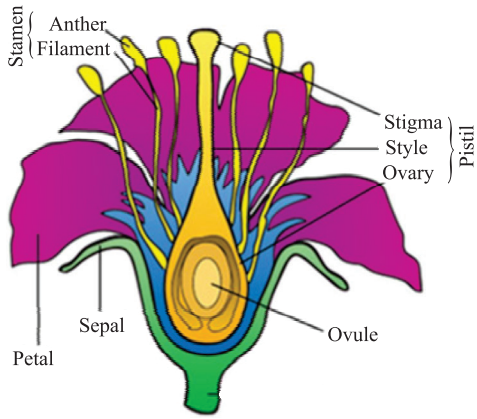
Sexual Reproduction in Plants

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

Types of Flowers

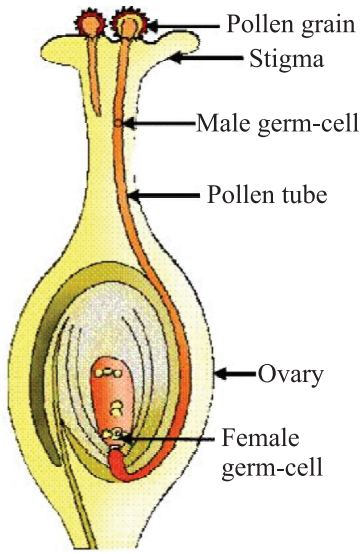
- **Bisexual flower :** Both male and female reproductive parts are present. *E.g.,* Hibiscus, mustard.
- **Unisexual flower :** Either male or female reproductive part is present. *E.g.,* Papaya, watermelon.

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.

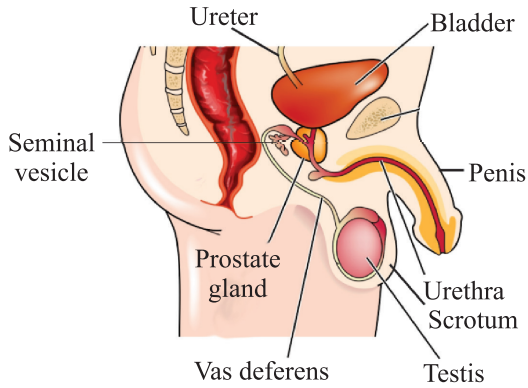
- Male germ cell *i.e.,* sperms are formed here.
- Testes release male sex hormone (testosterone). Its function is :
  (i) Regulate production of sperms.
  (ii) Bring changes at puberty.

(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.

- Uterus opens into vagina through cervix.

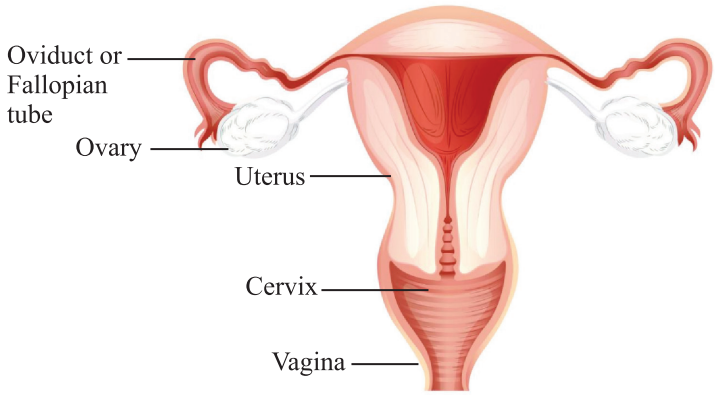


Fig. Human – female reproductive system

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.

QUESTIONS

VERY SHORT ANSWER TYPE QUESTIONS (1 Mark)

1. Name the two types of reproduction.
2. What type of reproduction takes place in plasmodium ?
3. Define vegetative propagation.
4. Where is DNA present in a cell ?
5. Name the glands associated with male reproductive system.
6. What is menstruation ?
7. Name two contraceptive methods.
8. Where are the reproductive parts located in a plant ?

SHORT ANSWER TYPE QUESTIONS (2 Marks)

1. Write two important functions of testosterone.
2. What is placenta ? Also write its functions.
3. Why do we see different types of organisms around us ?
4. What is the importance of variation ?
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.

SHORT ANSWER TYPE QUESTIONS (3 Marks)

1. What is tissue culture ?
2. Explain the process of fertilisation in flowering plants.
3. Name the different constituents of semen.
4. Draw a well-labelled diagram of male reproductive system.
5. What is pre-natal sex determination ? Why is it banned ?
6. 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.
3. What is contraception ? Give different methods of contraception.
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.

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

The transmission of characters/traits from one generation to the next generation.

Variation

The differences in the characters/traits between the parent and offspring.

Somatic 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.

Gametic variation

- 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

Appear during reproduction whether organisms multiply

Asexually	Sexually
• 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, 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.

(TABLE OF CONTRASTING CHARACTERS. SEVEN PAIRS)

CHARACTER	DOMINANT TRAIT	RECESSIVE TRAIT
Flower colour	Violet	White
Flower position	Axial	Terminal
Seed colour	Yellow	Green
Seed shape	Round	Wrinkled
Pod shape	Inflated	Constricted
Pod colour	Green	Yellow
Height of plant	Tall	Dwarf/Short

Seven pairs of contrasting characters in Garden Pea.

Medel'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.

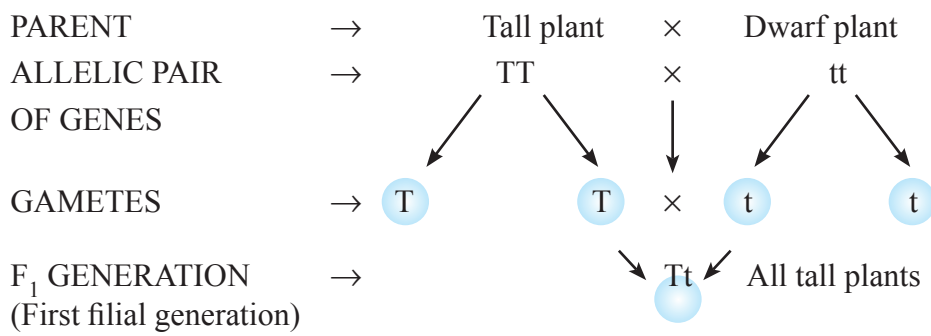
- **Mendel's Experiments :** Mendel conducted a series of experiments in which he crossed the pollinated plants to study one character (at a time).

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



SELF POLLINATION of F_1 gametes → Tt × Tt

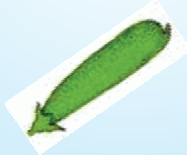
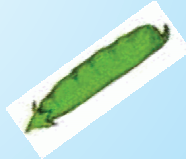
GAMETES: T, t | T, t

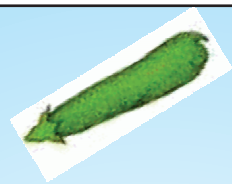
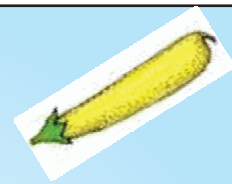
F_2 GENERATION →

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

CHARACTER	DOMINANT TRAIT	RECESSIVE TRAIT
Seed shape	Round	Wrinkled
Seed colour	Yellow	Green
Flower colour	Violet	White
Pod shape	 Inflated/full	 Constricted

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 F1 progeny were tall, no medium height plant. (Half way characteristic)

(ii) F2 progeny ¼ were short, ¾ were tall.

(iii) Phenotypic ratio F2 – 3 : 1 (3 tall : 1 short)

Genotypic ratio F2 – 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 × Rr Yy: RY, Ry, rY, ry

F_2 gametes →

	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.

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

In some animals, the temperature at which
the fertilized eggs are kept decides the gender.
E.g., in turtle

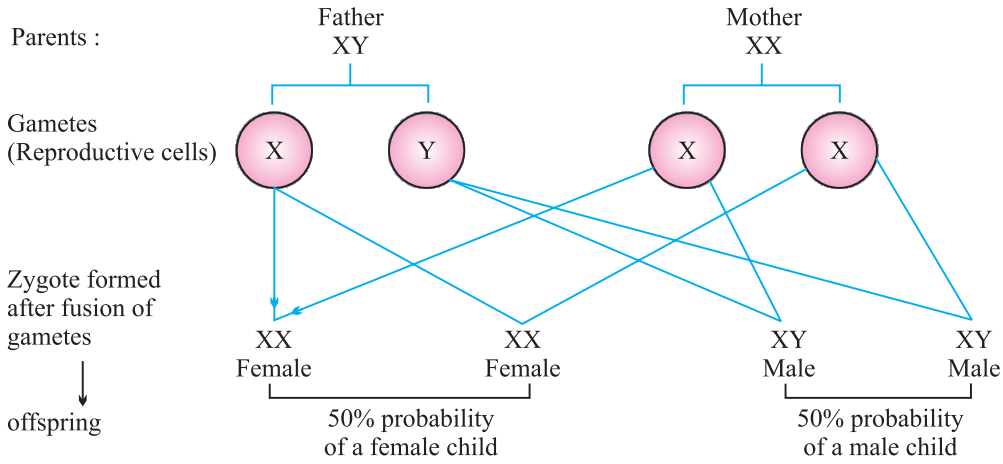
Genetic

In some animals like humans gender or
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
XY – Male

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 — ↓ 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.

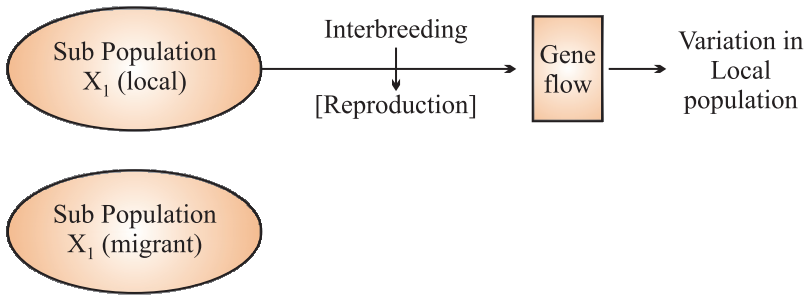
ACQUIRED AND INHERITED TRAITS

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.

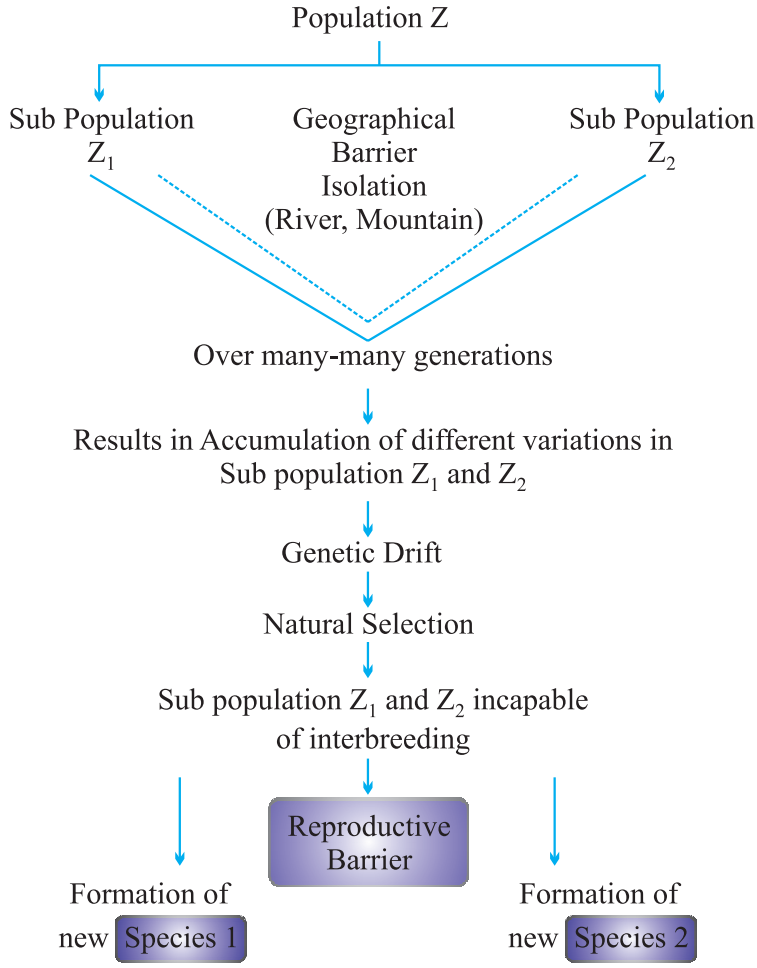
1. Gene flow : Occurs between population that are partly but not completely separated.



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

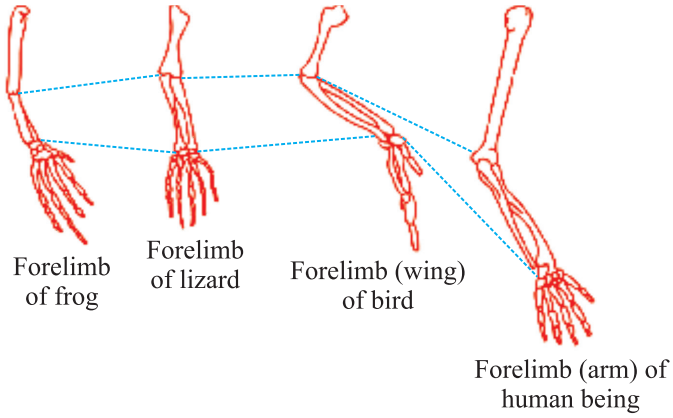
Both evolution and classification are interlinked.

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	Different basic structure, but perform similar function *i.e.,* flight.
Wings of bird →	Feathery covering along the arm	

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.

II. Detecting the ratios of difference of the same element in the fossil material *i.e.,* **Radio-carbon dating** [C-(14) dating]

Recent ⟶

1. (Top layer of the earth surface)
2. .....
3. .....
4. .....
5. .....

• ⟵ Older

6. .....

Evolution by Stages

Evolution takes place in stages *i.e.,* bit by bit generations.

I. Fitness Advantage

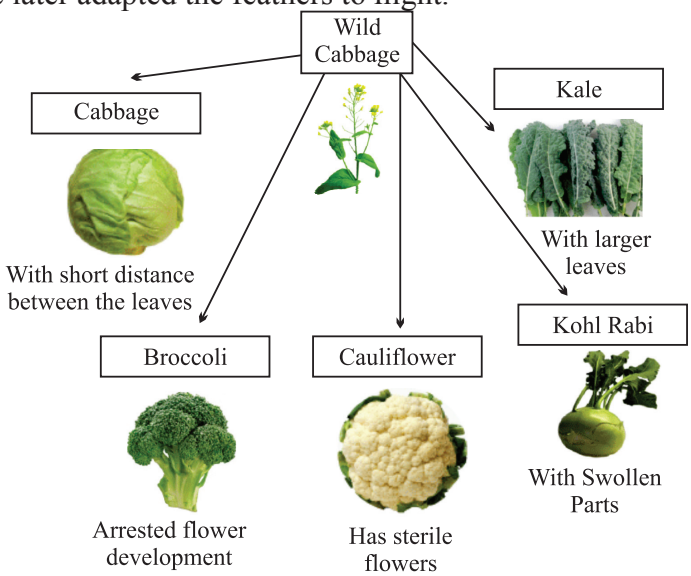
Evolution of Eyes : Evolution of complex organs is not sudden. It occurs due to minor changes in DNA, however takes place bit by bit over generations.

- 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.

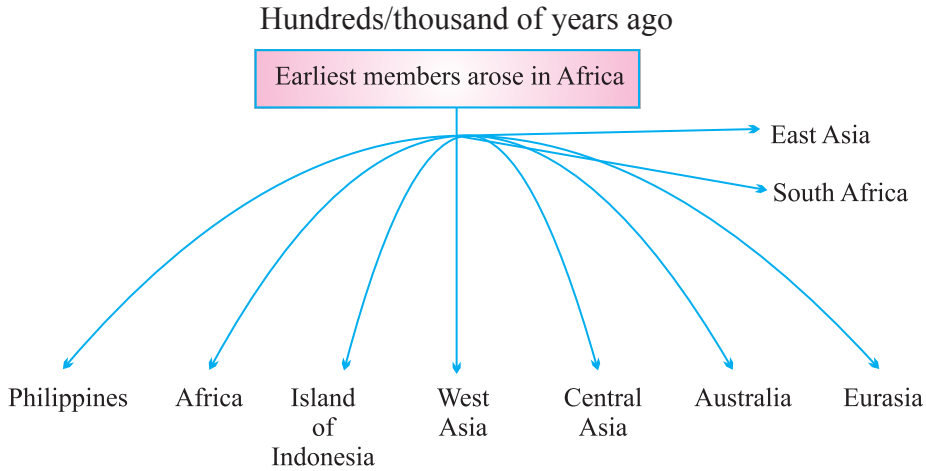
HUMAN EVOLUTION

Tools to study Human evolutionary relationship

- Excavating
- Time dating
- Fossils
- Determining DNA sequences

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 character *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 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)

1. Write the scientific name of men and 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 five varieties of vegetables which have been produced from 'wild cabbage' by the process of artificial selection.

SHORT ANSWER TYPE QUESTIONS (2 Marks)

1. Differentiate between homologous and analogous organs, with examples.
2. What are fossils ? How can the age of fossils be determined ?

SHORT ANSWER TYPE QUESTIONS (3 Marks)

1. Variation is beneficial to the species but not necessarily for the individual. Give three reasons to justify it.
2. The human hand, cat paw and horse foot, when studied in detail show the same structure of bones and point towards a common origin.

   (a) What do you conclude from this ?

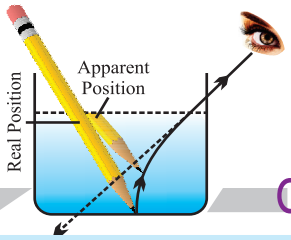
   (b) What is the term given to such structures ?

LONG ANSWER TYPE QUESTIONS (5 Marks)

1. Which one is the edible part in kale, kohlrabi, broccoli, cabbage and cauliflower ?
2. Name a recessive trait which is quiet common in human beings.

Hints to Long Answer Type Questions

1. Kale - Large leaves
   Kohl rabi - Swollen part
   Broccoli - Arrested flower
   Cauliflower - Sterile flower
   Cabbage - Leaves with short distance between them
2. (a) Human height
   (b) Skin colour
   (c) Attachment of ear lobes
   (d) Eye colour



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.

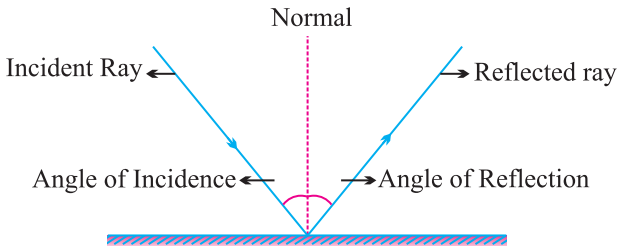
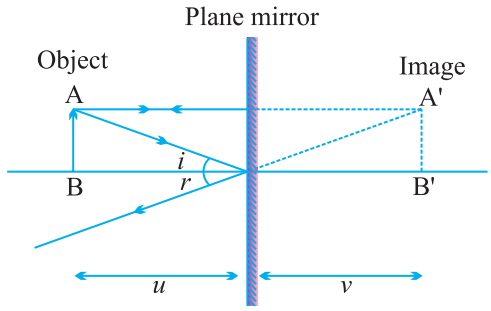


Image : It is a point where atleast two light rays actually meet or appear to meet.

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.

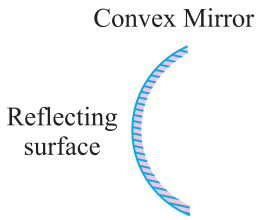
(iv) Laterally inverted.

Lateral Inversion : The right side of the object appears left side of the image and vice-versa.

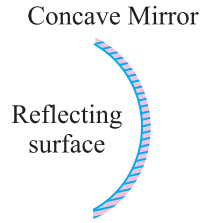
Application of lateral inversion : The word AMBULANCE is written as ƎƆNA⅃UƎMA so that it can be read correctly in rear view mirror of vehicles going in front of it.

Spherical Mirrors : Mirrors whose reflecting surface is curved.

Convex Mirror

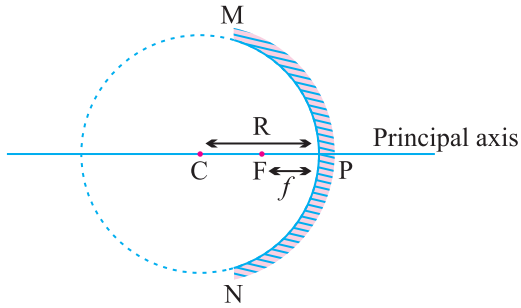


Concave Mirror



- Reflecting surface is curved outwards.
- Diverging mirror

- Reflecting surface is curved inwards.
- Converging mirror



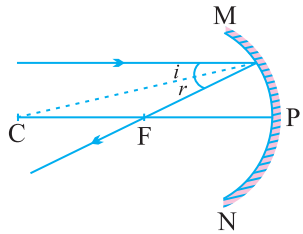
- **Principal axis :** The line joining the pole and center of curvature.
- **Pole (P) :** The centre of the spherical mirror.
- **Aperture (MN) :** It is the effective diameter of the spherical mirror.
- **Center of Curvature (C) :** The centre of the hollow glass sphere of which the mirror was a part.
- **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 curvature :

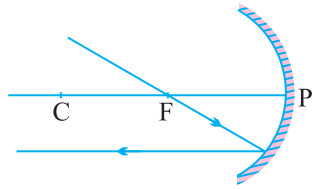
$$f = \frac{R}{2}$$

Rules for making ray diagrams by concave mirror

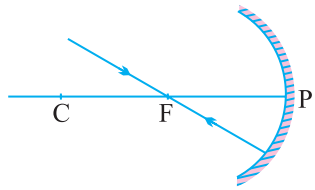
(i) A ray parallel to the principal axis will pass through the principal focus, after reflection.



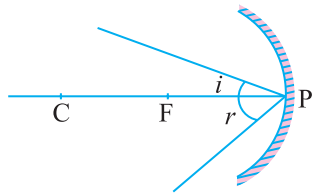
(ii) A ray passing through the principal focus of concave mirror will emerge parallel to principal axis after reflection.



(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.

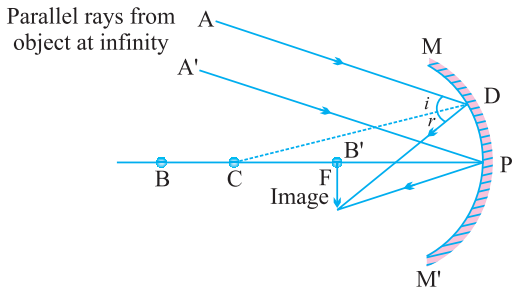


(iv) A ray incident obliquely to the principal axis of a concave mirror is reflected obliquely making equal angle.



Ray diagrams for images formed by concave mirror

(i) When object is at infinity :



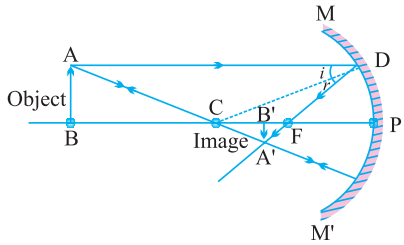
Image

Position – At 'F'

Nature – Real, inverted

Size – Point sized or highly diminished

(ii) When object is beyond 'C'



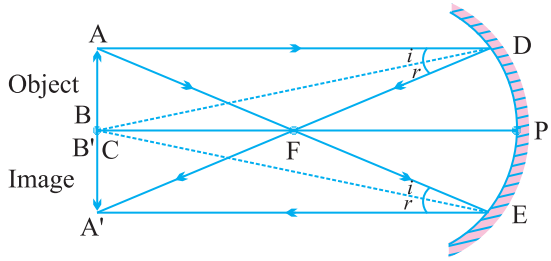
Image

Position – Between 'F' and 'C'

Nature – Real, inverted

Size – Diminished

(iii) When object is at 'C'



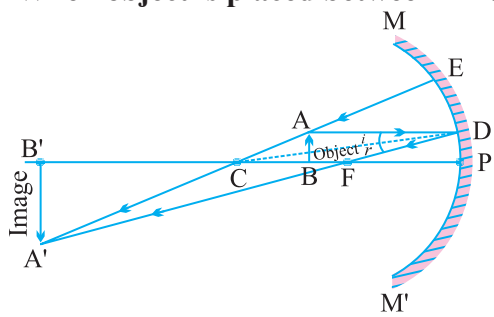
Image

Position – At 'C'

Nature – Real, inverted

Size – Same size as that of object

(iv) When object is placed between 'F' and 'C'



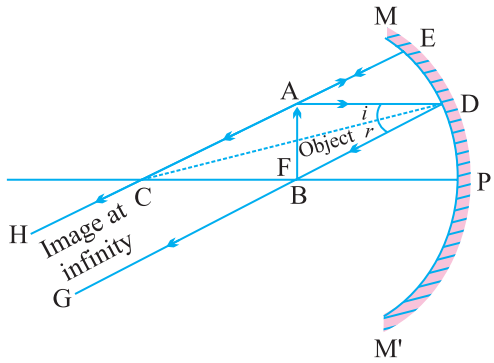
Image

Position – Beyond 'C'

Nature – Real, inverted

Size – Enlarged

(v) When object is placed at 'F'



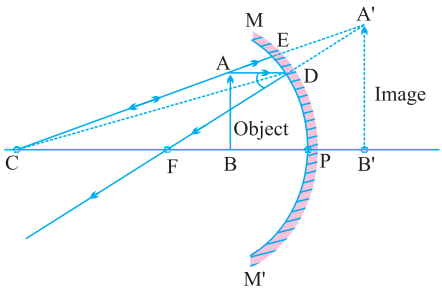
Image

Position – At Infinity

Nature – Real, inverted

Size – Highly enlarged

(vi) When object is between 'P' and 'F'



Image

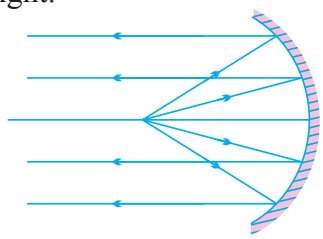
Position – Behind the mirror

Nature – Virtual, erect

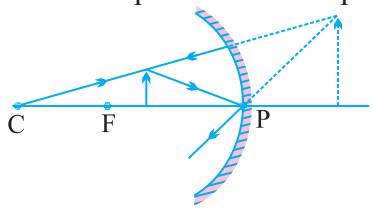
Size – Enlarged

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).

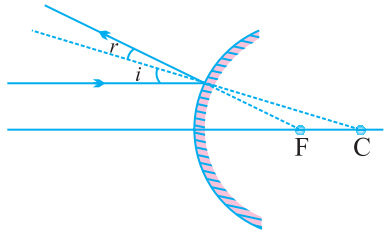


(iii) Concave mirror is used as shaving mirror to see a larger image of the face.

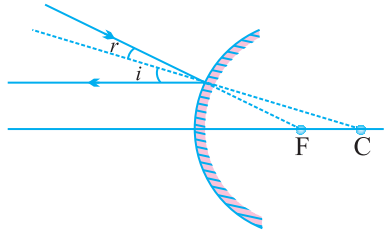
(iv) Large concave mirrors are used to concentrate sunlight to produce heat in solar furnace.

Rule for image formation by Convex Mirror

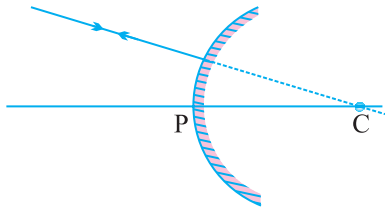
(i) A ray of light parallel to the principal axis of a convex mirror appear to diverge from the principal focus.



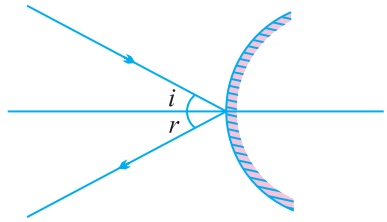
(ii) A ray which is directed towards the focus of the convex mirror will emerge parallel to the principal axis after reflection.



(iii) A ray directed towards the center of curvature of a convex mirror is reflected back along the same.

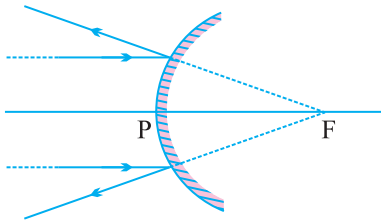


(iv) A ray incident obliquely to the principal axis is reflected obliquely.



Ray diagrams of images formed by convex mirror

(i) When object is placed at infinity : **Image**

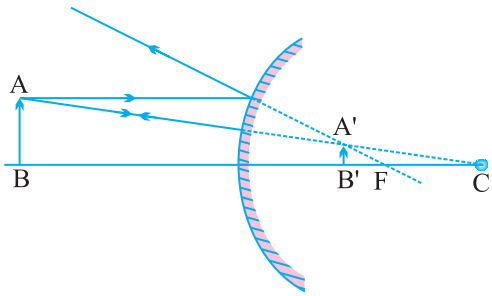


Position – At 'F'

Nature – Virtual, erect

Size – Point sized

(ii) When object is placed between pole and infinity **Image**



Position – Between 'P' and 'F'

Nature – Virtual, erect

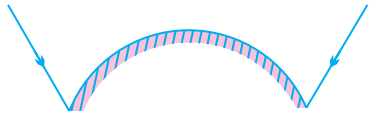
Size – Diminished

- 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

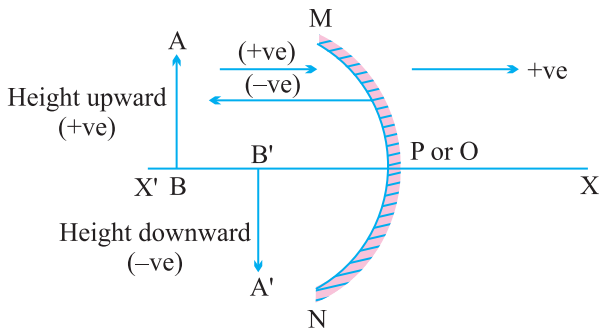
(i) The object is placed to the left of the mirror.

(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.

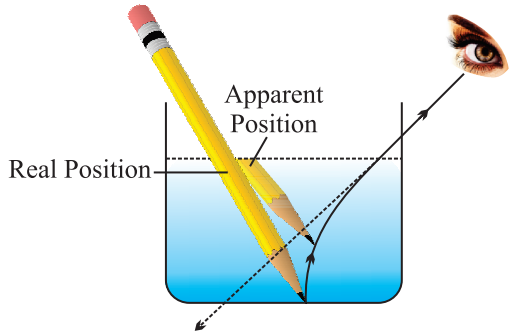
3. Name the type of mirror used in the following and reason for using it :
   (a) Solar furnace
   (b) Rear view mirror in a vehicle
4. What should be the position of the object, when a concave mirror is used :
   (a) as a shaving mirror ?
   (b) in torches as reflecting mirror ?
5. (a) Define principal 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.

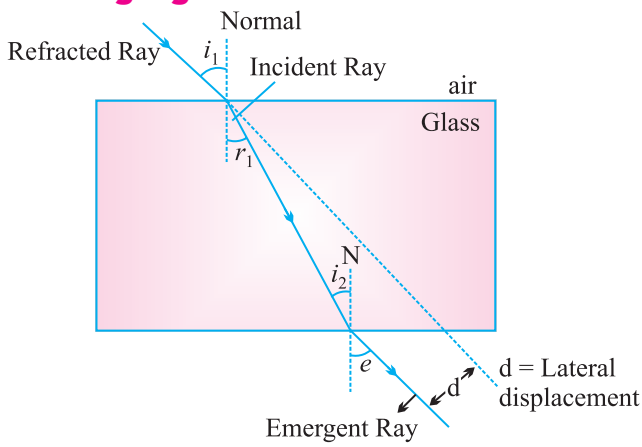
(ii) A pencil partially immersed in water appears to be bent at the interface of water and air.



(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.

$$n_{12} = \frac{1}{n_{21}}$$

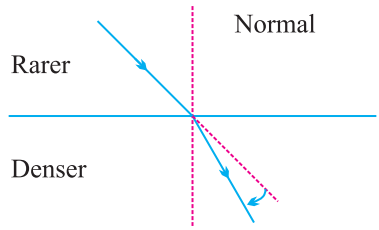
If refractive index of medium 1 w.r.t. air is given as ${}_1n^{air}$, and

If refractive index of medium 2 w.r.t. air is given as ${}_2n^{air}$

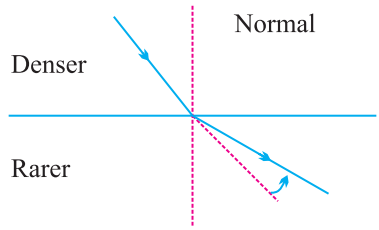
Then, refractive index of medium 1 w.r.t. medium 2 = $\frac{{}_1n^{air}}{{}_2n^{air}}$

- 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.



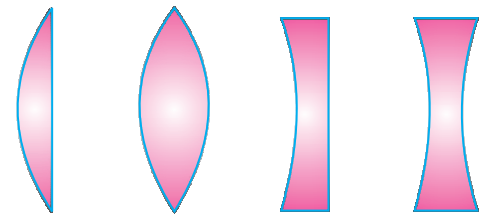
- When light enters obliquely from denser to a rarer medium, it bends away from the normal.



- Refractive index of a medium does not depend on physical density.

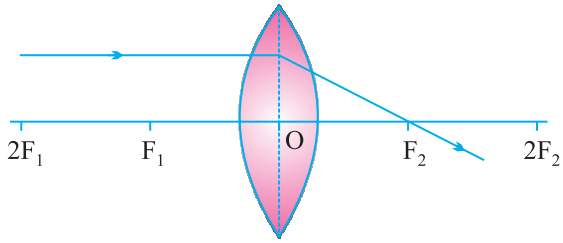
Spherical lens : A transparent medium bound by two surfaces, of which one or both surfaces are curved.

Convex lens	Concave lens
• Thin from corners	• Thick from corners
• Thick at center	• Thin at centre
• Converging	• Diverging

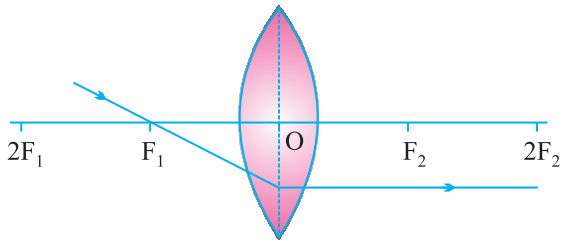


Rules for image formation by convex lens

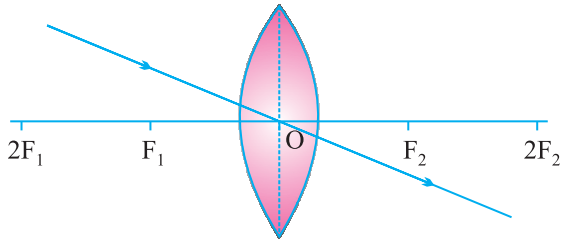
(i) A ray of light parallel to principal axis of a convex lens always pass through the focus on the other side of the lens.



(ii) A ray of light passing through the principal focus will emerge parallel to principal axis after refraction.

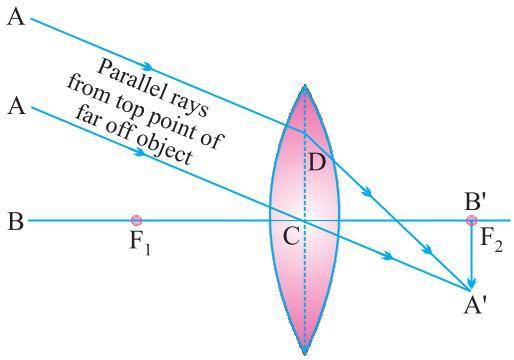


(iii) A ray of light passing through the optical center will emerge without any deviation.



Ray Diagrams of Imaged formed by Convex Lens

(i) When object is at infinity :



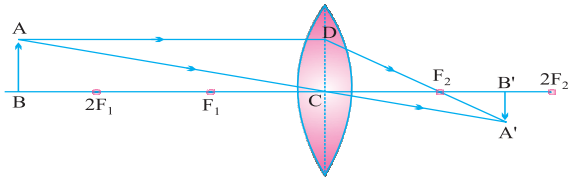
Image

Position – At 'F_2'

Nature – Real, inverted

Size – Point sized or highly diminished

(ii) When object is beyond '$2F_1$'



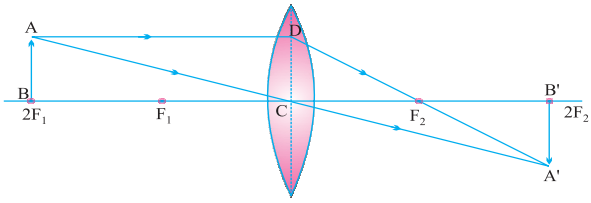
Image

Position – Between 'F_2' and '$2F_2$'

Nature – Real, inverted

Size – Diminished

(iii) When object is at '$2F_1$'



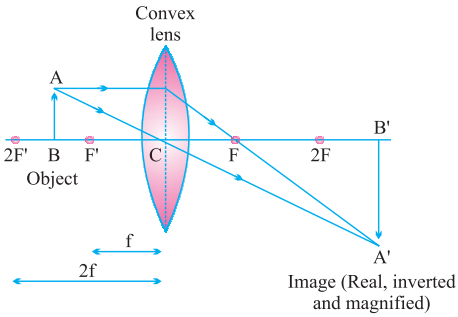
Image

Position – At '$2F_2$'

Nature – Real, inverted

Size – Same size

(iv) When object is between 'F_1' and '$2F_1$'



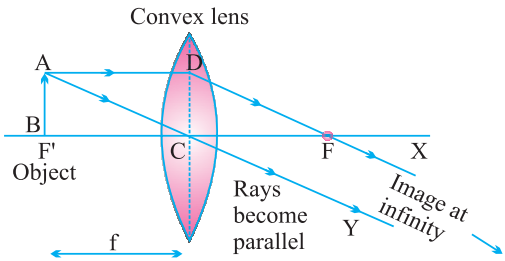
Image

Position – Beyond '$2F_2$'

Nature – Real, inverted

Size – Enlarged

(v) When object is at 'F_1'



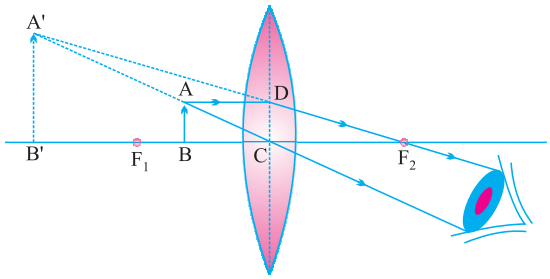
Image

Position – At Infinity

Nature – Real, inverted

Size – Highly enlarged

(vi) When object is between 'F_1' and optical centre



Image

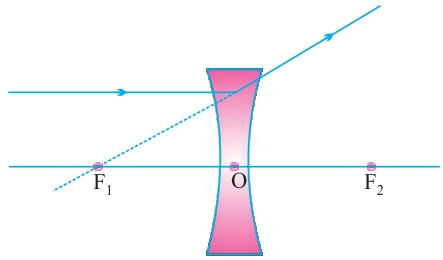
Position – On the same side of the lens as object

Nature – Virtual and erect

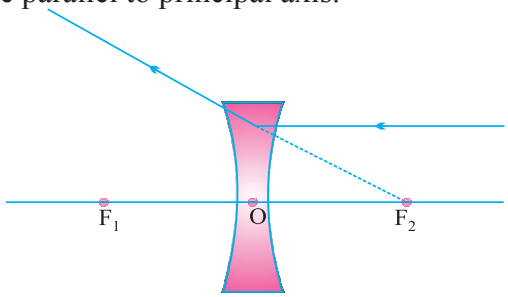
Size – Enlarged

Rules for Image Formation by Concave Lens

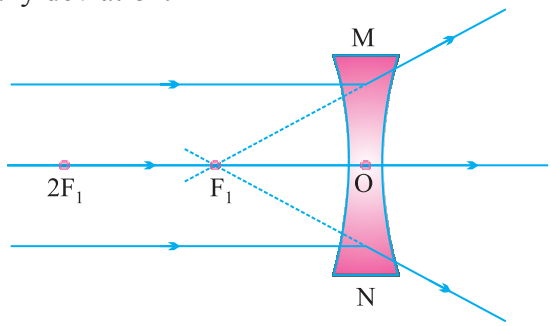
(i) A ray of light parallel to the principal axis appear to diverge from the principal focus located on the same side of the lens.



(ii) A ray of light appearing to meet at the principal focus of a concave lens will emerge parallel to principal axis.

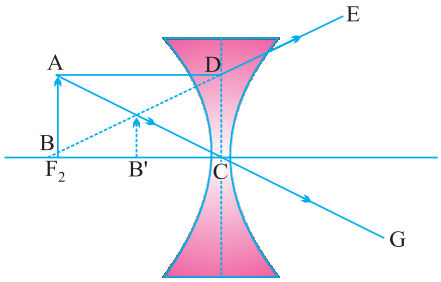


(iii) A ray of light passing through the optical centre of a lens will emerge without any deviation.



Ray Diagrams of Images Formed by a Concave Lens

(i) When object is placed at infinity :



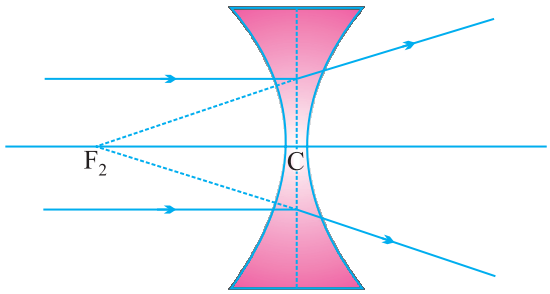
Image

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
- $\text{Power} \propto \dfrac{1}{\text{focal length or thickness}}$
- Power of a lens combination

$$P = P_1 + P_2 + P_3 .....$$

CHECK YOUR KNOWLEDGE

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 ?
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. 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.
6. 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.
7. (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.

8. (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 ?

9. A ray travelling in water enters obliquely into glass. Does the light bend towards or away from the normal and why ?

10. An object is placed at the focus of a convex lens. Draw ray diagram to locate the position of image formed.

Hints to Long Answer Type Questions

7. (a) No bending of light.

   (b) Change in refractive index of two medium.

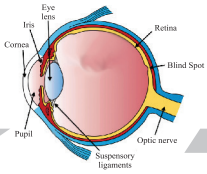
8. (a) **1 dioptre :** It is the power of lens whose focal length is 1 m.

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

   (b) Due to refraction of light.

10. Ray diagram.

Image formed	:	At infinity
Size	:	Enlarged
Nature	:	Real and inverted



Chapter - 11

The Human Eye and The Colourful World

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.

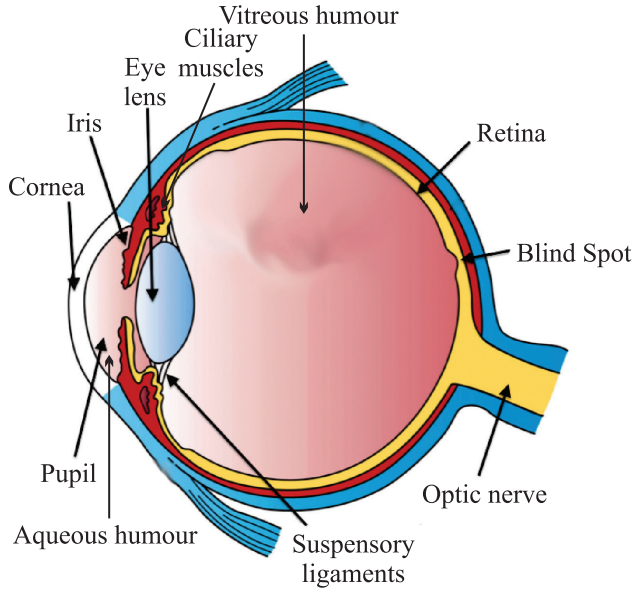
Near point or Least distance of distinct vision

The minimum distance at which objects can be seen most distinctively without strain.

- For a normal adult eye, its value is 25 cm.
- Range of human vision – 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)

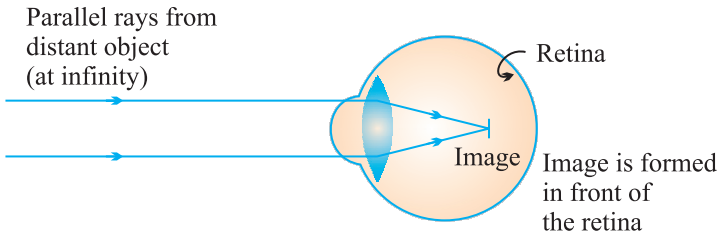
- A myopic person can see nearby objects clearly but cannot see distant objects clearly.
- Image is formed in front of retina.

Causes of Myopia

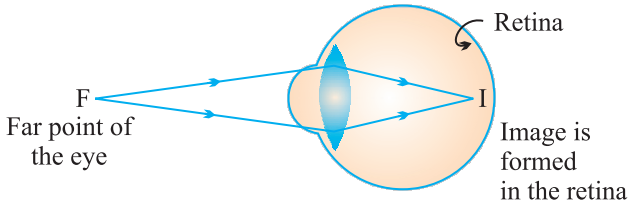
- Excessive curvature of eye lens
- Elongation of eye ball

Correction

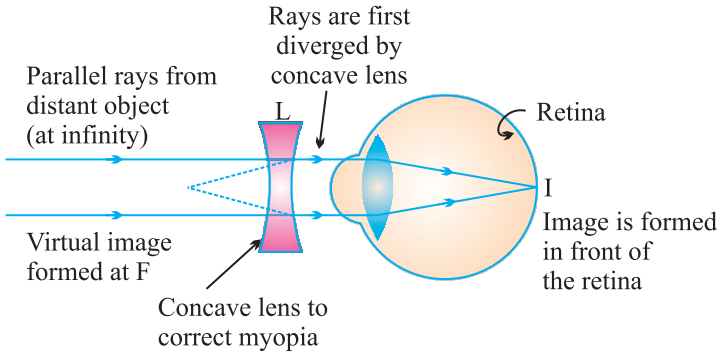
Use of concave lens of appropriate power.



(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)

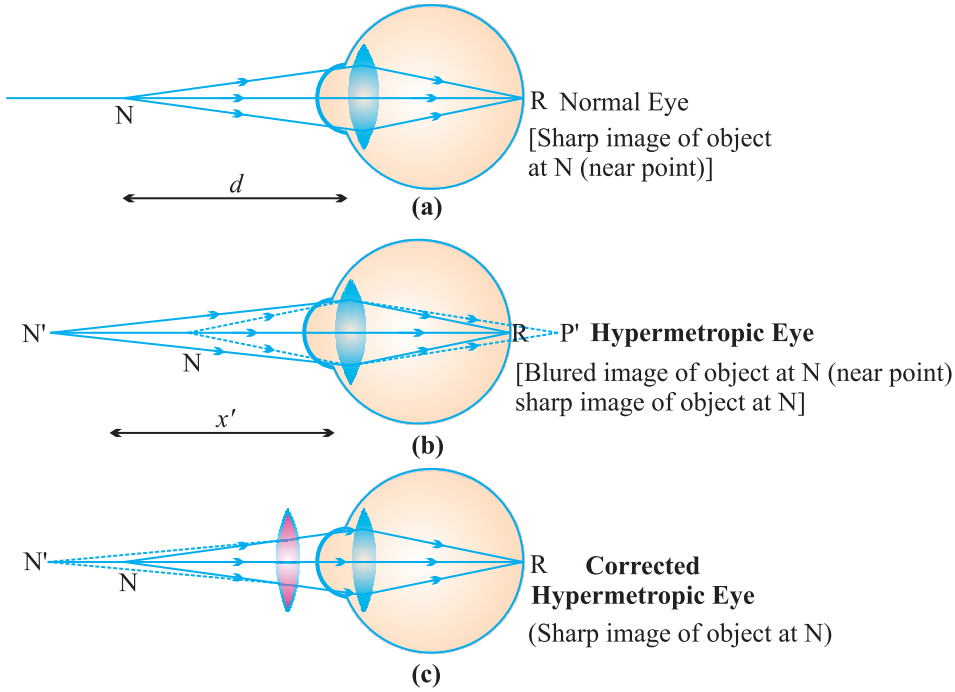
- Affected person can see far objects clearly but cannot see nearby objects clearly.
- The near point of the eye moves away.
- Image is formed behind the retina.

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.

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.

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 :

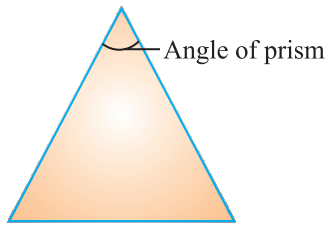
   (a) Elongation of eye ball.

   (b) Excessive curvature of eye lens.

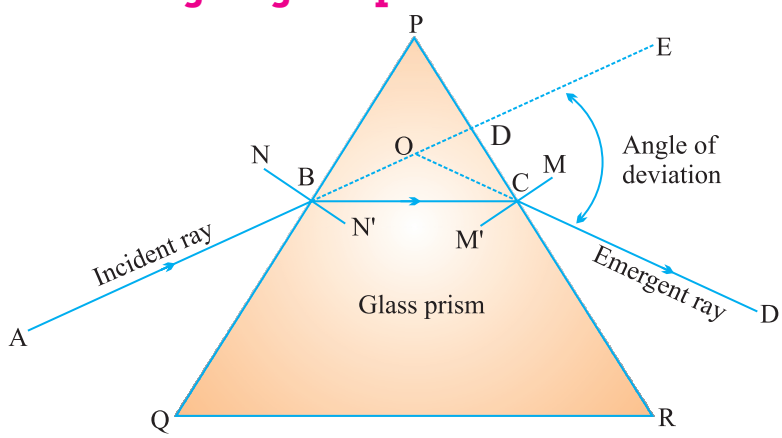
   Diagram of myopic eye and correction using concave lens.

Prism : It is a pyramidal piece of glass with two triangular bases and three rectangular lateral surfaces.

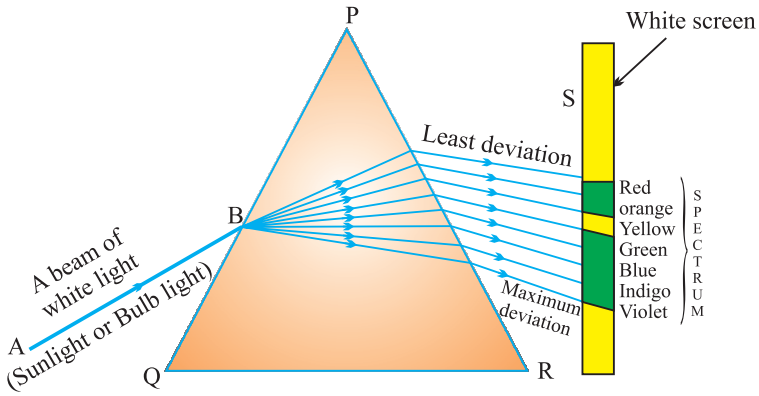
Angle of Prism : The angle between two adjoining lateral surfaces.



Refraction through a glass prism



Angle of deviation (*d*) : It is the angle between incident ray and emergent ray.



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.

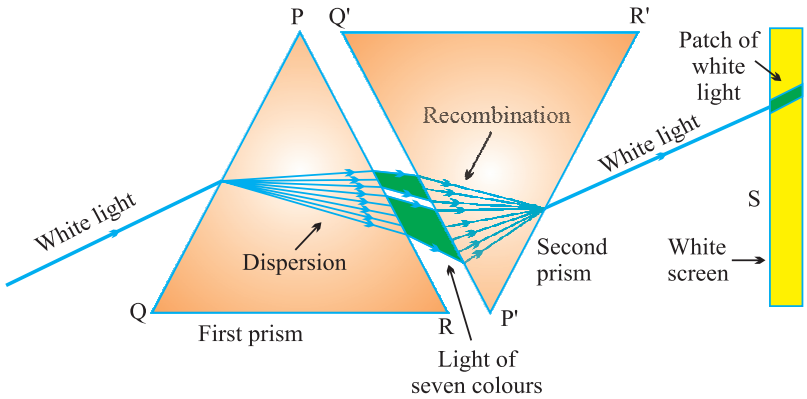
V I B G Y O R

$$\text{Angle of deviation} \propto \frac{1}{\text{wavelength}}$$

- 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.



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.

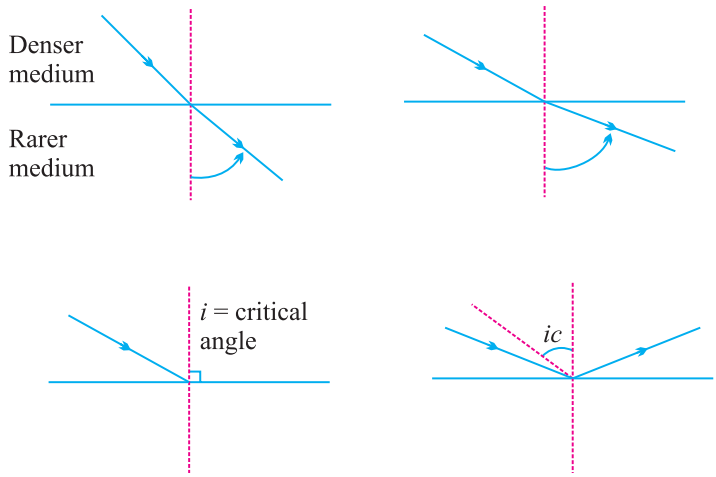
(iii) He formed a spectrum from sunlight and placed an identical but inverted prism in front of prism forming the spectrum. All the seven colours combined by the inverted prism and emerged as white light.

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.

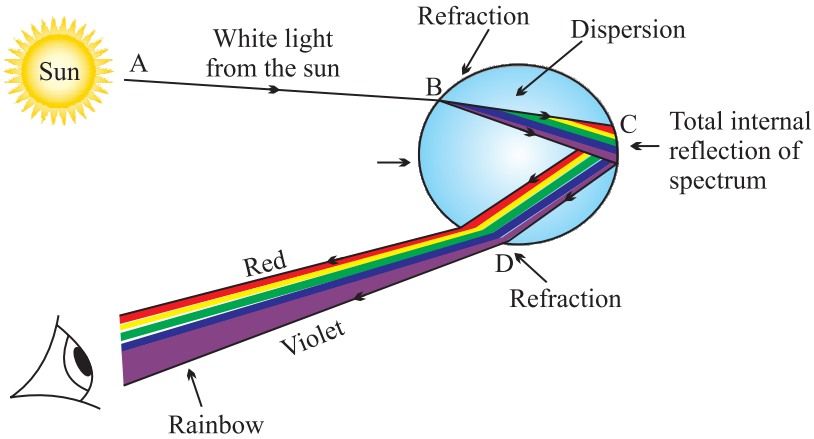
(ii) The angle of incidence should exceed critical angle, the light reflects in the denser medium.

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.

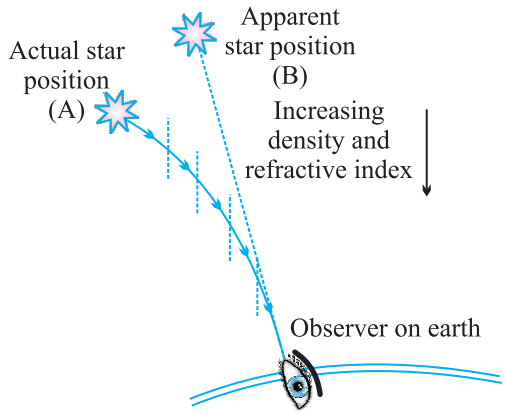
(v) Twinkling of stars.

(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.

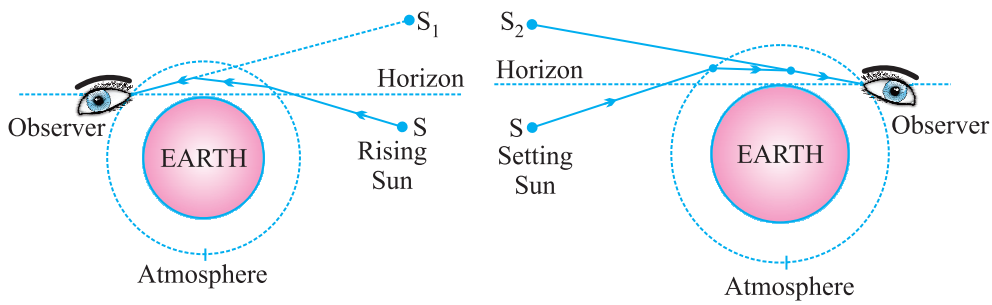


The refractive index of earth's atmosphere in general increases from top to bottom. So, the light coming from a star near the horizon has to travel from rarer to denser medium and it bends towards the normal. As a result the star appears higher.

(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

VERY SHORT ANSWER TYPE QUESTIONS

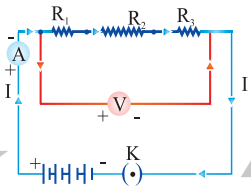
1. Which of the two is scattered more easily – light of shorter wavelength or light of longer wavelength ?
2. What is the near and far point of a normal eye ?
3. State two effects produced by the scattering of light by the atmosphere.
4. What is tyndall effect ?
5. Which light has longer wavelength – 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 ?

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.

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.



Chapter - 12

Electricity

- **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)

$$1 \text{ A} = 1 \text{ Cs}^{-1}$$

$$1 \text{ mA} = 10^{-3} \text{ A}$$

$$1 \ \mu\text{A} = 10^{-6} \text{ A}$$

Current is measured by Ammeter. Its symbol is —+ (A) −—

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)

$$1\ V = 1\ JC^{-1}$$

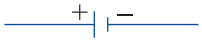
1 Volt : When 1 joule work is done in carrying one Coulomb charge then potential difference is called 1 volt.

Voltmeter : Instrument to measure potential difference.

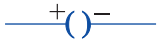
- It has high resistance and always connected in parallel. Symbol is

- 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 : 

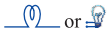
Battery :

Key (open) : 

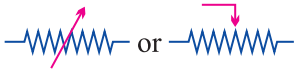
Key (closed) :

Wire joint :

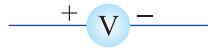
Wire Crossing (without join) :

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.

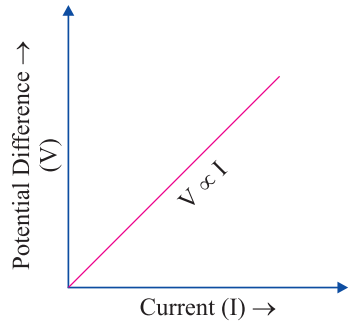
- Mathematical expression for Ohm's law :

$$V \propto I$$

$$V = IR$$

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,

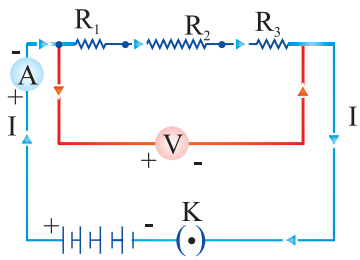
(iii)directly proportional to the temperature and

(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 :

$$V_1 = IR_1$$

$$V_2 = IR_2 \qquad [V_1 + V_2 + V_3 = V]$$

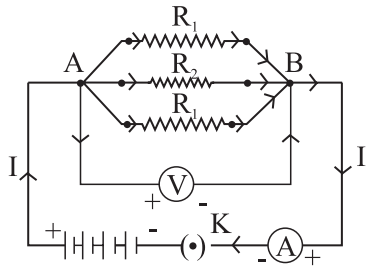
$$V_3 = IR_3 \qquad V = IR$$

$$V = IR_1 + IR_2 + IR_3$$

$$\Rightarrow \quad IR = I(R_1 + R_2 + R_3)$$

$$\Rightarrow \quad R = R_1 + R_2 + R_3$$

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 $E = P \times T \Rightarrow VIt$ $\{E = H\}$

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)

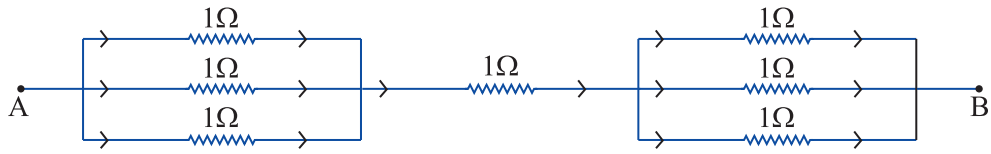
1. Define S.I. unit of :
   (a) Electric current
   (b) Potential difference
   (c) Resistance
   (d) Electric power
   (e) Electrical energy consumed
2. Define the term resistivity.
3. Device used for measuring the current is……. .
4. Name the element of filament of a bulb.
5. Write two types of resistors combination.

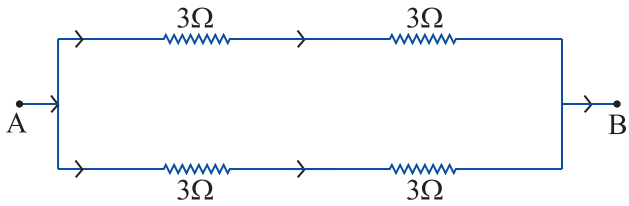
SHORT ANSWER TYPE QUESTIONS (2 Marks)

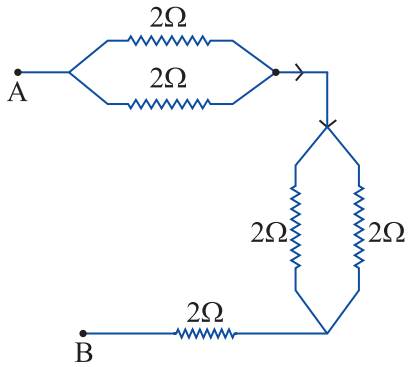
1. How the voltmeter and ammeter are connected in a circuit ?
2. Why the filament of bulb has high melting point ?
3. How does fuse wire protect electrical appliances ?
4. Find the number of joules in 1 KWh.
5. Find a relationship between P, I and V.
6. On what factors does resistance of a conductor depend ?

SHORT ANSWER TYPE QUESTIONS (3 Marks)

1. State Ohm's law. Derive relation between I, V and R. Draw the graph between V and I.
2. What is Joule's heating effect of current P ? Derive its expression.
3. What would be new resistance if length of conductor is doubled and thickness is halved ?
4. Find the effective resistance between A and B.



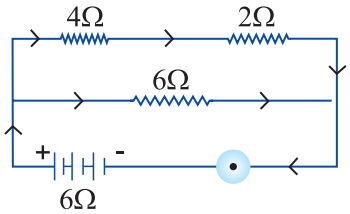




5. Which is the better way to connect lights and other appliances in domestic wiring and why ?

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 :

$$4\Omega + 2\Omega = 6\Omega$$

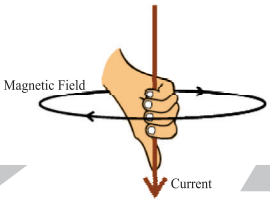
$$\frac{1}{R} = \frac{1}{6} + \frac{1}{6} = \frac{2}{6}\Omega = \frac{1}{3}\Omega$$

$$R = 3\Omega$$

   (b) V (across 4Ω) = IR = 1 × 4 = 4 V

   V (across 2Ω) = IR = 1 × 2 = 2 V
3. (a) R = 10Ω

   (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.

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.

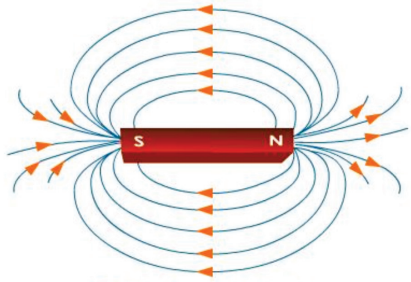
(iii) Field lines are closer in stronger magnetic field.

(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.

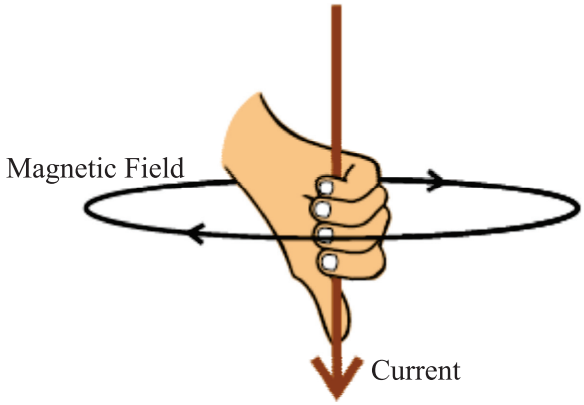
Magnetic Field of a Bar Magnet



- H. C. Oersted was the first person to state that electric current has magnetic field.

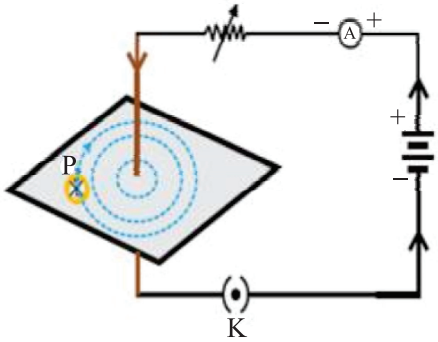
Right Hand Thumb Rule

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.



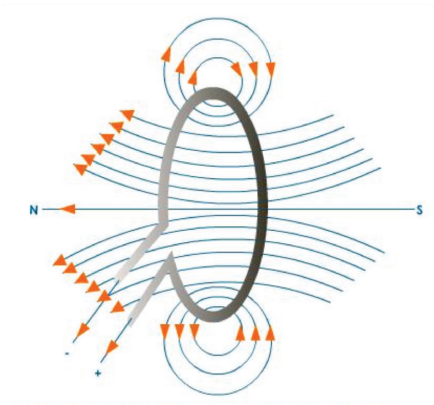
Magnetic Field Due to Current Through a Straight Conductor

- 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 ∝ Current passing through the conductor
- Magnetic field $\propto \frac{1}{\text{Distance from conductor}}$
- Magnetic field ∝ 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.

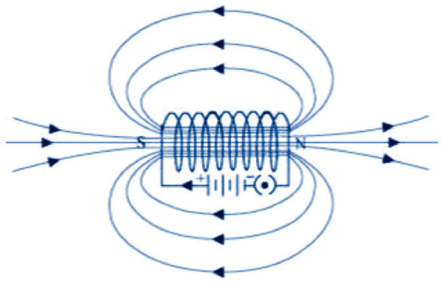
Solenoid

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

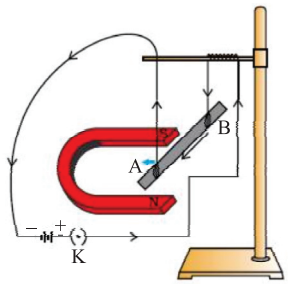
  (ii) Inside the solenoid : South to North
- Solenoid can be used to magnetise a magnetic material like soft iron.



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.

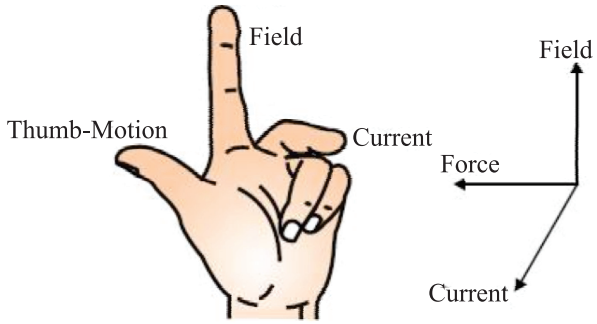


The displacement in the conductor is the maximum when the direction of current is at right angle to the direction of magnetic field.

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

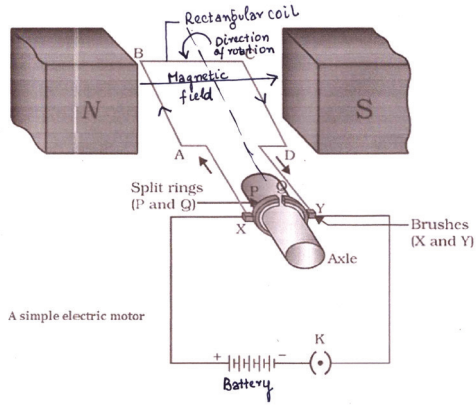
A motor is a device which converts electrical energy into mechanical energy. Electric motor is used in electric fans, washing machines refrigerators, mixer and grinder and other appliances.

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.



A simple electric motor

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.

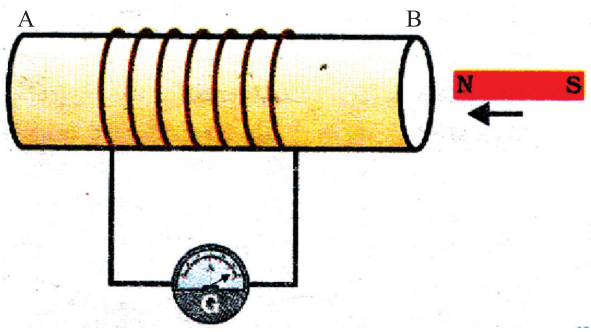
- Heart and brain in the human body have significant magnetic field.
- **MRI (Magnetic Resonance Imaging) :** Image of internal organs of body can be obtained using magnetic field of the organ.

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

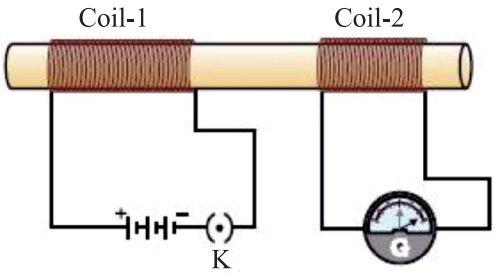


(i) **Magnet moved into the coil :** Momentary deflection in G indicating presence of current.

(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.

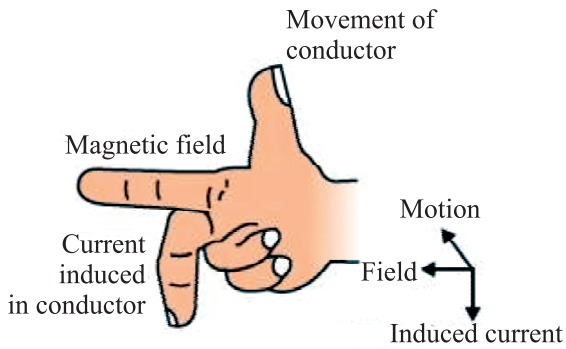
(ii) **Steady current :** No deflection.

(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.

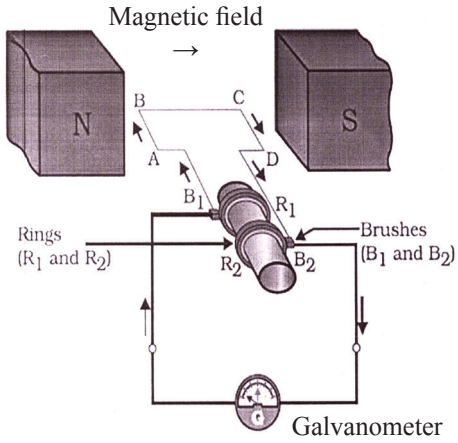
- Working principle of electric generator.
- Used to find direction of induced current.



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.

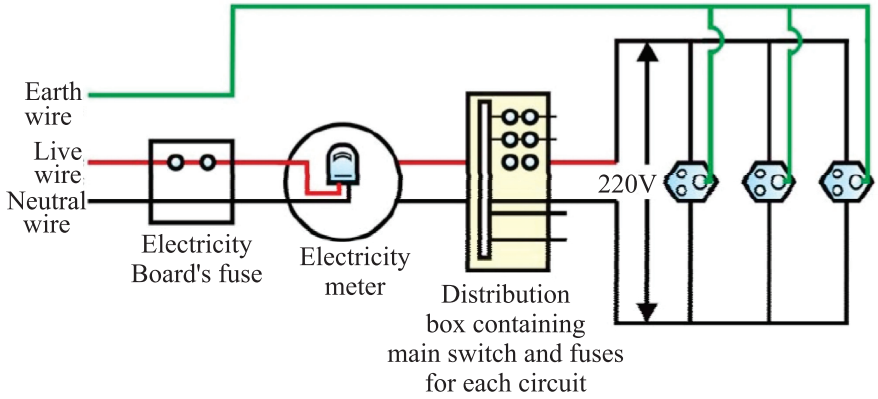
- D. C. can be stored.
- Loss of energy during transmission over long distance is high.
- Sources of D. C. : Cell, Battery, Storage cells.

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)

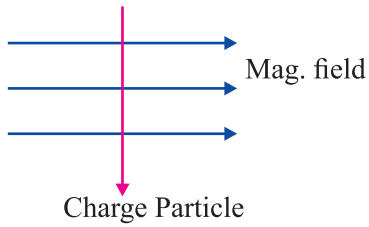
QUESTIONS

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 ?

SHORT ANSWER TYPE QUESTIONS (2 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.

SHORT ANSWER TYPE QUESTIONS (3 Marks)

1. What is solenoid ? Where the magnetic field is uniform in solenoid ?
2. Draw the pattern of magnetic field lines due to current carrying straight conductor.
3. 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 ?

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

- 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.

Need of energy :

- For making food
- For lightning
- 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 known to most of the people. *E.g.,* fossil fuels, bio mass etc.

I. FOSSIL FUELS :

- 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

- Released 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.
- Transmission of electricity is more efficient.

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.

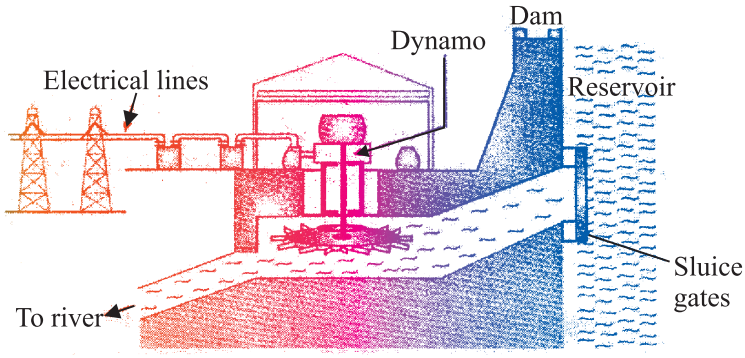
Disadvantages :

(i) Large areas of agricultural land, a vast variety of flora and fauna, human settlements get submerged in the water of reservoir formed by the dam.

(ii) Large ecosystems are destroyed.

(iii) Vegetation that submerged under water rots under 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 are called **Biomass**.

(1) Wood : It is a biomass and used as a fuel for a long time.

Disadvantages :

- Produces a lot of smoke on burning.
- Do not produce much heat.
- Thus by improvement in technology we can improve the efficiency of traditional sources of energy.

For *e.g.,* wood can be converted into much 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.

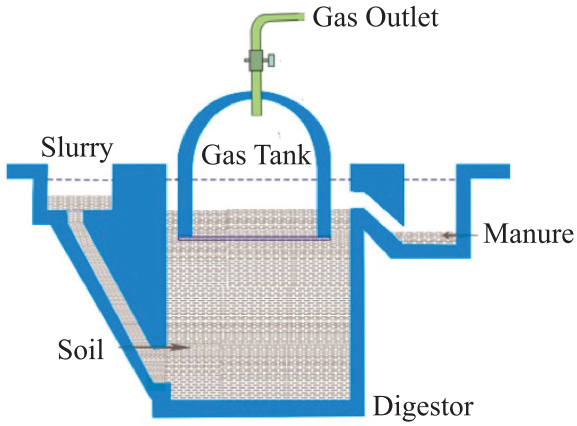
(ii) Does not produce smoke while burning.

(iii) It is a compact fuel, easy to handle and convenient to use.

(3) Cowdung : It is biomass but it is not good to burn cowdung directly as fuel because :

- 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 of the cow dung + water slurry. It takes few day 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.

(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 :

  * to generate electricity by turning the rotor of the turbine.

  * to lift water from the well.

  * 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 5th 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 380 MW of electricity.

Alternate or Non-conventional Sources of Energy

Day by day, our demand for energy increases, so there is a need for another source of energy.

Reasons for alternate sources of energy

(i) The 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 much longer time.

(iii) To reduce the pollution level and to save the environment.

I. SOLAR ENERGY :

- Sun is the ultimate source of energy.
- Energy obtained from the sun is called solar energy.

$$\text{Solar constant} = 1.4 \text{ KJ/s/m}^2$$

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

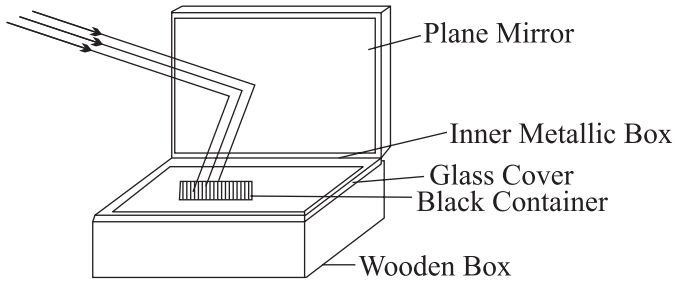
Solar heating devices :

- Use black painted surface because black surface absorbs more heat as compared to white or other surface.
- Use of glass plate because it allows infrared radiations to enter through it but does not allow the radiations to exit through it, causing more green house 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 dull 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.

(d) Upto four food items can be cooked at the same time.

Disadvantages :

(a) Solar cookers cannot be used during night.

(b) If the day sky is covered with clouds, even then 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 purpose.

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 cell 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.

Disadvantages :

(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.
Disadvantage:	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 no. of 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 :

When two nuclei of light elements (like hydrogen) combine to form a heavy nucleus (like helium) and tremendous amount of energy is released is called nuclear fusion.

$$ {}^{2}_{1}H\,(\text{deuterium}) + {}^{2}_{1}H \xrightarrow{\text{fusion}} {}^{3}_{2}He + {}^{1}_{0}n + Heat $$

- Very-very high temperature and pressure is needed for fusion.
- Hydrogen bomb is based on this phenomenon.
- Nuclear fusion is the source of energy in the sun and other stars.

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.

(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 would have cause some environmental damage.

How long will an energy resource last us ?

Sources of Energy

Non-renewable Sources of Energy

Sources that will get depleted some day. For example : Fossil fuel

Renewable Sources of Energy

Energy sources that can be regenerated and that will last for ever.

For example : Wind energy, water energy.

QUESTIONS

VERY SHORT ANSWER TYPE QUESTIONS (1 Mark)

1. Give two examples of fossil fuels.
2. Write two characteristics of good fuel.
3. What do you mean by nuclear energy ?
4. Which country is known as 'Country of Winds' ?
5. Write the full form of CNG and LPG.
6. Name the main component of solar cell.
7. What do you mean by fuel ?
8. How charcoal is different from wood ?
9. Biogas is also known as gobar gas. Justify.
10. Name a device which can be used for cooking so as to save fuel.

SHORT ANSWER TYPE QUESTIONS (2 Marks)

1. Write two disadvantages of using fossil fuels.
2. What are solar panels ? Write three uses of solar panels.
3. Name four gases mainly present in bio gas.
4. Define nuclear fusion.
5. Write two limitations of using wind energy.
6. Write name of four nuclear power reactors located in India.
7. Write two uses/advantages of geothermal energy.
8. Why we pay attention towards alternative or non-conventional sources of energy ?
9. Write two advantages and two limitations of dams for the production of hydro electricity.

SHORT ANSWER TYPE QUESTIONS (3 Marks)

1. Charcoal is a better fuel than wood. Why ?
2. What is bio mass ? How does bio gas plant help to reduce the problem of pollution?
3. Write three advantages and three limitations of using solar cooker.
4. Why it is not possible to make use of solar cells to meet all our needs ? State three reasons.

LONG ANSWER TYPE QUESTIONS (5 Marks)

1. Why tidal energy do not become the main source of energy ?
2. What is OTEC ? Which two main points are necessary for its working ?
3. Bio gas is a boom for farmer. Why ?
4. Draw a diagram of bio gas plant.

Hints to Long Answer Type Questions

1. (a) Few sites for building dams.

   (b) Rise and fall of water during tides is not high enough.

2. **OTEC :** Device used to harness ocean thermal energy.

   (a) Temperature difference of 20ºC or more.

   (b) Warm surface boil ammonia and vapours are used to run the turbine.

   (c) Minimum depth of water – 2000 m.

3. Bio gas is a boom as it is a

   (a) Clean and safe fuel.

   (b) Slurry left behind is a good manure.

4. See the diagram in text.

Chapter - 15

Our Environment

- 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.

Components of an ecosystem

- Abiotic components (Air, water, land)
- Biotic components (Plant, animals)
  - Producer
  - Consumer
    - Herbivore
    - Carnivore
    - Omnivore
    - Parasites
  - Decomposers

(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.,*

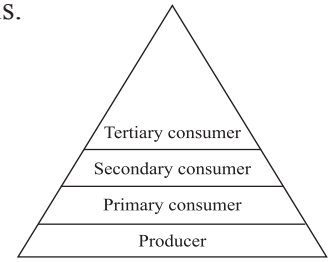
  Grass $\rightarrow$ Deer $\rightarrow$ Lion

- 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.

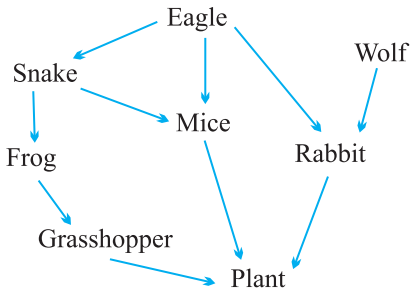
- Due to this gradual decrease in energy, food chains contain 3-4 trophic levels.



Trophic levels	Decrease in energy
Tertiary consumer	1 kJ
Secondary consumer	10 kJ
Primary consumer	100 kJ
Producer	1000 kJ

- **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.

QUESTIONS

VERY SHORT ANSWER TYPE QUESTIONS (1 Mark)

1. Define trophic level.
2. What is the full form of CFC and UNEP ?
3. Name the radiations that are absorbed by the ozone layer.
4. Which will get more energy secondary consumers or tertiary consumers ?
5. What is the functional unit of environment ?
6. Which of the following are not biodegradable :

   Wool, glass, silver foil, leather.
7. Name any two parasites.
8. What is KYOTO protocol ?

SHORT ANSWER TYPE QUESTIONS (2 Marks)

1. Why are green plants called producers ?
2. Name two materials which can be recycled.
3. What will happen if we kill all the organisms of a trophic 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.

SHORT ANSWER TYPE QUESTIONS (3 Marks)

1. Differentiate between biodegradable waste and non-biodegradable waste.
2. How ozone molecule is formed in the atmosphere ?
3. Define consumers. What are its further divisions ?
4. Why natural ecosystem is more stable than artificial ecosystem ?
5. Why some materials are not decomposed by the action of micro-organisms?
6. What is a food web ? Explain with example.
7. Give any two ways in which non-biodegradable wastes would affect the environment.
8. How the components of an ecosystem are dependent on each other ?

LONG ANSWER TYPE QUESTIONS (5 Marks)

1. What are different methods for disposal of garbage ?
2. What is food chain ? Give its characteristics. Explain how energy flows through different trophic levels in a food chain.
3. Explain how harmful chemicals enter our body.

Hints to Long Answer Type Questions

1. Methods for Garbage disposal :
   - Land filling
   - Composting
   - Recycling
   - Reuse
   - Biogas plant
   - Sewage treatment plant

2. **Food chain :** Transfer of energy through various trophic level in an ecosystem.

   Characteristics : (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 percent law.

3. Bio magnification

❑❑

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.	These are present in unlimited quantity.
E.g., Coal, petroleum.	*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

Three R's to save the environment :

3R's

REDUCE Use less	RECYCLE Segregate waste that can be recycled	REUSE Use again
1. Switching off	Plastic, glass, metal items	Instead of throwing

unnecessary lights and fans. 2. Repairing leaky taps. 3. Not wasting food.	can be recycled instead of synthesizing or extracting new ones.	things away, they can be used again.

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.

Stake holders of forests

Local people (Dependent on forest for their survival) nature)	Forest department (Govt. who owns the land and controls forest products resources)	Industrialist Wildlife (Who use various Who want to conserv

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.

QUESTIONS

VERY SHORT ANSWER TYPE QUESTIONS (1 Mark)

1. Name a clean fuel other than LPG and 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 the bacteria whose presence in water indicate contamination of water.
6. Write full form of CFC.
7. What is biodiversity ?
8. Why is reuse better than recycle ?
9. Name the person who is remembered for protection of Khejri trees in Rajasthan.
10. Who are called stake holders ?

SHORT ANSWER TYPE QUESTIONS (2 Marks)

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 two advantages of water harvesting.
5. List two disadvantages of building dams.
6. Why should we conserve forest and wild life ?
7. What are the 3R's to save our environment ?
8. How is burning of fossil fuels affecting our environment ?
9. What are the uses of coal and petroleum products ?
10. Name the rivers with which following dams are associated :
    (a) Tehri Dam
    (b) Bhakra Dam

LONG ANSWER TYPE QUESTIONS (5 Marks)

1. Write a short note on 'Chipko Andolan'.
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.

PRACTICE PAPER - I
(SOLVED)

Section-A

1. Which sodium compound is used as an antacid in medicine. 1

2. Give the function and source of Insulin hormone. 1

3. What do you observe when penta hydrated copper-Sulphate crystals are heated? Give reaction also. 2

4. Name the unit of inheritance. Write its functions.

5. What will be the amount of energy available to the organism of the 2nd trophic level of a food chain, if the energy available at the first trophic level is 10,000 joules. 2

6. Four elements P, Q, R and S have atomic numbers 12, 13, 14, 15 respectively. Answer the following questions giving reasons :

   (a) What is the valency of P.

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

   (c) Which of these elements will form basic oxides. 3

7. (a) Write the chemical names of CH_3 CO CH_3 and C_2H_5 COOH.

   (b) What happens when acetic acid and ethanal reacts in presence of concentrated H_2SO_4. Write the chemical equation involved. 3

8. Write any three advantages of vegetative propagation. 3

9. Draw a sectional view of human female reproductive system and label the part where :

   (a) Eggs develop

(b) Fertilizations take place.

(c) Fertilized egg get implanted. 3

10. Name the eye defect in which eye lens become cloudy or milky. Name the method for its correction. A person uses a lens of power – 2.0 D for correcting his distant vision and for correcting his near vision he used lens of power + 2.0 D. Calculate the focal length of lenses required to correct these defects. 3

11. Define the following terms :

(i) Recycling

(ii) Suistainable development

(iii) Chipko Andolan 3

12. What is the difference between a direct current and an alternating current? How many times does AC used in India change direction in one second?

Or

What is the role of fuse used in series with any electrical appliance? Why should a fuse with defined rating not be replaced by one with a larger rating? 3

13. Calculate the energy transferred by a 5A current flowing through a resistor of 2 Ohms for 30 minutes. 3

14. Sahil lives in Delhi and is much concerned about the increasing electricity bill of the house. He look some steps to save electricity and succeeded in doing so :

(i) Mention any two steps that Sahil might have taken to save electricity.

(ii) Which alternative source of energy would you suggest Sahil to use? 3

15. (a) Write the electron-dot structure of Sodium, Oxygen and Magnesium.

(b) Show the formation of MgO by the transfer of electrons

(c) What are the ions present in this compound? 3

16. Draw the ray diagram in each case to show the position and nature of the image formed when the object is placed :

(i) At the centres of curvature of a concave mirror.

(ii) Between the pole P and focus F of a concave mirror.

(iii) In front of a convex mirror.

(iv) At 2F of a convex lens.

(v) At infinity in front of a concave lens. 5

17. (i) Draw the pattern of magnetic field lines through and around a current carrying solenoid. What does the magnetic field pattern inside the solenoid indicate?

(ii) How can this principle be utilized to make on electromagnet

(iii) State two ways by which strength of this electromagnets can be increased. 5

18. (a) Draw a meat diagram of on excretory unit of human kidney and label the following parts.

(i) Bourman's capsule

(ii) Renal Artery

(iii) Glo merulus

(iv) Collecting diut

(b) Mention any two functions of the kidney.

(c) mention any two substances which are selectively re absorbed as the filterate flows along the tubular part of this unit. 5

19. (a) What happens chemically when quick lime is added to water?

(b) Balance the following chemical equation :

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

(c) What is decomposition reaction? Explain it with suitable example.

Or

(a) Balance the chemical equation :

$Fe\ (s) + H_2O\ (g) \rightarrow Fe_3\ O_4\ (s) + H_2\ (g)$

(b) Identify the type of reaction in the equation given below :

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

(c) When copper powder is heated in a China dish the surface of copper powder becomes coated with black colour substance :

(i) What is that black substance.

(ii) Why has this black coloured substance formed.

(iii) Write the chemical equation of the reaction take place. 5

20. (a) "Fossils are related to evolution". Justify this statement. Give two ways by which age of fossils can be estimated.

(b) List two difference between acquired trait and inherited trait. 5

21. Both soap and detergent are some type of salts :

(i) What is the difference between them

(ii) Describe in brief cleaning action of soap

(iii) Draw diagram of a micelle

(iv) Why do soaps not form lather in hard water

(v) List any problem that arise due to the use of detergents instead of soap 5

SECTION -B

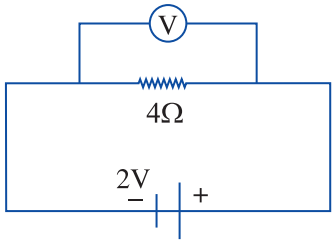
PRACTICAL SKILL BASED QUESTIONS)

22. Write the type of reaction and observation that can be made when :

    (a) Iron filling are added to copper sulphate solution.

    (b) When ferrous sulphate crystals are heated. 2

23. Calculate the current 'I' in the following circuit :



24. Draw a diagram showing various parts of an embryo of a dicot seed. 2

25. How does acetic acid react with sodium bicarbonate? Give chemical equation for this chemical change. 2

26. An object is placed at $2F_1$ in front of a convex lens. What is the -

    (a) Position (b) Size

    (c) Nature of image (d) Magnification. 2

27. Mention the observation of budding in Yeast. 2

SOLUTION TO PRACTICE PAPER - I

SECTION-A

1. Sodium hydrogen carbonate is used as an antacid in medicine. 1

2. Source of Insulin hormone - Pancreas ½

   Function of Insulin hormone - Metabolism of sugar ½

3. Blue colour of copper sulphate crystals changes to white - 2

$$\underset{\text{(Blue)}}{CuSO_4 . 5\,H_2O} \xrightarrow[\text{Heat}]{} \underset{\text{(White)}}{CuSO_4 + 5\,H_2O}$$

4. Gene is the unit of inheritance. 2

   Function : Gene inherits the traits or characters from parents to the offsprings.

5. Only 10 percent energy is available from the first trophic level to second trophic level.

$$10{,}000 \times \frac{10}{100} = 1000J$$

2

6. (a) The valency of P is 2 as its valence shell has 2 electrons in it. 3

   (b) Elements P and Q are metals as they have 2 and 3 electrons in their valence shell and they form positively charged ions when as R and S are non metals as they gain electron to complete their oclet.

   (c) P and Q will form basic oxides as they are metals.

7. (a) $CH_3CO\,CH_3$ – Propanone 3

   $C_2H_5\,COOH$ – Propanoic acid

   (b) Esterification takes place

$$CH_3\,COOH + C_2H_5OH \xrightarrow[H_2SO_4]{Conc} CH_3\,COOC_2H_5 + H_2O$$

8. Three advantages of vegetative propagation -

(i) Plants which do not produce viable seeds can be produced this method.

(ii) It is cheap easier and more rapid method of propagations.

(iii) Plants raised by this method can bear flowers and fruits more produced from seeds.

9. For diagram refer NCERT (Correct diagram) - 3

(a) Ovaries

(b) Fallopian tube

(c) Uterus (Correct labelling)

10. Sometimes, the crystalline lens of people at old age becomes milky or cloudy. This condition is called cataract. 3

It is possible to restore the vision through cataract surgery.

Focal length of the lens for distant vision $f = \frac{1}{P} = \frac{-1}{2} = -0.5m$

Focal length of the lens for near vision $= \frac{1}{2} = +0.5m$

11. (i) Recycling : The act of processing used or abandoned materials for creating new products. 3

(ii) Suistainable development : A pattern of resources used for obtaining economic and social growth of the present generation while preserving the resource for the needs of future generation.

(iii) Chipko Andolan : A grass root level movement in which the villagers used to hug the forest trees and prevent their mass felling by the contractors.

12. Correct difference between A/C and DC. 3

AC supply in India reverses its direction 100 times in 1 second.

Or

A fuse is a safety device having a short length of a thin, tin plated copper wire having low melting point which melts and breaks the circuit if the current exceeds a safe values the fuse cannot the replaced because then its purpose will not be solved.

13. $P = I^2 \times R$

$I = 5\ A$ $\quad R = 2\ \Omega \quad \therefore \quad P = (5)^2 \times 2$

$= 50w$

$= \frac{50}{1000}$ kw

Power = 0.05 kw

time : 30 minutes = $\frac{30}{00}$ hours

$= \frac{1}{2}$ hours = 0.5 hours

E = P x t

= 0.05 x 0.5

E = 0.025 kwh

14. (i) Switch of the lights and fans when not in use. Usage of energy efficient electrical appliances.

(ii) Solar energy.

15. (a) $\dot{Na}$, $\ddot{O}$, $\ddot{Mg}$

(b) $\dot{Mg} + :\dot{O}: \longrightarrow [Mg]^{2+} [:\ddot{O}:]^{2-}$ or MgO

(c) Mg^{2+} , O^{2-}

16. For diagram refer NCERT (Correct diagram). 5

17. Diagram (refer NCERT) → Pattern - 1 mark

Correct direction = 1 mark.

Magnetic field pattern inside the solenoid indicates that the magnetic field is same at all points inside the solenoid. This principle is utilized to magnetize a piece of magnetic material like soft iron when placed inside the coil.

Ways to strengthen the electromagnet :

(i) Increase the amount of electric current through it

(ii) Increase the number of turns of coil.

18. (a) Correct diagram - 1 mark

Correct labelling - 2 mark.

(b) Functions of kidney

(i) To remove the waste material from the blood.

(ii) To keep balance of ions and water content (osmoregulation) inside the body organ.

(c) Glucose, amino acids, salts, water (any two) - 1 mark

19. (a) $CaO + H_2O \rightarrow Ca(OH)_2$

Calcium hydroxide is formed and hising sound is produced.

(b) $MnO_2 + 4HCl \rightarrow MnCl_2 + Cl_2 + 2H_2O$

(c) When a single substance decomposes under suitable conditions to form two or more substances

e.g. : $CaCO_3\,(s) \xrightarrow{heat} CaO(s) + Co_2\,(g)$.

Or

(a) $3Fe\,(s) + 4H_2O(g) \longrightarrow Fe_3\,O_4(s) + 4H_2(g)$

(b) Double displacement reaction

(c) (i) Black substance is Copper oxide

(ii) When copper powder burns with oxygen copper oxide is formed.

(ii) $2(Cu\,(s) + O_2(g) \longrightarrow 2CuO$ (Black).

20. Preserved traces of the living organisms of the past are called fossils + explanation.

Two ways :

Relative – Fossils closer to the surface are more recent

Carbon Dating – Finding the ratio of different isotopes

Acquired trait	*Inherited trait*
(i) Are not passed onto next generation	(ii) Can be passed on to next generation

(iii) They cannot direct evolution

(ii) They bring about evolution of \ species.

21. (i) Correct difference - 1 mark

(ii) Cleansing action of soap - 1 mark

(iii) Diagram of micelle - 1 mark

(iv) Correct explanation - 1 mark

(v) Detergents are non-biodegradable hence harm the environment - 1 | mark.

SECTION – B

(BASED ON PRACTICAL SKILL)

22. (a) Displacement reaction :

Observation : Blue coloured copper sulphate solution turns green and Reddish brown coat deposited on iron-fillings.

(b) Decomposition reaction :

Observation : Green colour of ferrous-sulphate crystals changes.

23. According to Ohm's Law $V = IR$

$$I = \frac{V}{R}$$

$V = 2V$

$R = 4\Omega$

$$I = \frac{2}{4} = \frac{1}{2} = 0.5A$$

24. Correct diagram - 1 mark

Correct labelling - 1 mark

25. $CH_3COOH + NaHCO_3 \longrightarrow CH_3COONa + H_2O + CO_2$

CO_2 gas is evolved which turns lime water milky.

26. Position of Image = At $2F_2$

Size of Image = Same size as that of the object

Nature of image = Real and inverted

Magnification = $m = \frac{v}{u} = \frac{-h_2}{h_1} = -h_2 = h_1 = -1$

$= -1$

27. Budding in Yeast :

(i) A small protuberance arises from parent body called bud

(ii) Nucleus divides to form two daughter nuclei, of which one passes into the bud.

(iii) The bud now detaches from the parent body and graves in dependently as a new individual or may remain attached to the parent body, forming chain of cells.

(iv) Parental identity is not last.

PRACTICE QUESTION
PAPER–II

Time : 3 Hours Maximum Marks : 80

General Instructions :

(i) The question paper consists of 27 questions.

(ii) All questions are compulsory.

(iii) There is internal choice in two questions of 3 marks each and one question of five marks.

(iv) Question numbers 1 and 2 are one mark questions. These are to be answered in one word or one sentence.

(v) Question numbers 3 to 5 are two marks question. These are to be answered in 30 word each.

(vi) Question numbers 6 to 15 are thee marks questions. These are to be answered in about 50 words each.

(vii) Question numbers 16 to 21 are 5 marks questions. These are to be answered in about 70 words each.

(viii) Question numbers 22 to 27 are questions based on practical skills. Each question is a two marks question.

Section–A

1. Write the full form of AIDS. 1

2. Write the formula of functional group of be ketone 1

3. Give any two ways in which biodegradable substances would affect the environment. 2

4. Why are some patients of diabetes treated by giving infections of insulin? 2

5. What is sustainable management? Write the 3R's to save environment. 2

6. Write the balanced equation for the following chemical reactions : 3

   (a) Hydrogen + chlorine $\rightarrow$ Hydrogen chloride

   (b) Barium Chloride + Aluminium sulphate $\rightarrow$ Baricum sulphate + Aluminium chloride

   (c) Sodium + water $\rightarrow$ Sodium hydroxide + Hydrogen.

7. What is neutralization reaction? Give two examples. 3

8. Describe the double circulation in human beings. Why is it necessary? 3

9. What is presbyopia? Write two causes of this defect. Name the type of lens which can be used to correct presbyopia. 3

10. Explain Ohm's law. Draw the electric circuit for studying Ohm's law. 3

Or

Write the factors on which resistance of a conductor depends.

11. Two circular coils A and B are placed closed to each other. If the current in Coil A is changed, will some current be induced in the coil B ? Give reasons. 3

12. Sahil taunts his wife for having only daughters and no son. As a student of biology, Sahil's brother Deepak Convinced him that his wife has no role in giving birth to girls only. 3

    Now answer the following :

    (a) How did Deepak explain the process of six determination of his brother?

    (b) Mention the values shown by Deepak.

13. 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. 3

Or

Write down three major difference between Mendellev's periodic table and Modern periodic table.

14. What are renewable and non-renewable sources of energy? What are the qualities of an ideal source of energy? 3

15. What are amphoteric oxides? Give two examples of amphoteric oxides. 3

16. (a) Draw the ray diagram for a concave mirror, when the object is placed between Focus and centre of curvature.

    (b) A concave lens has focal length of 15 cm. At what distance should the object from the lens be placed so that it forms an image at 10 cm from the lens? Also, find the magnification produced by the lens. 5

17. (a) What is an homologous series?

    (b) Explain the cleansing action of soap with the help of diagram. 5

18. Draw a labelled diagram of female reproductive system and write the function of its different parts. 5

19. (a) State Fleming's left hand rule. 5

    (b) Name two safety measures commonly used in electric circuits. How can we avoid the overloading of electric circuits?

20. (a) Explain the terms : 5

    (i) Corrosion

    (ii) Rancidity

    (b) A Shiny brown coloured element 'X' on heating in air becomes black in colour. Name the element X and the black coloured compound formed.

21. What are plant hormones? Name different plant hormones along with their functions. 5

Section - B

22. A student is given four samples A, B, C and D to find their pH. He observed that the colour of pH paper become light red(A), dark red(B), Orange(C) and dark blue(D). Arrange the samples with increasing pH value. 2

23. Show diagrammatically binary fission in Amoeba. 2

24. Show diagrammatically path of a light ray passing through a prism. 2

25. Differentiate between reflection and refraction of light. 2

26. How will you determine the equivalent resistance of two resistors when connected in series? 2

27. Write four steps to show that CO_2 is given out during respiration. 2

PRACTICE QUESTION

PAPER–III

Time : 3 Hours | Maximum Marks : 80

General Instructions :

(i) The question paper consists of 27 questions.

(ii) All questions are compulsory.

(iii) There is internal choice in two questions of 3 marks each and one question of five marks.

(iv) Question numbers 1 and 2 are one mark questions. These are to be answered in one word or one sentence.

(v) Question numbers 3 to 5 are two marks question. These are to be answered in 30 word each.

(vi) Question numbers 6 to 15 are thee marks questions. These are to be answered in about 50 words each.

(vii) Question numbers 16 to 21 are 5 marks questions. These are to be answered in about 70 words each.

(viii) Question numbers 22 to 27 are questions based on practical skills. Each question is a two marks question.

1. What is the far point and near point of human eye with normal vision? 1

2. Why is lake considered to be natural ecosystem? 1

3. An element 'X' on reaction with dilute acid evolves a gas that burns with a pop sound while a compound 'Y' on reaction with dilute acid evolves a gas that turns lime water milky. Identify 'X' and 'Y'. 2

4. Explain the statement. "Bile does not contain any enzyme but it is essential for digestion." 2

5. Light enters from air to glass plate having refractive index 1.50. What is speed of light in glass? The speed of light in vacuum is 3×10^8 m/s. 2

6. Why should we conserve forest? Suggest two ways to conserve forest? 3

7. A torch bulb is rated 2.5 V and 750 mA

Calculate its : (i) Power (ii) Resistance (iii) the energy consumed if the bulb is lighted for 4 hrs.? 3

8. How did Mendel's experiments shows that different traits are inherited independently? Explain. 3

9. Given below are some elements of modern parodic table. Atomic number of the element is given below. 3

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

(i) Which elements has one electron in outer most shell. Also write its electronic configuration.

(ii) Which of two element belong to same group.

(iii) Which of two element belong to same period? Which one has higher atomic radii?

10. State the changes that takes place in the uterus when : 3

(i) Implantation of embryo has occurred.

(ii) Female gamete/egg is not fertilised.

11. Shivang and his friends visited a town while they were on excursion. They were served tea in cups of clay or Kulhad. Shivang asked for disposable plastic cups and said Kulhad a dirty crockery and not safe for his health. 3

(i) Do you agree Shivang was right.

(ii) Do you like disposable plastic cups? Give reasons in support of your answer.

12. Complete the following reactions – 3

(i) $CH_3\ CH_2OH \xrightarrow{\text{Conc } H_2SO_4}$

(ii) $CH_3COOH + NaHCO_3 \rightarrow$

(iii) $CH_4 + Cl_2 \xrightarrow{\text{Sunlight}}$

13. When copper powder is heated is a China dish, the surface of copper powder become coated with black colour substance.

(i) What is this black substance?

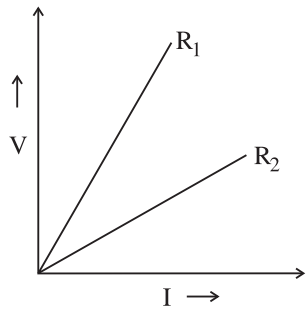
(ii) Why has the black coloured substance formed?

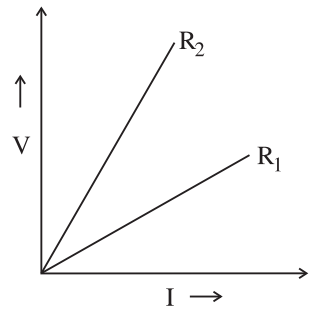
(iii) Write the chemical equation of above reaction.

14. Two student's perform experiments on two given resistors R_1 and R_2 and plot the V-I graphs shown by diagrams I and 2.

If $R_1 > R_2$ which of two diagrams correctly represent the situation on the plotted curves?

Justify your answer :





15. Draw a ray diagram to illustrate hypermetropia or far sightedness. How is it corrected by using spectacles. Draw a ray diagram to explain it. 3

16. Draw a well labelled diagram of female reproductive system. Explain two methods of contraception? 5

17. An organic compound. 'A' of molecular formula $C_2 H_6 0$. on oxidation with dil KMnO4 solution forms another compound B having molecular formula $C_2 H_4 O_2$ in the presence of conc. H_2SO_4. A and B react to give sweet smelling substance 'C'. Identify A ; B and C. Write all the chemical equations involved. 5

18. What is meant by power of lens. Define its SI unit? You have two lens. A and B of focal lengths + 10 cm and –10 cm respectively. State the nature and power of lens. Which of two lens will form a virtual and magnified image of an object placed 8 cm from the lens. Draw a ray diagram to justify your answer? 5

19. (a) When is the force experienced by a current carrying conductor placed in a magnetic field largest?

(b) A coil of insulated copper is connected to a galvanometer. What will happen if a bar magnet is :

(i) Pushed into the coil?

(ii) Withdrawn from the coil?

(iii) Held stationary inside coil?

20. A chemical compound having a strong smell of chlorine is used to disinfect water :

(a) Identify the compound

(b) Write the chemical equation of its preparation.

(c) Write its uses.

21. Explain how the sex of child is determined in human being? How variations are caused during sexual reproduction. 5

22. To study the dependence of current(I) on potential difference(V) across a resistor R. a student set up on circuit :

(i) Draw the circuit diagram.

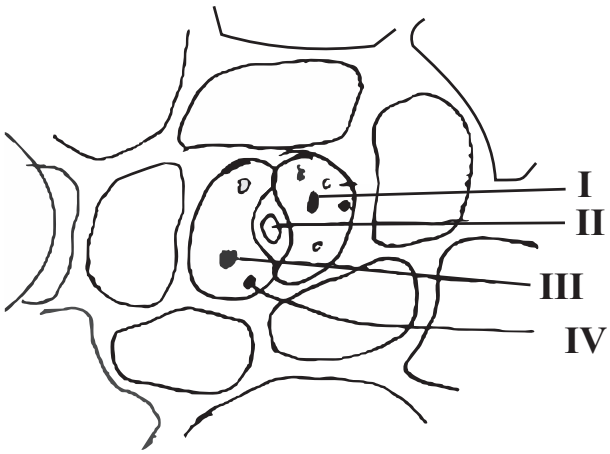
(ii) What will be change in reading of voltmeter when reading in ammter increase.

23. A student set up the apparatus for the experiment to show CO_2 is released during respiration. He kept a small test tube containing KOH pellets in conical flask.

(i) Why the kept small test tube containing KOH pellets in conical flask?

(ii) What he will observe after 2 hrs. of setting the experiment.

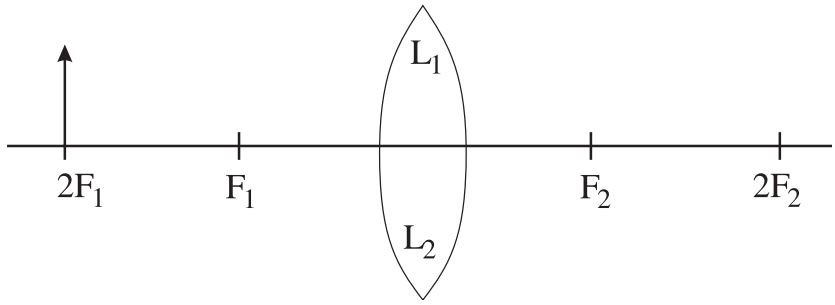
24. A student draw the following sketch of stomatal apparatus. The parts I, II, III and IV are labelled. Identify them.



25. While doing an experiment a student observed that the blue colour of the aqueous copper sulphate solution has changed on adding iron fillings. State the colour change of copper sulphate and name the reactions.

26. Name the type of asexual reproduction in which two individual are formed from a single parent and the parental identity is lost. Write the first step from where such type of reproduction begins. Draw first two stages of this reproduction. 2

27. In the ray diagram PQ is object placed in front of convex lens L1 L2. F1 and F2 are two foci given on principal anis. Complete the ray diagram to locate the position of image formed after the refraction through it. Also compare the size of object and the image. 2



CBSE PAPER ANNUAL EXAM. 2017-18

Time : 3 Hours Maximum Marks : 80

General Instructions :

(i) The question paper comprises two Section. A and B. You are to attempt both the sections.

(ii) All questions are compulsory.

(iii) All questions of Section An and Section B are to be attempted separately.

(iv) There is an internal choice in three questions of three marks each, two questions of five marks each in Section A and one question of two marks in section B.

(v) Question numbers 1 and 2 in Section A are one mark questions. They are to be answered in one word or in one sentence.

(vi) question numbers 3 to 5 in Section A are two marks questions. These are to be answered in about 30 words each.

(vii) Question numbers 6 to 15 in Section A are three marks questions. These are to be answered in about 50 words each.

(viii) Question numbers 16 to 21 in Section A are five marks questions. These are to be answered in about 70 words each.

(ix) Question numbers 22 to 27 in Section B are based on practical skills. Each question is a two marks question. These are to be answered in brief.

SECTION-A

1. A Mendelian experiment consisted of breeding pea plants bearing violet flowers with pea plants bearing white flowers. What will be the result in F_1 progeny? 1

2. Write the energy conversion that takes place in a hydropower plant. 1

3. A compound 'X' on heating with excess conc. sulphuric acid at 443 K gives an unsaturated compound 'Y'. 'X' also reacts with sodium metal to evolve a colourless gas 'Z'. Identify 'X', 'Y' and 'Z'. Write the equation of the chemical reaction of formation of 'Y' and also write the role of sulphuric acid in the reaction.

4. (a) Name one gustatory receptor and one olfactory receptor present in human beings.

(b) Write a and b in the given flow chart of neuron through which information travels as an electrical impulse.

Dendrite → a → b → End point of Neuron.

5. 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.

6. Decomposition reactions require energy either in the form of heat or light or electricity for breaking down the reactants. Write one equation each for decomposition reactions where energy is supplied in the form of heat, light and electricity.

7. 2 mL of sodium hydroxide solution is added to a few pieces of granulated zinc metal taken in a test tube. When the contents are warmed, a gas evolves which is bubbled through a soap solution before testing. Write the equation of the chemical reaction involved and the test to detect the gas. Name the gas which will be evolved when the same metal reacts with dilute solution of a strong acid.

Or

The pH of a salt used to make tasty and crispy pakoras is 14. Identify the salt and write a chemical equation for its formation. List its two uses.

8. (a) Why are most carbon compounds poor conductors of electricity?

(b) Write the name and structure of a saturated compound in which the carbon atoms are arranged in a ring. Give the number of single bonds present in this compound.

9. Name the hormones secreted by the following endocrine glands and specify one function of each :

(a) Thyroid (b) Pituitary (c) Pancreas.

10. Write one main difference between asexual and sexual mode of reproduction. Which species is likely to have comparatively better chances of survival- the one reproducing asexually or the one reproducing sexually? Give reason to justify your answer.

11. 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.

Or

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.

12. 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 ?

Or

(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 220V.

13. (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.

14. Students in a school listened to the news read in the morning assembly that the mountain of garbage in Delhi, suddenly exploded and various vehicles got buried under it. Several people were also injured and there was traffic jam all around. IN the brain storming session the teacher also discussed this issue and asked the students to find out a solution to the problem of garbage. Finally they arrived at two main points - one is self management of the garbage we produce and the second is to generate less garbage at individual level.

(a) Suggest two measures to manage the garbage we produce.

(b) As an indiviaul, what can we do to generate the least garbage? Give two points.

(c) List wo values the teacher instilled in his students in this episode.

15. What is a dam? Why do we seek to build large dams? While building large dams, which three main problems should particularly by addressed to maintain peace among local people? Mention them.

16. (a) Write the steps involved in the extraction of pure metals in the middle of the activity series from their carbonate ores.

(b) How is copper extracted from its sulphide one? Explain the various steps supported by chemical equations. Draw labelled diagram for the electrolytic refining of copper.

17. (a) The modern periodic table has been evolved through the early attempts of Dobereiner, Newland and Mendeleev. List one advantage and one limitation of all the three attempts.

(b) Name the scientist who first of all showed that atomic number of an element is more fundamental property than its atomic mass.

(c) State Modern periodic law.

18. (a) Mention any two components of blood.

(b) Trace the movement of oxygenated blood in the body.

(c) Write the function of valved present in between atria and ventricles.

(d) Write one structural difference between the composition of artery and veins.

Or

(a) Define excretion.

(b) Name the basic filtration unit present in the kidney.

(c) Draw excretory system in human beings and label the following organs of excretory system which perform following functions :

(i) form urine.

(ii) is a long tube which collects urine from kidney.

(iii) store urine until it is passed out.

19. (a) Write the function of following parts in human female reproductive system :

(i) Ovary (ii) Oviduct (iii) Uterus

(b) Describe in brief the structure and function of placenta.

20. (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.

Or

(a) Write the function of each of the following parts of human eye :

(i) Cornea (ii) Iris

(iii) Crystalline lens (iv) Ciliary muscles.

(b) Why does the sun appear reddish early in the morning? Will this phenomenon be observed by an astronaut on the Moon? Give reason to justify your answer.

21. (a) State Fleming's left hand rule.

(b) Write the principle of working of an electric motor.

(c) Explain the function of the following parts of an electric motor :

(i) Armature (ii) Brushes (iii) Split ring.

SECTION-B

22. A student added few pieces of aluminium metal to two test tubes A and B containing aqueous solutions of iron sulphate and copper sulphate. In the second part of her experiment, she added iron metal to another test tubes C and D containing aqueous solutions of aluminium sulphate and copper sulphate.

In which test tube or test tubes will she observe colour change? On the basis of this experiment, state which one is the most reactive metal and why.

23. What is observed when a solution of sodium sulphate is added to a solution of barium chloride taken in a test tube? Write equation for the chemical reaction involved and name the type of reaction in this case.

24. List the steps of preparation of temporary mount of a leaf peel to observe stomata.

25. Name the process by which an amoeba reproduces. Draw the various stages of its reproduction in a proper sequence.

Or

A student is viewing under a microscope a permanent slide showing various stages of asexual reproduction by budding in yeast. Draw diagrams of what he observes. (in proper sequence)

26. An object of height 4.0 cm is placed at a distance of 30 cm from the optical centre 'O' of a convex lens of focal length 20 cm. Draw a ray diagram to find the position and size of the image formed. Mark optical centre 'O' and principle focus 'F' on the diagram. Also find the approximate ratio of size of the image to the size of the object.

27. 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	08.	1.0

Plot a graph between current (I) and potential difference (V) and determine the resistance (R) of the resistor.

Marking Scheme of Sciece (086)

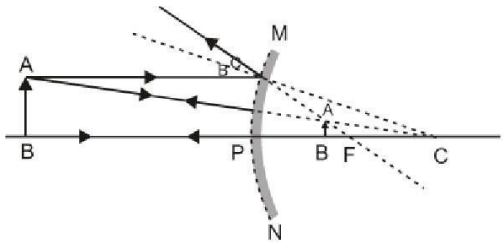
1. Violet flowers 1

2. Potential/Kinetic/Mechanical Energy into electrical energy 1

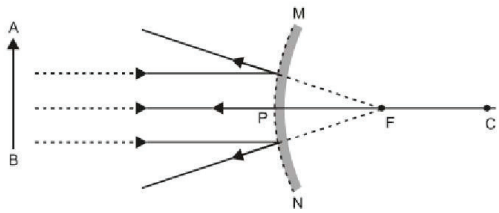
3. ● X-Ethanol/(C_2H_5OH)/Ethyl Akohol
   ● Y-Ethene/(C_2H_2)
   ● Z-Hydrogen/(H_2)
   (any two) ½ + ½
   ● $CH_3—CH_2OH \xrightarrow{\text{conc. } H_2SO_4} CH_2{=}CH_2OH + CH_2$
   ● Role of sulphuric acid-dehydrating agent. ½

4. (a) Due to ambiguity in the question award 1 mark whether attempted or not.
   (b) ● Cell-body/cyton ½×2
   ● Axon ½×2

5. ● Convex Mirror ½
   ● Labelled Ray Diagram for any position of object



OR



Note : If arrows not marked, ½ mark to be deducted.

6. ● $CaCO_3 \xrightarrow{heat} CaO + CO_2$

● $2FeSO_4 \xrightarrow{heat} Fe_2O_3 + SO_2 + SO_3$ **Any one**

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

● $2\ AgCl \xrightarrow{sunlight} 2Ag + Cl_2$

● $2\ AgBr \xrightarrow{sunlight} 2Ag + Br_2$ **Any one**

● $2\ H_2O \xrightarrow{electricity} 2H_2 + O_2$

(or any other equation for above decomposition reaction.)

Note : No marks to be deducted if equations are not balanced.

7. $Zn + 2NaOH \rightarrow Na_2ZnO_2 + H_2$ 1

● When a burning splinter is brought near the gas, it burns with a Pop Sound. 1

● Gas-Hydrogen/H_2

OR

● $NaHCO_3$ (Sodium Hydrogen Carbontate/Sodium Bicarbonate) 1

Uses :

For making baking powder

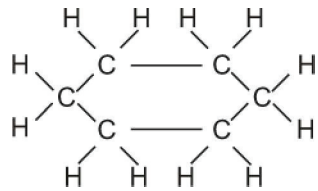
As ingredient of antacid.

Soda-acid fire extinguishers (Any two) ½+½

Note : As no salt can have pH = 14, give full credit for any attempt of the candidates.

8. (a) Carbon compounds form Covalent bonds/do not dissociate into ions/ do not have charged particles (ions) 1

(b) Cyclohexane 1



Total No. of single bonds = 18 ½

(Or any other cycloalkance with corresponsding number of bonds)

9. (a) Thyroxine, regulates carbohydrate protein and fat metabolism/controls metabollism for balance of body growth. ½+½

(b) Growth hormone, regulates growth and development of body (or any other correct answer) ½+½

(c) Insulin, regulates/decreases blood sugar level ½+½

Or

Glucagon, regulates/increses blood sugar

10. Any one of the following difference : 1

(i) In sexual reproduction two opposite sexes are involved where as asexual reproduction only one individual is involved. 1

(ii) In sexual reproduction male and female gamete formation takes place where as in asexual no gamete formation occurs. 1

- Sexually reproducing organisms have better chances of survival 1
- Because more variations are generated. 1

11. Ist law the incident ray, refracted ray and normal to the interface at the point of incidence lie in the same plane. 1

2nd law : The sine of angle of Incidence bears a constant ratio with sine of angle of refration for a given pair of media. Or $\frac{\sin i}{\sin r}$ = constant

Absolute Refractive Index of a medium = $\frac{\text{speed of light in air or vacuum}}{\text{speed of light in the medium}}$

(Award full marks if the same thing is given in the form of statement)

OR

Power of lens = Ability to converge/diverge light rays passing through it/ reciprocal of the focal length in metres/1/f (in meters) ½

SI unit of power is Dioptre ½

Power of 1st lens $P_1 = \frac{100}{f_1} = \frac{100}{40cm} = +2.5D$ ½

Nature : Converging lens/Convex lens

Power of 2nd lens $P_2 = \frac{100}{f_2} = \frac{100}{-20\,cm} = -5D$ ½

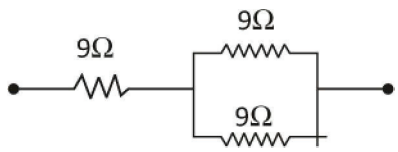
Nature : Diverging lens/Concave lns. ½

12. (i) Two 9 ohm resistors in parallel connected to one 9 ohms in series.

$$\frac{1}{R_p} = \frac{1}{9} + \frac{1}{9} = \frac{2}{9}$$

$$\therefore \quad R_P = \frac{9}{2}\Omega$$

$$R = 9\Omega + \frac{9}{2}\Omega = 13.5\Omega$$



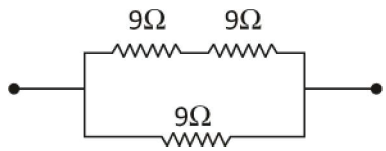
½

(ii) Two 9 ohm resistors in series connected to one 9 ohms in parallel.

$$R_s = 9\Omega + 9\Omega = 18\Omega$$

$$\frac{1}{R} = \frac{1}{18} + \frac{1}{9} = \frac{3}{18}$$

$$\therefore \quad R = 6\Omega$$



OR

(a) Joule's las of heating–Heat produced in a resistor is (i) directly proportional to the square of current for a given resistance, (ii) directly proportional to the resistance for a given current and (iii) directly proportional to the time for which the current flows through the resistor/H= I^2Rt where, H = Heat produced, I = current, R = Resistance of the conductor and t = Time for which the current flows through the resistor. 1

Note : If the condidate gives only the expression H = [^{2}Rt award ½ mark only]

(b) Current in 1st bulb, $I_1 = \frac{P_1}{v} = \frac{100}{220} = \frac{5}{11}$ A or 0.45 A 1

Current in Z buib, $I_2 = \frac{P_2}{v} = \frac{60}{220} = \frac{3}{11}$ A or 0.27 A 1

13. (a) Facrtors which resistance of a conductor depends :

(i) Length of conductor (or R α l) ½

(ii) Area of cross-section of the conductor (or R α 1/A) ½

(b) Metals are good conductor of electricity–as they have low resistivity/ have free electrons

Glass is a bad conductor of electricity–as it has high resistivity/have no free electrons ½

(c) Reasons : ½

Alloys have high resistivity/high melting point/alloys do not oxidize (Or burn) readily at high temperatures. (any one)

14. (a) Incineration/Waste compaction/Biogas generation/Composting/ Segregation and safe disposal/Vermicomposing. (Any other) (any two) ½+½

(b) Reuse of empty bottles, books etc.

Reduce the use of non-biodegradable substances like polythene, thermocol etc. (Any other)

(c) Awareness about environment, scientific attitude, Concern for community health and personal health. (Any two)

½½

15. (1) Dam is a barrier that is built across a river or a stream for storage of water. ½

(2) Large dam can ensure the storage of adequate water for irrigation and also for generating electricity. ½+½

(3) Social problem, economic problem and environmental problem.1½

16. (a) (i) Calcination (ii) Reduction (iii) Purification

(in the given sequence only) ½

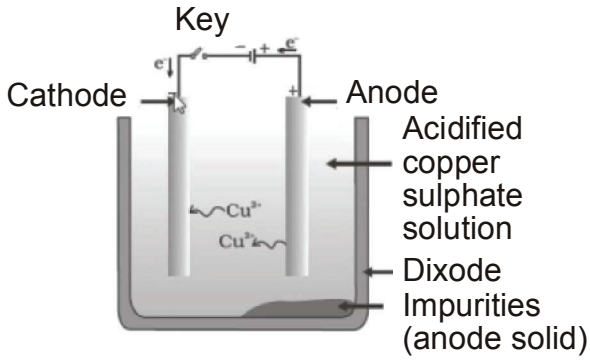
(b) Sulphide ore of copper is heated in air

$2Cu_2S+3O_2 \rightarrow 2Cu_2O+2SO_2$

$2Cu_2O + Cu_2S \rightarrow 6Cu_2 + SO_2$

(**Note :** Full marks to be awarded even when only equations are written.)

(c) Labelled diagram of electrolytic refining of copper



17. **Dobereiner Periodic Table** ½+½

Advantage : To Predict the atomic mass of middle element in each triad

Limitation : Dobereiner could identify only three triads

Newland Periodic table ½+½

Advantage : Every eighth element had properties similar to that of first/ co-related the properties of elements with their atomic mass.,

Limitation : It was only applicable up to Calcium/only 56 elements and no future element.

Mendeleev's Periodic table ½+½

Advantage : Elements with similar properties could be grouped/He predicted the existence of new elements that had not been discovered at that time.

Limitation : No fixed position for hydrogen/position of isotopes/Atomic masses do not increase in a regular manner.

Henry Moseley 1

Properties of elements are a periodic function of their atomic number 1

18. (a) Plasma, red blood cells, white blood cells, platetets (any two) ½, ½

(b) Lungs → Left side of the heart → aorta → body organs ½×4

Note : Give weightage even if same thing is explained in the form of Paragraph.

(c) Prevent back flow of blood 1

(d) Artery has thick elastic wall and vein is thin walled/valves are present in the veins and not in arteries. 1

OR

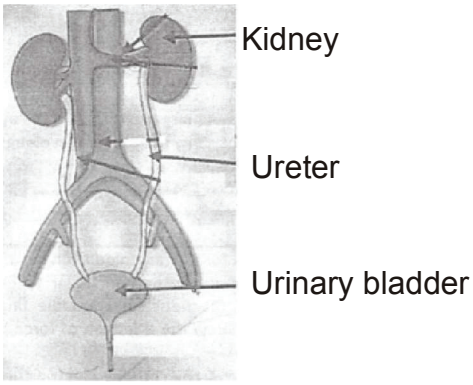
(a) Process involved in removal of nitrogenous/harmful metabolic waste form the body. 1

(b) Nephron. 1

(c) Diagram or Human Excretory System :

Labelling of the follwing parts

(i) kidney (ii) ureter (iii) urinary bladder



Drawing 1½

Labelling ½

19. (a) (i) Ovary – releases egg/female gamete/ovum 1

releases oestrogen/female hormones (any one)

(ii) Oviduct-Transportation of ovum/egg from ovary to the uterus/ Site of fertilization 1

(a) Placenta is a disc embedded in uterine wall which contains villi on the embryo side of the tissue and blood space on mother side.

20. (a) Defect of vision - Myopia or short sightedness or near sightedness. 1

Causes of myopia : (i) Excessive curvature of eye lens/eye lens becomes more converging.

(ii) Elongation of eye ball. ½+½

Methods of correction : By the use of concave lens of suitable power of focal length the defect is corrected./suitable diagrammatic representation. 1

(b) **Due to atmospheric refraction** **1**

The density of different layers of air keeps on changing due to which the apparent image of the stars keeps on changing. This changing position of stars appears as twinkling of stars. 1

OR

(a) Function of :

- Cornea : focuses light rays/permits the light to enter the eye.
- Iris : Controls amount of light entering the eye./controls the size of pupil.
- Crystalline Lens : Converges light rays onto retina.
- Cilliary Muscles : Adjusts focal length of eye lens by contraction and relaxation so that sharp image can be obtained on the retina.helps in accommodation. ½×4

(b) In early moring, sun light has to cover larger distance in tha atmosphere. So, the shorter wavelengths scatter out. Only the longer wavelengths like red reach our eye. 1½

On moon–No ½

Cause : Moon has no atmosphere 1

21. - Fleming's left hand rule : stretch the forefinger, middle finger and thumb of left hand in such a way that they are mutually perpendicular to each other. If the forefinger point in the direction of magnetic field, middle finger point in the direction of current then the thumb show the direction of force or motion on the current carrying conductor. 1
- Principle of working of electric motor : A coil carring electric current placed in an external magnetic field experiences a force. 1
- Function of armature : Enhances the power of the motor/induces motion. 1
- Function of brushes : Helps easy transfer on charge between the coil and the external circuit.
- Function of split rings : Reverses the direction of current after each half rotation of the coil so that the coil can keep rotating continuously. 1

SECTION-B

22. In the test tube A, B, D she will observe colour change (No splitting of marks). 1

    Aluminum is the most reactive metal, because it displaces Iron, Zinc and Copper from their aqueous salt solutions. ½+½

23. White precipitate is observed ½

    Na_2SO_4 (aq) + $BaCl_2$(aq) $\rightarrow$ BasO4(s) + 2NaCl(aq) 1

    Double displacement reaction. ½

24. The steps are :

    (i) Removal of peel from leaf ½

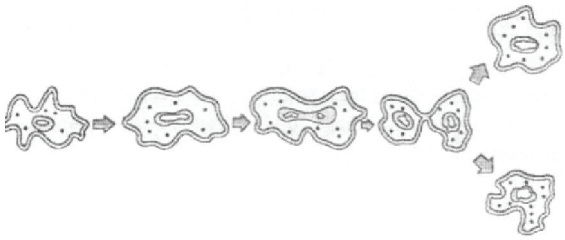
    (ii) Stain with safranin ½

    (iii) Put the stained peel on a clean slide ½

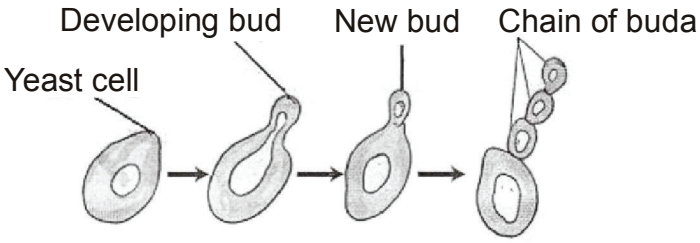
    (iv) Mount it with glycerine and cover slip ½

25. Binary fission ½

    - Diagram ½



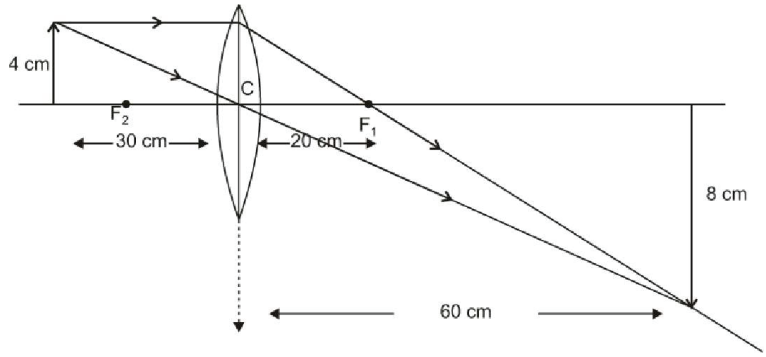
OR



26. Ray diagram

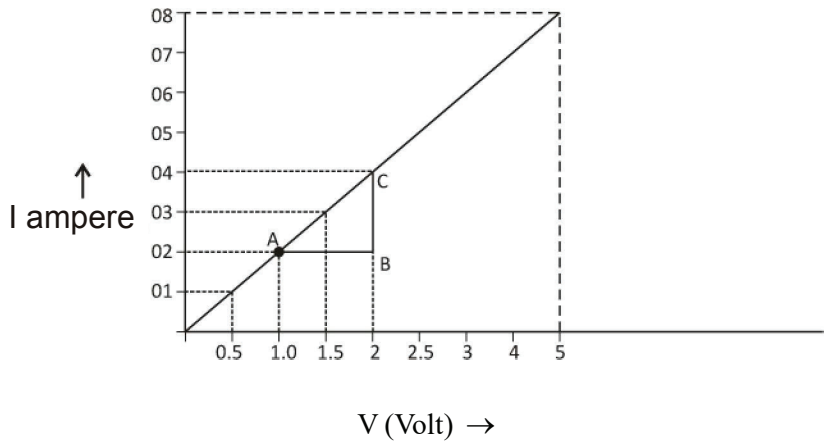
Position of O and f ½

Ratio=hi/ho approximately 2 : 1 ½



27. Plotting of correct graph 1

Calculation of resistance 1



$$\text{Resistance} = \frac{\Delta V}{\Delta I} = \frac{AB}{BC} = \frac{(2-1)V}{(0.4-0.2)A} = \frac{1V}{0.2A} = 5\Omega.$$

SAMPLE QUESTION PAPER 2017-18

SCIENCE

Class-X

Time : 3 Hours Maximum Marks : 80

General Instructions :

(i) The question paper comprises two Section. A and B. You are to attempt both the sections.

(ii) All questions are compulsory.

(iii) All questions of Section An and Section B are to be attempted separately.

(iv) There is an internal choice in three questions of three marks each, two questions of five marks each in Section A and one question of two marks in section B.

(v) Question numbers 1 and 2 in Section A are one mark questions. They are to be answered in one word or in one sentence.

(vi) question numbers 3 to 5 in Section A are two marks questions. These are to be answered in about 30 words each.

(vii) Question numbers 6 to 15 in Section A are three marks questions. These are to be answered in about 50 words each.

(viii) Question numbers 16 to 21 in Section A are five marks questions. These are to be answered in about 70 words each.

(ix) Question numbers 22 to 27 in section B are based on practical skills. Each question is a two marks question. These are to be answered in brief.

SECTION-A

1. Give an example of a flower which contains both stamens and carpels.

2. Mention any one point of difference between Pepsin and Trypsin.

3. An element 'X' has mass number 35 and the number of neutrons, is 18. Identify the group number and period of 'X'.

4. An object of height 1.2 m is placed before a concave mirror of focal length 20 cm so that a real image is formed at a distance of 60 cm from it. Find the position of an object. What will be the height of the image formed?

5. Why is there a need to harness non-conventional sources of energy? Give two main reasons.

6. Name the electric device that converts mechanical energy into electrical energy. Draw the labelled diagram and explain the principle involved in this device.

Or

(i) What is the function of earth wire in electrical instruments?

(ii) Explain what is short circuiting an electric supply.

(iii) What is the usual current rating of the fuse wire in the line to feed.

(a) Lights and fans?

(b) Appliances of 2 kW or more power?

7. Draw a circuit diagram of an electric circuit containing a cell, a key, an ammeter, a resistor of 4 Ω in series with a combination of two resistors (8 Ω each) in parallel and a voltmeter across parallel combination. Each of them dissipate maximum energy and can withstand a maximum power of 16 W without melting. Find the maximum current that can flow through the three resistors.

8. In the electrolysis of water,

(a) Name the gas collected at anode and cathode

(b) Why is the volume of gas collected at one electrode double than the other?

(c) What would happen if dill H_2SO_4 is not added to water?

9. Differentiate between the arrangement of elements in Mendeleev's periodic table and Modern periodic table.

10. Explain the ways in which glucose is broken down in absence of oxygen.

Or

List three difference between arteries and veins.

11. How do Mendel's experiments show that traits may be dominant or recessive?

12. Rohit focused the image of a candle frame on a white screen using a convex lens.

He noted down the position of the candle, screen and lens as under :

Position of candle = 26.0 cm

Position of convex lens = 50.0 cm
Position of screen = 74.0 cm

(i) What is the focal length of the convex lens?

(ii) Where will the image be formed if he shifts the candle towards the lens at a position of 38 cm?

(iii) Draw a ray diagram to show the formation of the image in case (ii) as said above?

13. "pH has a great importance in our daily life" explain by giving three examples.

Or

A compound which is prepared from gypsum has the property of hardening when mixed with a proper quantity of water. Identify the compound and write its chemical formula. Write the chemical equation for its preparation. Mention any one use of the compound.

14. Why are fossils considered important in the study of evolution? Explain two ways by which age of fossils can be estimated.

15. Our Government launches campaigns to provide information about AIDS prevention, testing and treatment by putting posters, conducting radio shows and using other agencies of advertisements.

(a) To which category of diseases AIDS belong? Name its causative organism.

(b) Which kind of value is Government trying to develop in the citizens by conducting the above kind of programs.

16. With the help of a labelled circuit diagram wire describe an activity to illustrate the pattern of the magnetic field lines around a straight current carrying long conducting wire.

(i) Name the rule that is used to find the direction of magnetic field associated with a current carrying conductor.

(ii) Is there a similar magnetic field produced around a thin beam of moving (a) alpha particles and (b) neutrons? Justify your answer.

17. You are given balls and stick model of six carbon atoms and fourteen hydrogen atoms and sufficient number of sticks. In how many ways one can join the models of six carbon atoms and fourteen hydrogen atoms to form different molecules of C_6H_{14}.

Or

Draw the structural formulae of all the possible isomers of the compound with the molecular formula C_3H_6O and also give their electron dot structures.

18. (a)

    (i) Draw a neat diagram of human brain and

    (ii) label Medulla and Cerebellum

    (iii) Write the functions of the above mentioned parts

    (b) "Both overproduction and underproduction of Growth hormone leads to disorders in the body." Explain.

19. Noopur needs a lens of power -4.5D for correction of her vision.

    (a) What kind of defect in vision is she suffering from?

    (b) What is the focal length and nature of the corrective lens?

    (c) Draw ray diagrams showing the (i) defected eye and (ii) correction for this defect.

    (d) What are the causes of this defect?

20. (a) What is reactivity series? How does the reactivity series of metals help in predicting the relative activities of various metals?

    (b) Suggest different chemical processes used for obtaining a metal from its oxides for metals in the middle of the reactivity series and metals towards the top of the reactivity series. Support your answer with one example each.

21. (a) "Improvements in our lifestyle have resulted in greater amounts of waste generation." Give two examples to support the given statement. Suggest one change that we can incorporate in our lifestyle in order to reduce non-biodegradable waste.

    (b) The following organisms form a food chain.

    Insect, hawk, Grass, Snake, Frog.

    Which of these will have highest concentration of non-biodegradable chemicals? Name the phenomenon.

Or

(a) What do you understand by 'Watershed Management"? List any two advantages of watershed management.

(b) "Human beings occupy the top level in any food chain." What are the consequences of this on our body?

SECTION-B

22. What do you observe when you drop a few drops of acetic acid to a test tube containing :

    (a) Phenolphthalein

    (b) Distilled water

    (c) Universal indicator

    (d) Sodium hydrogen carbonate

23. Riya performs two set of experiments to study the length of the foam formed which are as follow:

    Set - I : She takes 10 ml of distilled water in test tube 'A' and adds 5-6 drops of liquid soap in it and shakes the test tube vigorously.

    Set - II: She take 10 ml of distilled water ina test tube 'A' and adds 5-6 drops of liquid soap with half spoonful of $CaSO_4$ in it and shakes the test tube. Write your observation and reason.

24. A student observed a permanent slide showing asexual reproduction in yeast. Draw diagrams of the observations he must have made from the slide. Name the process also.

25. A student conducted an experiment to show CO_2 is released during respiration. List two precautions that he/she must take for obtaining correct observations.

26. The values of current I flowing in a given resistor for the corresponding values of potential difference V across the resistor are given below :

I (ampere)	0.5	1.0	2.0	3.0	4.0
V (volt)	1.6	3.4	6.7	10.2	13.2

Plot a graph between V and I and calculate the resistance of the resistor.

Or

In a given ammeter, a student sees that needle indicates 17 divisions in ammeter while performing an experiment to verify Ohm's law. If ammeter has 10 divisions between 0 and 0.5A, then what is the value corresponding to 17 divisions?

27. Draw a path of light ray passing through a prism. label angle of incidence and angle of deviation in the ray diagram.

❑❑