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INDEX

SYLLABUS

Unit I: Chemical Substances – Nature and Behaviour

Chapter – 1 Chemical substance: - Nature and Behaviour

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

Chapter – 2 Acids, Bases, and Salts

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

Chapter – 3 Metals and non-metals

Metals and non-metals: Properties of metals and non-metals; Reactivity series; Formation and properties of ionic compounds.

Chapter – 4 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), the 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.

Unit II: World of Living

Chapter – 5 Life Processes

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

Chapter – 6 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.

Chapter – 7 Reproduction

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

Chapter – 8 Heredity and Evolution

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

Unit III: Natural Phenomena

Chapter – 9 Light – Reflection and Refraction

Reflection of light by curved surfaces; Images formed by spherical mirrors, the 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 the spherical lens; Image formed by spherical lenses; Lens formula (Derivation not required); Magnification Power of a lens.

Chapter 10 - The Human Eye and The Colourful World

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, and applications in daily life (excluding colour of the sun at sunrise and sunset).

Unit IV: How Things Work

Chapter – 11 Effects of Current

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

Chapter – 12 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 a current-carrying conductor, Fleming's Left-Hand Rule, Electric Motor, Electromagnetic induction. The 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.

Unit V: Natural Resources

Chapter – 13 Our Environment

Eco-system, Environmental problems, Ozone depletion, waste production, and their solutions.

Biodegradable and non-biodegradable substances.

CHAPTER 1

CHEMICAL REACTIONS AND EQUATION

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NOTES

Chemical reactions are fundamental processes that occur around us every day. In this chapter, we explore the concept of chemical reactions, learn how to represent them using chemical equations, and understand the different types of chemical reactions.

Chemical equations are used to represent **chemical reactions**. **Reactants** change chemically into **products**

The law of conservation of matter requires that a proper chemical equation be **balanced**

Coefficients are used to show the relative numbers of reactant and product molecules.

One important Law in chemistry is the **LAW OF CONSERVATION OF MATTER (MASS)**, which states that in any closed system, the amount of matter stays constant.

Chemical reactions can be classified by type. **Combination reactions** (also called **composition reactions**) make a substance from other substances. **Decomposition reactions** break one substance down into multiple substances. **Combustion reactions** combine molecular oxygen with the atoms of another reactant.

Oxidation reactions are reactions in which an atom loses an electron

Reduction reactions are reactions in which an atom gains an electron

These two processes always occur together, so they are collectively referred to as **oxidation-reduction** (or **redox**) **reactions**. The species being oxidized it called the **reducing agent**, while the species being reduced is the **oxidizing agent**

Alternate definitions of oxidation and reduction focus on the gain or loss of oxygen atoms, or the loss or gain of hydrogen atoms. Redox reactions are easily balanced if the overall reaction is first separated into **half reactions**, which are individually balanced

Oxidation-reduction reactions are common in organic and biological chemistry.

Respiration, the process by which we inhale and metabolize oxygen, is a series of redox reactions. In the absence of oxygen, redox reactions still occur in a process called **anaerobic metabolism**

Antioxidants such as ascorbic acid also play a part in the human diet, acting as reducing agents in various biochemical reactions.

Photosynthesis the process by which plants convert water and carbon dioxide to glucose, is also based on redox reactions.

Chemical Equation The symbolic representation of chemical reaction using symbols and formulae is known as **Chemical Equation**. For this, reactants are written in left hand side whereas products are written on the right.

Balanced Chemical Equation

A balanced chemical equation is the one where the number of atoms involved in reactants side is equal to number of atoms on product side.

Eq.1. Example of Balanced Chemical Equation

Steps to form Balanced Equation

To show how to balance the equation, the following equation is used-

$Fe + H_2O \rightarrow Fe_3O_4 + H_2$

Step 1: First of all, draw the boxes around each formula as shown below-

Step 2: Find out the number of atoms of each element. **For Example**, on reactant side, 1 for Fe, 2 H, and 1 O and on product side we have, 3 for Fe, 4 for O and 2 for H.

Step 3: Start to balance the equation with the compound having maximum number of atoms. While balancing does not alter the formula of the compound.

Step 4: One by one balance each element on reactant and product side.

Step 5: After balancing number of atoms on both the side of the equation, finally check the correctness of the balanced equation.

Step 6: then write the symbols of the physical state of reactants and products as shown below-

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

This above equation represents the balanced equation.

Types of Chemical Reaction

- **Combination Reaction** is reaction when single product is formed from the combination of two or more reactants. **For Example**-

$$CaO\ (s) + H_2O\ (l) \longrightarrow Ca(OH)_2\ (aq)$$

Eq.2. Example of Combination Reaction

Reactions can be exothermic as well as endothermic. Exothermic reaction release heats and raises the temperature of the surroundings. **For Example**, Respiration is an example of exothermic reaction.

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

Eq.3. Example of Exothermic Reaction

Endothermic reaction involved the absorption of the heat and thus it cools the surrounding. The decomposition of dead organic material is an endothermic reaction.

- **Decomposition Reaction** is type of reaction which involves breakdown of single reactant into simpler products. Decomposition of silver chloride into silver and chlorine in presence of sunlight is an example of decomposition reaction.

Eq.4. Example of Decomposition Reaction

- **Displacement Reaction** is a reaction in which more reactive element will displaces the less reactive element.

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

Eq. 5. Example of Displacement Reaction

- **Double Displacement Reaction** is a type of reaction in which cations and anions in the reactants switch the places to form new products.

$$Na_2(SO)_4\ (aq) + BaCl_2\ (aq) \rightarrow\ BaSO_4\ (s) + NaCl\ (aq)$$

Eq. 6. Example of Double Displacement Reaction

- **Redox Reaction** is also known as **Oxidation-reduction Reaction**. In this type of reaction transfer of electrons occurs between the two species. Oxidation is defined as addition of oxygen or removal of hydrogen. Reduction is defined as removal of oxygen or addition of hydrogen. Oxidizing agent is the one which gains the electrons and is reduced in a chemical reaction.

Reducing agent is oxidized in a chemical reaction and it loses the electrons. Fluorine is the strongest oxidizing agent. Formic acid is a reducing agent

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

Eq.7. Example of Redox Reaction

SUMMARY

Introduction:

Chemical reactions play a crucial role in our everyday lives. They occur when substances interact with one another, resulting in the formation of new substances with different properties.

Chemical Reactions:

A chemical reaction is a process in which one or more substances, called reactants, combine or break apart to form new substances, known as products. During a chemical reaction, there is a rearrangement of atoms, but no new atoms are created or destroyed. This principle is known as the Law of Conservation of Mass.

Chemical Equations:

Chemical equations are symbolic representations of chemical reactions. They provide a concise way to communicate the reactants, products, and conditions of a reaction. A typical chemical equation consists of reactants on the left side, an arrow indicating the direction of the reaction, and products on the right side.

Example of a Chemical Equation:

Let's consider the reaction between hydrogen gas (H_2) and oxygen gas (O_2) to form water (H_2O):

$2H_2 + O_2 \rightarrow 2H_2O$

In this equation, the numbers preceding the elements and compounds are called coefficients. They indicate the relative proportions of reactants and products.

Types of Chemical Reactions:

Chemical reactions can be classified into several types:

a) **Combination Reactions:**

These reactions occur when two or more substances combine to form a single product. The general form can be represented as:

$A + B \rightarrow AB$

b) **Decomposition Reactions:**

Decomposition reactions involve the breakdown of a compound into two or more simpler substances. The general form can be represented as:

$AB \rightarrow A + B$

c) **Displacement Reactions:**

Displacement reactions occur when an element reacts with a compound, leading to the displacement of another element in the compound. The general form can be represented as:

$A + BC \rightarrow AC + B$

d) **Double Displacement Reactions:**

These reactions involve the exchange of ions between two compounds, resulting in the formation of new compounds. The general form can be represented as:

$AB + CD \rightarrow AD + CB$

e) **Redox Reactions:**

Redox (reduction-oxidation) reactions involve the transfer of electrons between reactants. One species undergoes oxidation (loses electrons), while the other undergoes reduction (gains electrons).

Balancing Chemical Equations:

Balancing chemical equations is crucial to satisfy the Law of Conservation of Mass. It involves adjusting coefficients to ensure the same number of atoms of each element is present on both sides of the equation.

Guidelines for Balancing Equations:

a) Start by balancing the atoms of the most complex or least abundant element.

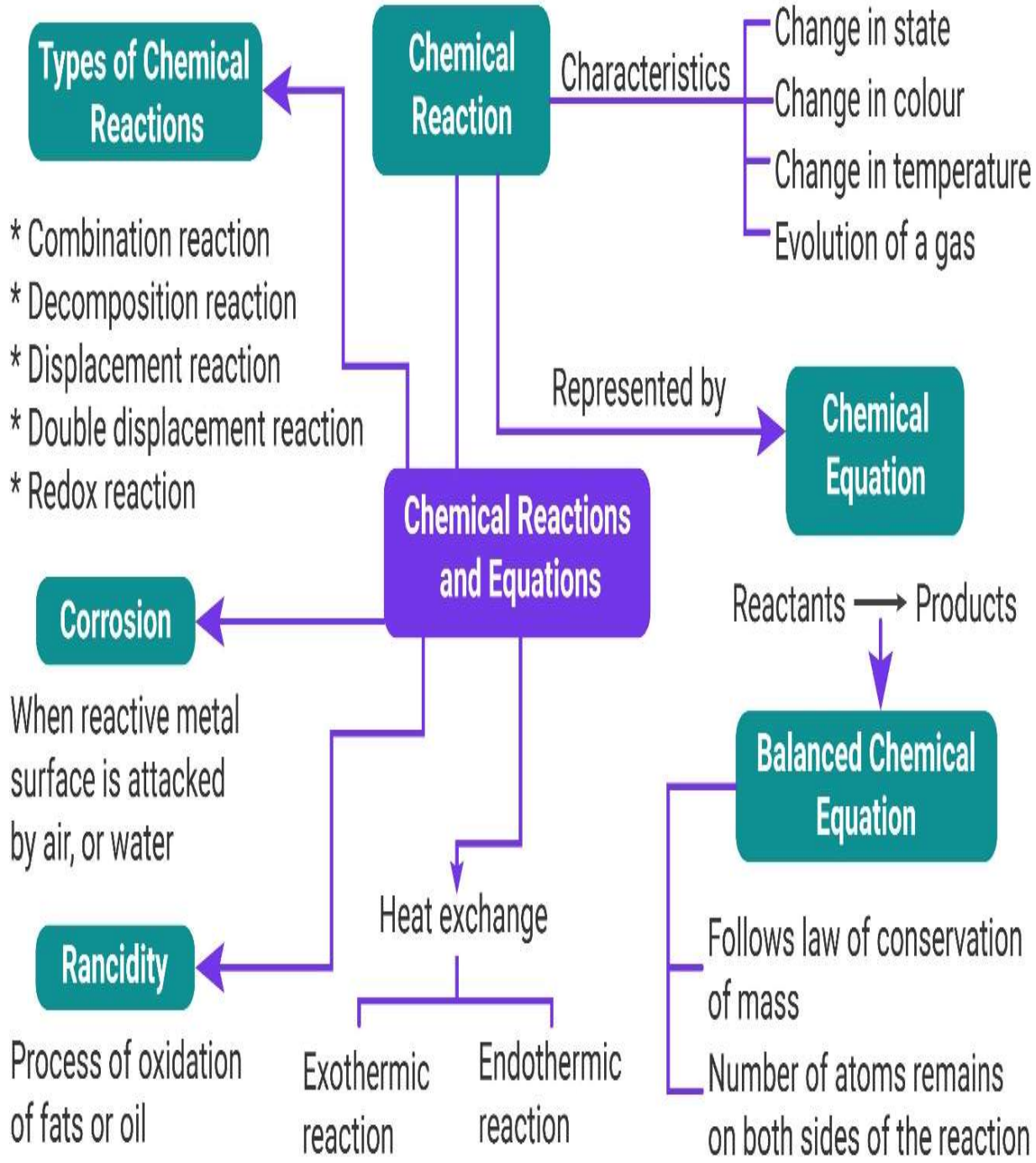
b) Balance atoms of one element at a time, avoiding changing the subscripts.

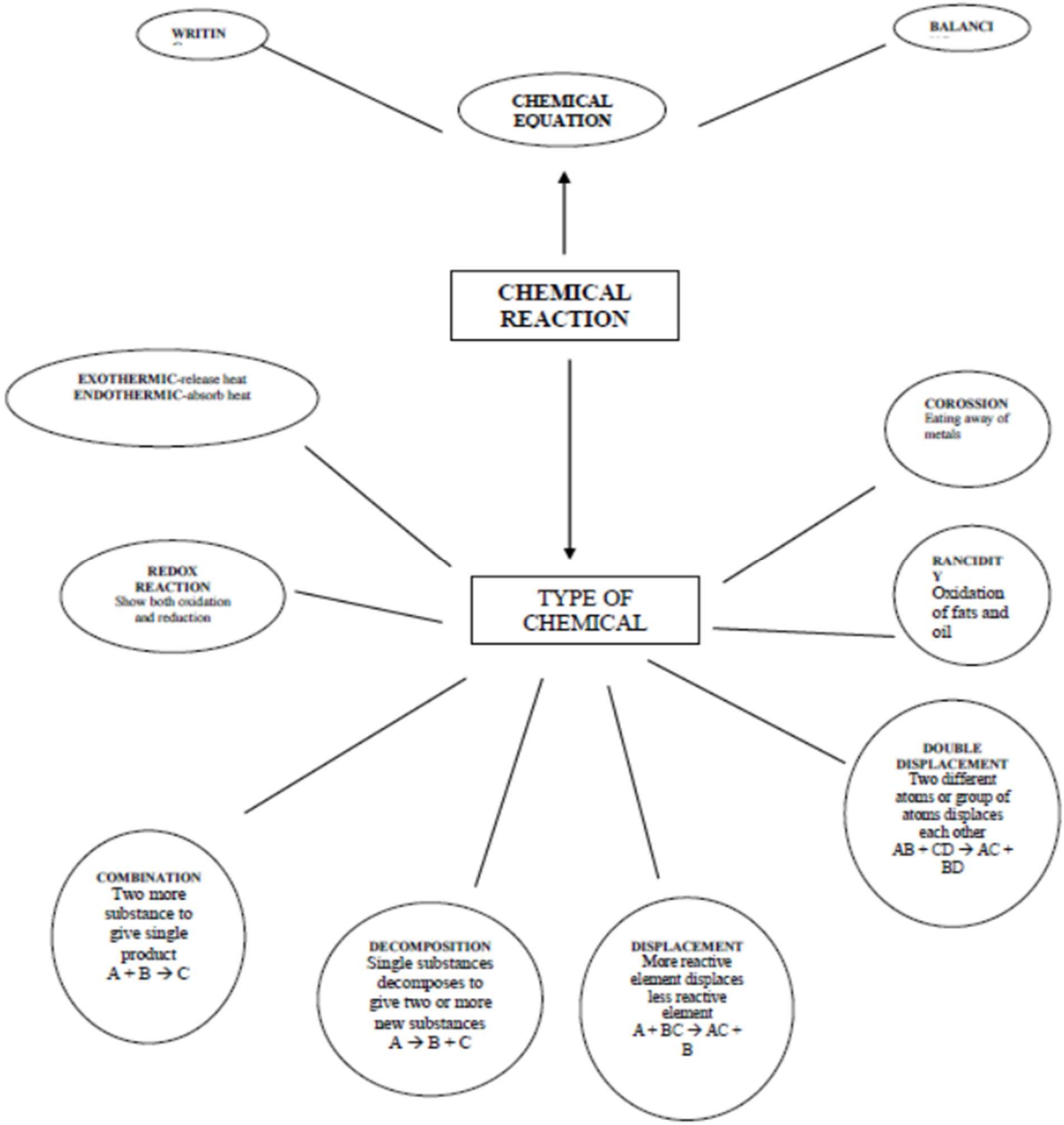
c) Use coefficients to adjust the number of atoms, never change the subscripts.

Conclusion:

Chemical reactions and equations are fundamental concepts in chemistry. Understanding them allows us to predict and explain a wide range of phenomena in the natural world. Remember, practicing and applying these concepts will improve your grasp of chemistry and help you excel in your studies.

Mind Map





Question Bank:

MCQS(1X15=15)

1. Magnesium ribbon is rubbed before burning because it has a coating of

(a) basic magnesium carbonate

(b) basic magnesium oxide

(c) basic magnesium sulphide

(d) basic magnesium chloride

Answer: b

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

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

(i) Iron metal is getting oxidized

(ii) Water is getting reduced

(iii) Water is acting as reducing agent

(iv) Water is acting as oxidizing agent

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

(b) (ii) and (iv)

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

(d) (ii) and (iv)

Answer: c

3. Oxidation is a process which involves

(i) addition of oxygen

(ii) addition of hydrogen

(iii) removal of oxygen

(iv) removal of hydrogen

a) (i) and (ii)

b) (ii) and (iii)

c) (i) and (iv)

d) (ii) and (iv)

Ans. C

4. Electrolysis of water is a decomposition reaction. The mole ratio of hydrogen and oxygen gases liberated during electrolysis of water is:

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

Ans (b) 2:1

5. When green coloured ferrous sulphate crystals are heated, the colour of the crystal changes because

(a) it is decomposed to ferric oxide

(b) it loses water of crystallisation

(c) it forms SO_2

(d) it forms SO_3

Ans (b) it loses water of crystallisation

6. $2HNO_3 + Ca(OH)_2 \rightarrow Ca(NO_3)_2 + 2H_2O$; is an example of

(i) displacement reaction

(ii) double displacement reaction

(iii) neutralisation reaction

(iv) combination reaction.

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

Ans (b) (ii) and (iii)

7. What is observed when a solution of potassium iodide is added to silver nitrate solution?

(a) No reaction takes place

(b) White precipitate of silver iodide is formed

(c) yellow precipitate of Agl is formed

(d) Agl is soluble in water.

Ans (b) White precipitate of silver iodide is formed

8. **Identify 'x', 'y' and 'z' in the following balanced reaction**

$$x\mathrm{Pb(NO_3)_2}(s) \xrightarrow{\text{Heat}} y\mathrm{PbO}(s) + z\mathrm{NO_2}(g) + \mathrm{O_2}(g)$$

(a) 2, 4, 2 (b) 2, 2, 4 (c) 2, 4, 4 (d) 4, 2, 2

Ans (b) 2, 2, 4

9. **In which of the following, heat energy will be evolved**?

(a) Electrolysis of water

(b) Dissolution of NH_4 Cl in water

(c) Burning of L.P.G.

(d) Decomposition of AgBr in the presence of sunlight

Ans (c) Burning of L.P.G.

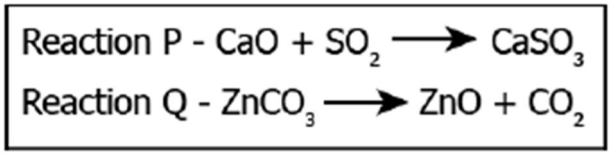
10. A substance X which is a group 2 element is used intensively in the cement industry . This element is present in bones also. On treatment with water, it forms a solution which turns red litmus blue. Element X is

(a) Cu (b) Ca (c)Na (d) Al

Ans (b) Ca

11. A student learns that some products are formed as a result of combining two compounds while some compounds are formed as a result of the dissociation of two compounds. The image shows two reactions.

Which reaction is an example of a combination reaction and a decomposition reaction?



(a) Both reactions are examples of combination reaction

(b) Both reactions are examples of a decomposition reaction

(c) Reaction P is an example of a combination reaction, while reaction Q is an example of a decomposition reaction

(d) Reaction P is an example of a decomposition reaction, while reaction Q is an example of a combination reaction

Answer: Option (c)

12. **A substance 'X' is used in white-washing and is obtained by heating limestone in the absence of air. Identify 'X'.**
(a) $CaOCl_2$
(b) $Ca(OH)_2$
(c) CaO
(d) $CaCO_3$

Answer d)

13. **$Pb + CuCl_2 \rightarrow PbCl_2 + Cu$**
The above reaction is an example of:
(a) combination
(b) double displacement
(c) decomposition
(d) displacement

Answer (d)

14.

$MnO_2 + x\ HCl \rightarrow MnCl_2 + y\ H_2O + z\ Cl_2$
In order to balance the above chemical equation. the values of x, y and z respectively are :

(a) 6,2,2
(b) 4,1,2
(c) 4,2,1
(d) 2,2,1

Answer (c)

15. On placing a copper coin in a test tube containing green ferrous sulphate solution, it will be observed that the ferrous sulphate solution

(a) turns blue, and a grey substance is deposited on the copper coin.

(b) turns colourless and a grey substance is deposited on the copper coin.

(c) turns colourless and a reddish–brown substance is deposited on the copper coin.

(d) remains green with no change in the copper coin.

Answer (d)

ASSERTION & REASONING(1X10=10)

Q. no 1 to 10 are Assertion - Reasoning based questions. These consist of two statements – Assertion (A) and Reason (R). Answer these questions selecting the appropriate option given below: (a) Both A and R are true and R is the correct explanation of A

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

(c) A is true but R is false

(d) A is False but R is true

1. Assertion: Silver bromide decomposition is used in black and white photography.

Reason: Light provides energy for this exothermic reaction.

Answer: (b) Both A and R are true and R is not the correct explanation of A

2. Assertion: The colour of aqueous solution of copper sulphate turns colourless when a piece of lead is added to it.

Reason: Lead is more reactive then copper , and hence displaces copper from its salt solution.

Answer: (a) Both A and R are true and R is the correct explanation of A

3. Assertion (A) : Calcium carbonate when heated gives calcium oxide and water.
Reason (R) : On heating calcium carbonate, decomposition reaction takes place.

(d) A is False but R is true

4. **Assertion** (A) : In a reaction of copper with oxygen, copper serves as a reducing agent.

Reason (R) : The substance which gains oxygen in a chemical reaction acts as a reducing agent.

Answer: (a) Both A and R are true and R is the correct explanation of A

5. **Assertion** (A) : In electrolysis of water, the volume of hydrogen liberated is twice the volume of oxygen formed.

Reason (R) : Water (H_20) has hydrogen and oxygen in the ratio of 1:2 by volume.

Answer (c) A is true but R is false

6. Assertion(A): A lead nitrate on thermal decomposition gives lead oxide, brown coloured nitrogen dioxide and oxygen gas.

Reason(R): Lead nitrate reacts with potassium iodide to form yellow ppt of lead iodide and the reaction is double displacement as well as precipitation reaction

Answer (b) Both A and R are true and R is not the correct explanation of A

7. Assertion (A): Pungent smelling gas is produced when sulphur burns in air.

Reason (R) : Sulphur trioxide is formed on reaction of sulphur with oxygen.

Answer (c) A is true but R is false

8. Assertion (A) : In a reaction of copper with oxygen, copper serves as a reducing agent.

Reason (R) : The substance which gains oxygen in a chemical reaction acts as a reducing agent.

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

9. Assertion (A) : Decomposition of vegetable matter into compost is an example of exothermic reactions.

Reason (R) : Exothermic reaction are those reactions in which heat is evolved

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

10. Assertion (A): A white washed wall develops a coating of calcium carbonate after a few days.

Reason (R): Calcium oxide on the wall reacts slowly with carbon dioxide in the air**.**

Answer (c) A is true but R is false

CASE BASED QUESTIONS(4X5=20)

1. **Read the following and answer any four questions from 1.1 to 1.4:**

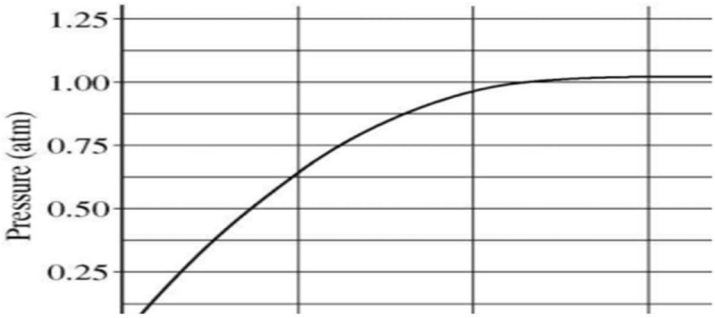
Marble's popularity began in ancient Rome and Greece, where white and off-white marble were used to construct a variety of structures, from hand-held sculptures to massive pillars and buildings.

1.1 The substance not likely to contain CaCO3 is

a) Dolomite b) A marble statue c) Calcined gypsum d) Sea shells.

Answer : c) Calcined gypsum(partially hydrated gypsum)

1.2 A student added 10g of calcium carbonate in a rigid container, secured it tightly and started to heat it. After some time, an increase in pressure was observed, the pressure reading was then noted at intervals of 5 mins and plotted against time, in a graph as shown below. During which time interval did maximum decomposition took place?



a) 15-20 min b) 10-15 min c) 5-10 min d) 0-5 min

Answer d) 0-5 min

1.3 Gas A, obtained above is a reactant for a very important biochemical process which occurs in the presence of sunlight. Identify the name of the process –

a) Respiration b) Photosynthesis c) Transpiration d) photolysis

Answer: b) Photosynthesis ($CO_{2\ is}$ Gas A)

1.4 Calcium oxide can be reduced to calcium, by heating with sodium metal. Which compound would act as an oxidizing agent in the above process? a) Sodium b) sodium oxide c) calcium d) calcium oxide

Answer: d) calcium oxide (Gets reduced itself to help oxidation of Sodium)

2. The redox processes conveys no information about the mechanism by which change takes place. Reactions are classified as redox and non-redox on the basis of stoichiometry; oxygen-atom, hydrogen-atom, and electron transfer are stoichiometric categories. Every atom consists of a positive nucleus, surrounded by negative electrons, which determine the bonding characteristics of each element. In forming chemical bonds, atoms donate, acquire, or share electrons. This makes it possible to assign every atom an oxidation number, which specifies the number of its electrons that can be involved in forming bonds with other atoms.

1. A redox reaction is one in which

(a) both substances are reduced (b) both substances are oxidised (c) an acid is neutralised by base (d) one substance is oxidised while the other is reduced simultaneously

2. An oxidising agent is a substance

(a)which oxidises itself and reduces the other (b) which reduces itself and oxidises the other (c) Which reduces itself and reduces the other (d) which oxidises itself and oxidises the other

3. Which of the following regarding Oxidation is incorrect

(a) loss of electrons (b) increase of oxidation number (c) decrease of oxidation number (d) Removal of hydrogen

4. Reduction is

(a) gain of electrons (b) sharing of electrons © loss of electrons (d)addition of oxygen

3. A lady wanted to give a coating of white wash to her room. She purchased quick lime from the market and dissolved it in water and immediately applied the same on the wall. In this process, she spoiled her hands and even suffered minor burns. Her friend advised her not be in haste and keep the container overnight before applying a coating on the wall. She followed her advice and there was now no problem.

1. What mistake was committed by the lady?

2. Why did she suffer from burns?

3. Why was so much heat evolved?

4. Write the balanced equation for the reaction involved

Answer

1. The lady should have waited for a few hours because when quick lime is dissolved in water, slaked lime is formed and this process is highly exothermic.

2. The solution might have become very hot and that is why the lady suffered from burns.

3. Quick lime is CaO and it reacts with water to form $Ca(OH)_2$ which is known as slaked lime. The dissolution process is highly exothermic. That is why so much heat was evolved. By keeping container overnight, the chemical reaction subsided and now there was no problem to apply the coating of white wash on the wall. In this way, she rendered service to the lady

$$CaO(s)+H_2O(l) \rightarrow Ca(OH)_2(s) + Heat$$

4. **A chemical reaction is a representation of chemical change in terms of symbols and formulae of reactants and products. There are various types of chemical reactions like combination, decomposition, displacement, double displacement, oxidation and reduction reactions. Reactions in which heat is released along with the formation of products are called exothermic chemical reactions. All combustion reactions are exothermic reactions**.

(i) The chemical reaction in which a single substance breaks down into two or more simpler substances upon heating is known as
(a) thermal decomposition reaction
(b) photo decomposition reaction
(c) electric decomposition reaction
(d) both (a) and (c)

(ii) The massive force that pushes the rocket forward through space is generated due to the
(a) combination reaction
(b) decomposition reaction
(c) displacement reaction
(d) double displacement reaction

(iii) A white salt on heating decomposes to give brown fumes and yellow residue is left behind. The yellow residue left is of
(a) lead nitrate
(b) nitrogen oxide
(c) lead oxide
(d) oxygen gas

(iv) Complete the following statements by choosing correct type of reaction for X and Y.
Statement 1: The heating of lead nitrate is an example of 'X' reaction.
Statement 2: The burning of magnesium is an example of 'Y' reaction.
(a) X- Combination, Y- Decomposition
(b) X- Decomposition, Y-Combination
(c) X- Combination, Y-Displacement
(d) X- Displacement, Y-Decomposition

Answer

(i) (a) thermal decomposition reaction

(ii) (b) decomposition reaction

(iii) (c) lead oxide

(iv)(b) X- Decomposition, Y-Combination

5. We have seen that the decomposition reactions require energy either in the form of heat, light or electricity for breaking down the reactants. Reactions in which energy is absorbed are known as endothermic reactions.

1.) Write the definition of exothermic reaction.

Ans. Reactions in which heat is evolved during the process are called as exothermic reactions, such as mixing of calcium oxide with water.

2.) What do you mean endothermic reactions?

Ans. Reactions in which heat is trapped or absorbed are called as endothermic reactions, such as glucose mixed with water.

3.) Write a reaction which falls under endothermic reaction.

Ans. Melting of ice, evaporation are considered under endothermic reactions. A chemical equation for these types of reaction is:

$N_2 + O_2 + \text{heat} \rightarrow 2\ NO$

4.) What is decomposition reaction?

Ans. Reactions in which a substance or reactant fragments to give one or many products.

5.) Explain photolysis.

Ans. Reactions in which reactant id decomposed with the help of sunlight are called as photolytic decomposition.

Ex: $2AgCl + \text{sunlight} \rightarrow 2Ag + Cl_2$

SHORT ANSWER QUESTIONS(2X10=20)

1. **Discuss the various types of chemical reactions, providing an example for each type.**

Answer:

- **Combination reaction: Example - $2Mg + O_2 \rightarrow 2MgO$**
- **Decomposition reaction: Example - $2H_2O \rightarrow 2H_2 + O_2$**
- **Displacement reaction: Example - $Zn + CuSO_4 \rightarrow ZnSO_4 + Cu$**
- **Double displacement reaction: Example - $NaCl + AgNO_3 \rightarrow AgCl + NaNO_3$**

Types of Chemical Reactions:

Chemical reactions can be classified into several types:

a) **Combination Reactions:**

These reactions occur when two or more substances combine to form a single product. The general form can be represented as:

$A + B \rightarrow AB$

b) **Decomposition Reactions:**

Decomposition reactions involve the breakdown of a compound into two or more simpler substances. The general form can be represented as:

$AB \rightarrow A + B$

c) **Displacement Reactions:**

Displacement reactions occur when an element reacts with a compound, leading to the displacement of another element in the compound. The general form can be represented as:

$A + BC \rightarrow AC + B$

d) **Double Displacement Reactions:**

These reactions involve the exchange of ions between two compounds, resulting in the formation of new compounds. The general form can be represented as:

$AB + CD \rightarrow AD + CB$

e) **Redox Reactions:**

Redox (reduction-oxidation) reactions involve the transfer of electrons between reactants. One species undergoes oxidation (loses electrons), while the other undergoes reduction (gains electrons).

2. Explain the difference between an element and a compound.

Answer: An element is a pure substance that consists of only one type of atom. It cannot be broken down into simpler substances by chemical means. In contrast, a compound is a substance formed by the chemical combination of two or more elements in a fixed ratio. It can be broken down into its constituent elements through chemical reactions.

3. 2 g of silver chloride is taken in a china dish and the china dish is placed in sunlight for sometime. What will be your observation in this case ? Write the chemical reaction involved in the form of a balanced chemical equation. Identify the type of chemical reaction

Answer: The white silver chloride turns grey in sunlight. This is because silver chloride decomposes to form silver and chlorine gas. Sunlight

$2AgCl(s) \rightarrow 2Ag(s) + Cl_2(g)$ It is a photodecomposition reaction.

4. Write the balanced chemical equations for the following reactions and identify the type of reaction in each case.

(a)Nitrogen gas is treated with hydrogen gas in the presence of a catalyst at 773K to form ammonia gas.

(b)Sodium hydroxide solution is treated with acetic acid to form sodium acetate and water.

(c) Ethanol is warmed with ethanoic acid to form ethyl acetate in the presence of concentrated H_2SO_4.

(d) Ethene is burnt in the presence of oxygen to form carbon dioxide and water and releases heat and light.

Answer

(a)

$$N_2(g) + 3H_2(g) \xrightarrow[Catalyst]{773K} 2NH_3(g)$$

It is an addition reaction.

(b) $NaOH\ (aq) + CH_3COOH\ (aq) \rightarrow CH_3COONa\ (aq) + H_2O\ (l)$

It is a double displacement or a neutralisation reaction.

(c)

$$C_2H_5OH(l) + CH_3OH(l) \xrightarrow{H^+} CH_3COOC_2H_5(l) + H_2O(l)$$

It is a double displacement or an esterification reaction.

(d) $C_2H_4\ (g) + 3\ O_2\ (g) \rightarrow 2\ CO_2\ (g) + 2\ H_2O\ (g)$ + Heat + light

It is a redox or a combustion reaction.

5. Identify the reducing agent in the following reactions

(a) $4\ NH_3 + 5\ O_2 \rightarrow 4\ NO + 6\ H_2O$

(b) $H_2O + F_2 \rightarrow HF + HOF$

(c) $Fe_2O_3 + 3\ CO \rightarrow 2\ Fe + 3\ CO_2$

(d) $2\ H_2 + O_2 \rightarrow 2\ H_2O$

Answer : (a) Here, ammonia (NH_3) is the reducing agent.

(b) Here, water (H_2O) is the reducing agent.

(c) Here, carbon monoxide (CO) is the reducing agent.

(d) Here, hydrogen (H_2) is the reducing agent.

6. We made the following observations during the reaction of some metals with dilute hydrochloric acid.

(a) Silver metal does not show any change

(b) The temperature of the reaction mixture rises when aluminium (Al) is added.

(c) The sodium metal reaction is highly explosive.

Explain these observations giving suitable reasons.

Answer : (a) Silver does not show any characteristics change because silver is less reactive than hydrogen. Thus, it cannot displace hydrogen from dilute hydrochloric acid.

(b) The reaction between aluminium (Al) and hydrochloric acid is highly exothermic. Thus, the temperature of the reaction mixture rises.

(c) Sodium is a highly reactive metal. It reacts with hydrochloric acid, vigorously forming hydrogen gas and a large amount of heat

7. A silver article generally turns black when kept in the open for a few days. The article, when rubbed with toothpaste again, starts shining.

(a) Why do silver articles turn black when kept in the open for a few days? Name the phenomenon involved.

(b) Name the black substance formed and give its chemical formula.

Answer:

(a) The silver article turns black when kept in the air because the silver article reacts with sulphur compounds such as hydrogen sulphide (H_2S) present in the air to form silver sulphide Ag_2S. This phenomenon is called corrosion. It is also known as tarnishing of silver.

(b) The black substance is silver sulphide. Its chemical formula is Ag_2S.

8. (i) Write two observations when lead nitrate is heated in a test tube.

(ii) Name the type of reaction.

(iii) Write a balanced chemical equation to represent the above reaction.

Answer

(i)Lead nitrate($Pb(NO_3)_2$) is a white salt which on heating under flame forms a yellow precipitate of Lead oxide (PbO), Nitrogen gas (NO_2) and Oxygen gas (NO_2) as a product.

Brown fumes are liberated during the reaction indicating the formation of Nitrogen gas (NO_2)

(ii) thermal decomposition

(iii) $2\ Pb(NO_3)_2 \rightarrow 2\ PbO + 4\ NO_2 + O_2$.

9. 2 g of ferrous sulphate crystals are heated in a dry boiling tube.
(a) List any two observations.
(b) Name the type of chemical reaction taking place.
(c) Write balanced chemical equation for the reaction and name the products formed.

Answer:
(a) Ferrous sulphate crystals ($FeSO_4.7H_2O$) lose water when heated and the

colour of the crystal's changes. It then decomposes to ferric oxide (Fe_2O_3), sulphur dioxide (SO_2) and sulphur trioxide (SO_3) with a smell of burning sulphur.
(b) This is a thermal decomposition reaction.

(c) $$2FeSO_{4(s)} \longrightarrow Fe_2O_{3(s)} + SO_{2(g)} + SO_{3(g)}$$

Ferrous sulphate — Ferric oxide — Sulphur dioxide — Sulphur trioxide

10. Take 3 g of barium hydroxide in a test tube, now add about 2 g of ammonium chloride and mix the contents with the help of a glass rod. Now touch the test tube from outside.

(i) What do you feel on touching the test tube?
(ii) State the inference about the type of reaction occurred.
(iii) Write the balanced chemical equation of the reaction involved.
Answer:
(i) When barium hydroxide is added into ammonium chloride, the bottom of test tube is found to be cooler.
(ii) It is an endothermic reaction.
(iii) $Ba(OH)_2 + 2NH_4Cl \rightarrow BaCl_2 + 2NH_4OH$

LONG ANSWER QUESTIONS(5X5=25)

1. Write fully balanced equations for the reactions of :

i. Sulphur dioxide and water

ii. Sodium with water

iii. Iron with oxygen

iv. Aluminium and potassium hydroxide.

v. Iron (III) oxide and dilute sulphuric acid

Answer

i. $SO_2(g) + H_2O(l) \longrightarrow H_2SO_3$
ii. $2Na(s) + 2H_2O(l) \longrightarrow 2NaOH(aq) + H_2(g)$
iii. $4Fe(s) + 3O_2(g) \xrightarrow{heat} 2Fe_2O_3(s)$
iv. $2Al(s) + 2KOH(aq) + 2H_2O(l) \longrightarrow 2KAlO_2(aq) + 3H_2(g)$
v. $Fe_2O_3(s) + 3H_2SO_4(aq) \longrightarrow Fe_2(SO_4)_3 + 3H_2O(l)$

2. Describe the steps involved in balancing a chemical equation using an example.

Answer: Balancing a chemical equation involves ensuring that the number of atoms of each element is the same on both sides of the equation. The steps are as follows:

i) Write the unbalanced equation.

ii) Count the number of atoms for each element on both sides of the equation.

iii) Identify the element that has an unequal number of atoms.

iv) Adjust the coefficients in front of the reactants and products to balance the equation.

v) Verify that the number of atoms of each element is now equal on both sides.

3. **Discuss the applications of redox reactions in everyday life, providing relevant examples.**

Answer: Redox reactions find numerous applications in daily life, including:

The process of respiration in living organisms involves redox reactions, where glucose is oxidized to produce energy.

Batteries, such as the lead-acid battery in cars, rely on redox reactions to generate electrical energy.

The extraction of metals from their ores involves redox reactions. For example, the extraction of iron from iron ore involves the reduction of iron(III) oxide using carbon.

The process of photosynthesis in plants is a redox reaction where carbon dioxide is reduced to glucose using energy from sunlight.

The use of bleach as a disinfectant relies on redox reactions, where the bleach oxidizes harmful microorganisms.

4. Give the characteristic tests for the following gases

(a) CO_2

(b) SO_2

(c) O_2

(d) H_2

Answer:

The characteristics test for

(a) CO_2: CO_2 turns lime water milky due to the formation of insoluble calcium carbonate.

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

(b) SO_2: SO_2 turns purple coloured acidic potassium permanganate solution colourless.

$5\ SO_2 + 2\ KMnO_4 + 2\ H_2O \rightarrow K_2SO_4 + 2\ MnSO_4 + 2\ H_2SO_4$

(c) O_2: We can confirm the evolution of oxygen gas by bringing a burning candle near the mouth of the test tube containing the reaction mixture. The intensity of the flame increases because oxygen supports burning.

(d) H_2: Hydrogen (H_2) gas burns with a pop sound when a burning candle is brought near it.

5. Write a balanced chemical equation for each of the following reactions and also classify them.

(a)Lead acetate solution is treated with dilute hydrochloric acid to form lead chloride and acetic acid solution.

(b)A piece of sodium metal is added to absolute ethanol to form sodium ethoxide and hydrogen gas.

(c)Iron (III) oxide on heating with carbon monoxide reacts to form solid iron and liberates carbon dioxide gas.

(d)Hydrogen sulphide gas reacts with oxygen gas to form solid sulphur and liquid water.

Ans.

$$(a)\ Pb(COOCH_3)_2(aq) + 2HCl(dil.) \longrightarrow PbCl_2(s) + 2CH_3COOH(l)$$

$$(b)\ 2Na(s) + 2C_2H_5OH(l) \longrightarrow 2C_2H_5ONa(l) + H_2(g)$$

$$(c)\ Fe_2O_3(s) + 3CO(g) \longrightarrow 2Fe(s) + 3CO_2(g)$$

$$(d)\ 2H_2S(g) + 3O_2(g) \longrightarrow 2H_2O(l) + 2SO_2(g)$$

VERY LONG ANSWER QUESTIONS(5X5=25)

1. Discuss the signs of a chemical reaction: evolution of gas, change in color, formation of a precipitate, and change in temperature.

Answer : Signs of a Chemical Reaction

The signs of a chemical reaction include the evolution of gas, change in color, formation of a precipitate, and change in temperature.

These signs help identify when a chemical reaction has occurred.

The evolution of gas is seen as the formation of bubbles or the release of a gas with a distinct odor.

A change in color indicates a chemical reaction, as the original substances transform into compounds with different colors.

The formation of a precipitate, a solid substance that settles at the bottom, also indicates a chemical reaction.

Lastly, a change in temperature, either an increase or decrease, is a clear sign of a chemical reaction. Recognizing these signs is important for studying and understanding chemical reactions.

2. Discuss the differences between displacement reactions based on activity series.

Answer : Displacement reactions involve the replacement of one element by another in a compound.

The reactivity or activity series determines which metal can displace another metal from a compound.

More reactive metals can displace less reactive metals from their compounds.

Displacement reactions based on the activity series are typically complete, resulting in the formation of new compounds and the release of the displaced metal.

These reactions involve oxidation-reduction processes, with the more reactive metal acting as the reducing agent and the less reactive metal cation acting as the oxidizing agent.

The activity series provides a hierarchical order of reactivity for metals, helping predict which metals can displace others in a displacement reaction.

Displacement reactions based on the activity series have practical applications in metal extraction from ores.

Understanding the differences in reactivity, completeness, oxidation-reduction, and the hierarchical order of the activity series is important for studying and predicting displacement reactions.

3. How do chemical reactions play a role in everyday life? Provide examples of chemical reactions that occur in our surroundings.

Answer : Chemical reactions play a vital role in our everyday lives, contributing to numerous processes and phenomena that we encounter. Here are some examples of chemical reactions that occur in our surroundings and their significance:

Combustion Reactions: Combustion reactions, such as burning of fuels, provide energy for various applications. For instance, the combustion of gasoline in car engines powers our vehicles, while the combustion of natural gas in stoves and furnaces provides heat for cooking and heating.

Digestion: The process of digestion involves a series of chemical reactions in our body. Enzymes break down food into simpler molecules through hydrolysis reactions, allowing our bodies to absorb nutrients and obtain energy.

Photosynthesis: Photosynthesis is a crucial chemical reaction occurring in plants, algae, and some bacteria. It converts carbon dioxide, water, and sunlight into glucose and oxygen, producing food for plants and releasing oxygen into the atmosphere. This process is vital for maintaining oxygen levels and sustaining life on Earth.

Respiration: Respiration is a series of chemical reactions that occur in cells, allowing organisms to convert glucose and oxygen into carbon dioxide, water, and energy. This energy is utilized for various cellular processes, including movement, growth, and maintenance of body temperature.

Rusting: Rusting is a chemical reaction that occurs when iron or steel comes into contact with oxygen and water. This process, known as oxidation, leads to the formation of iron oxide (rust). Rusting can cause deterioration of metal structures and objects in our surroundings.

Baking: Baking involves various chemical reactions. For example, during the mixing of ingredients, leavening agents like baking powder or yeast produce carbon dioxide gas through a chemical reaction, causing the dough or batter to

rise. The reaction between heat, proteins, and sugars during baking results in the browning and flavor development of baked goods.

Tarnishing: Tarnishing is a chemical reaction that occurs when metals, such as silver or copper, react with sulfur compounds in the air or other substances. This reaction leads to the formation of a tarnished layer on the metal surface, altering its appearance.

Acid-Base Reactions: Acid-base reactions are prevalent in our daily lives. For example, the reaction between an acid (such as vinegar) and a base (such as baking soda) produces carbon dioxide gas, which is utilized in baking or for cleaning purposes.

These examples highlight the significant role of chemical reactions in everyday life, influencing processes ranging from energy production to food digestion, and from material deterioration to the development of flavours in cooking.

Understanding these reactions helps us appreciate their impact and opens up opportunities for scientific advancements and applications.

4. Give reasons:

a) Why do fireflies' glow at night?

b) Grapes hanging on the plant do not ferment, but after being plucked from the plant can be fermented.

c) Silver metal does not show any change

d) The temperature of the reaction mixture rises when aluminium (Al) is added.

e) The sodium metal reaction is highly explosive.

Answer:

(a) Fireflies glow at night because of a chemical reaction involving light's emission. Fireflies store a protein (luciferin) that combines with oxygen in the air to form a new substance (oxyluciferin) and the evolution of energy in light.

(b) When attached to the plants, Grapes are living, and therefore, their immune system prevents fermentation. The microbes can grow in the plucked grapes, which can be fermented under anaerobic conditions

(c) Evaporation of petrol is a physical change as it only gets converted from one physical state to another.

(d) Burning of Liquefied Petroleum Gas (LPG) is a chemical change as heating produces carbon dioxide and water.

(e) The heating of an iron rod to red hot is a physical change as heating involves only temperature change.

5. (a) Write one example for each of decomposition reaction carried out with help of

(i) Electricity (ii) Heat (iii) Light

(b) Which of the following statements is correct and why copper can displace silver from silver nitrate and silver can displace copper from copper sulphate solution

(c) What is the role of catalysts in chemical reactions?

Answer

(a) i) $2H_2O \xrightarrow{\text{electricity}} 2H_2(g) + O_2$

ii) $CaCO_3 \xrightarrow{\text{heat}} CaO + CO_2$

iii) $2AgBr \xrightarrow{\text{Sunlight}} 2Ag + Br_2$

(b) Copper can displace silver from $AgNO_3$ because copper is more reactive than Ag

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

(c) Catalysts are substances that speed up a chemical reaction without being consumed in the process. An example is the enzyme amylase, which speeds up the breakdown of starch into glucose during digestion

CHAPTER 2

ACIDS BASES AND SALTS

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PGT CHEMISTRY

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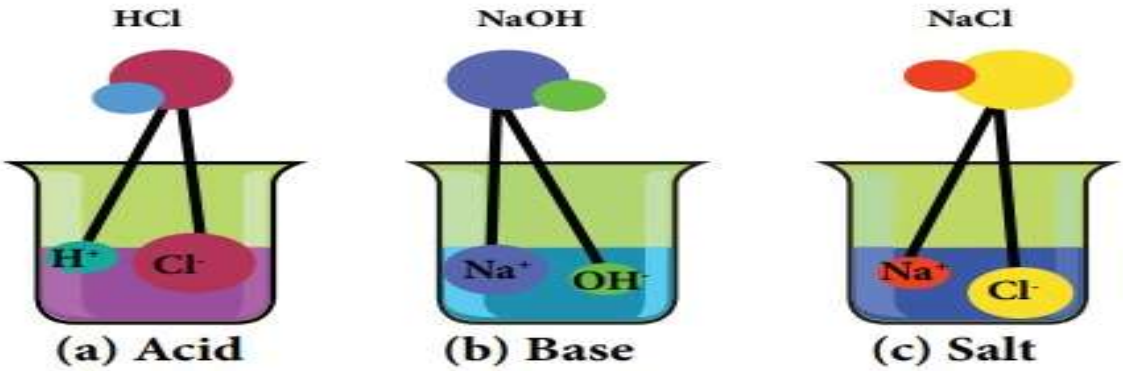
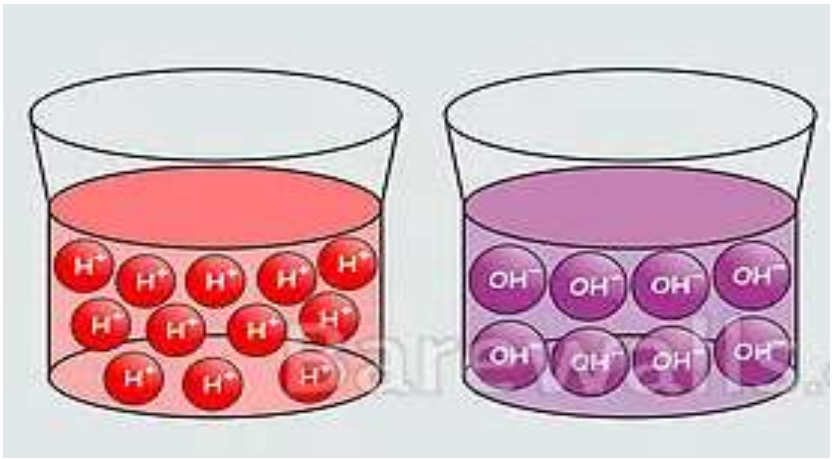
ACIDS, BASES AND SALTS

Topics in the Chapter

- Introduction
- Properties of Acids
- Properties of Bases
- Types of Indicators and its properties
- Reaction of Acids and Bases with Metals
- Reaction of Acids with Metal Carbonates
- Reaction of Acids and Bases with each other
- Reaction of Metallic Oxides with Acids
- Reaction of a Non-metallic Oxide with Base
- Similarities between all Acids and all Bases
- Acid or Base in Water Solution
- Strength of Acids and Base solution





POINTS TO REMEMBER

Acid-base indicators are dyes or mixtures of dyes which are used to indicate the presence of acids and bases.

● Acidic nature of a substance is due to the formation of H+ (aq) ions in solution.

● Formation of OH–(aq) ions in solution are responsible for the basic nature of a substance.

● When an acid reacts with a metal, hydrogen gas is evolved and a corresponding salt is formed.

●When a base reacts with a metal, along with the evolution of hydrogen gas a salt is formed which has a negative ion composed of the metal and oxygen.

● When an acid reacts with a metal carbonate or metal hydrogen carbonate, it gives the corresponding salt, carbon dioxide gas and water.

● Acidic and basic solutions in water conduct electricity because the produce hydrogen and hydroxide ions respectively.

● The strength of an acid or an alkali can be tested by using a scale called the pH scale (0-14) which gives the measure of hydrogen ion concentration in a solution.

● A neutral solution has a pH of exactly 7, while an acidic solution has a pH less than 7 and a basic solution a pH more than 7.

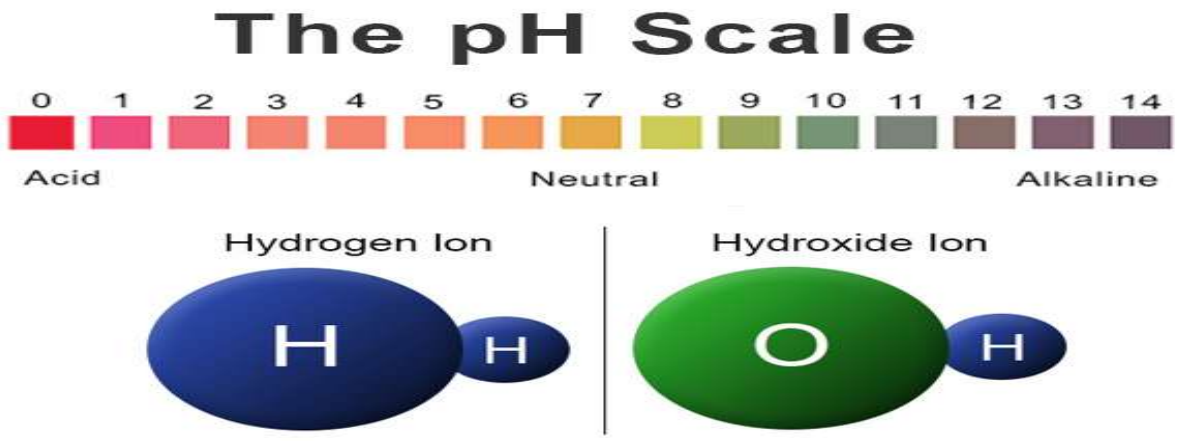
● Living beings carry out their metabolic activities within an optimal pH range.

● Mixing concentrated acids or bases with water is a highly exothermic process.

● Acids and bases neutralise each other to form corresponding salts and water.

● Water of crystallisation is the fixed number of water molecules present in one formula unit of a salt.

● Salts have various uses in everyday life and in industries.



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, $Ca(OH)_2$

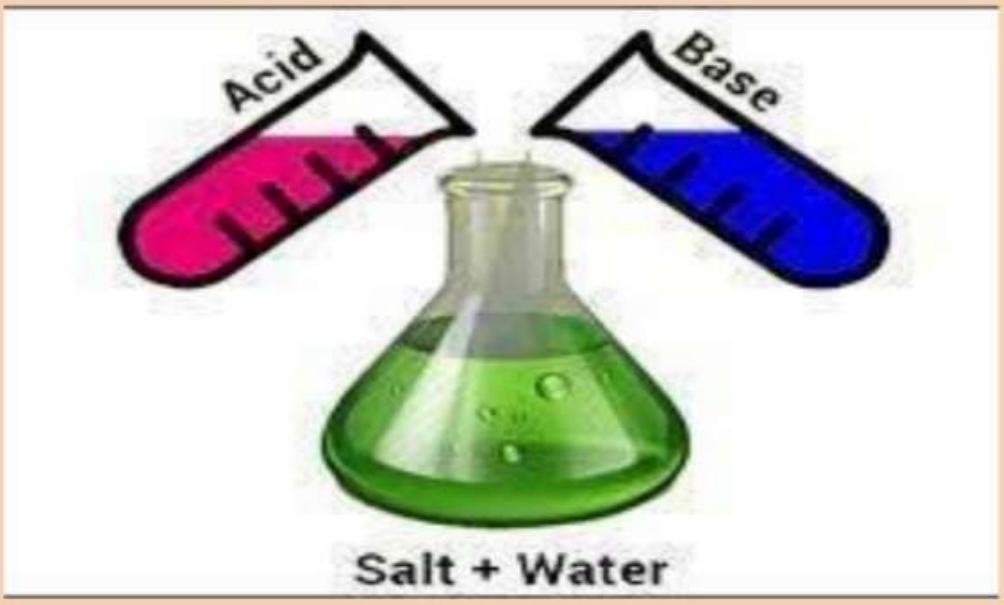
Weak Bases : NH_4OH

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 : KCl. , NaCl,



INDICATORS :

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

TYPES OF INDICATORS

Natural indicators (in plants.)
- — Found in nature
- — Litmus, red cabbage leaves extract, flowers of hydrangea plant, turmeric

Synthetic indicators (substances.)
- — These are chemical
- — Methyl orange, phenolphthalein

Olfactory indicators (have different odour)
- — These substances in acid and bases.

	S. No.	Indicator	Smell/Colour in acidic solution	Smell/Colour in basic solution
Indicator Natural	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

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Indicator — Natural	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

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.

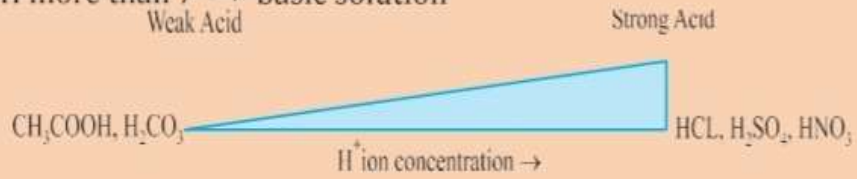
Universal indicator : is a mixture of several indicators. It shows different colours at different concentrations of H^+ ions in the solution.

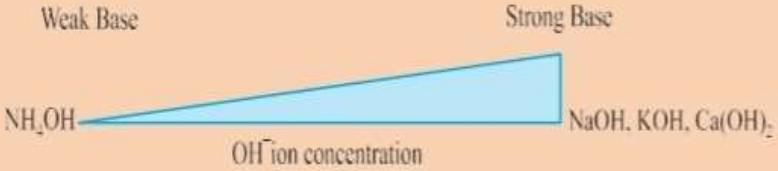
pH Scale : A scale for measuring H^+ ion concentration in a solution p in pH stands for 'potenz' a German word which means power.

pH = 7 → neutral solution

pH less than 7 → acidic solution

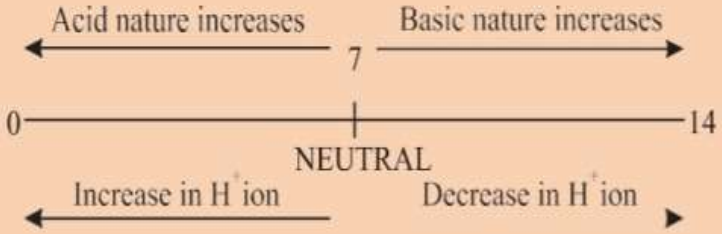
pH more than 7 → basic solution





On diluting an acid : pH increases ↑

On diluting a base : pH decreases ↓



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Importance of pH in everyday life

1. Plants and animals are pH sensitive	• Our body works within the pH range of 7-7.8. • When pH of rain water is less than 5.6, it is called acid rain.
2. pH of the soil	• Plants require a specific pH range for their healthy growth.

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

pH of Salts :

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

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

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

Chemicals from Common Salt (NaCl)

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

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

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

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 → 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.

for eg 1. $CuSO_4.5H_2O$ 2. $FeSO_4.7H_2O$

MULTIPLE CHOICE QUESTIONS AND ANSWERS

1. An aqueous solution turns red litmus solution blue. Excess addition of which of the following solution would reverse the change?

(a) Baking powder (b) Lime

(c) Ammonium hydroxide solution (d) Hydrochloric acid (d)

2. Bleaching powder gives smell of chlorine because it-

(a) contains excess of chlorine (b) is a mixture of chlorine and slaked lime

(c) is unstable (d) gives chlorine on exposure to atmosphere (d)

3. A solution turns red litmus blue,its pH is likely to be

(a) 1 (b) 4 (c) 5 (d) 10 (d)

4. A solution reacts with crushed egg-shells to give a gas that turns lime-water milky. The solution contains

(a). NaCl (b). HCl (c) LiCl (d) KCl (b)

5. Which of the following is considered as a strong acid?

(a). Acetic acid (b). Maleic acid (c). Nitric acid (d). Tartaric acid (c)

6. When copper oxide and dilute hydrochloric acid react, the colour changes to which of the following colour?

(a). Black (b). Bluish-green (c). White (d). Yellow (b)

7. Name the gas that is evolved on reaction of dilute hydrochloric acid with sodium sulphite?

(a). Sulphur trioxide (b). Hydrogen Sulphide

(c). Sulphur dioxide (d). Carbon dioxide (c)

8. NaOH is obtained by the electrolysis of

(a) Aq. solution of NaCl (b) Aq. Na2CO3 + CaCl2(aq)

©. Aq. NaHCO3 (d). Molten NaCl (a)

9. The colour of the pH paper turned red when it was dipped in X solution. The X is-

(a) Dilute Hydrochloric acid. (b) Dilute sodium hydroxide solution.

(c) Tap water (d) Dilute sodium bicarbonate solution. (a)

10. Which of the following is the synthetic indicator?

(a) Methyl orange (b) Phenolphthalein

(c) China rose (d) Both (a) and (b) (d)

11. Which of the following acid present in curd?

(a) Acetic acid (b) Citric acid

(c) Oxalic acid (d) Lactic acid (d)

12. Which of following tablets are used by a person suffering from acidity?

(a) Antacid (b) Antabuse

(c) Antasalt (d) None of these (a)

13. Which of the following is the organic acids?

(a) HCl (b) HNO_3 (c) H_2SO_4 (d) CH_3COOH (d)

14. When NaOH and HCl are mixed in equal molar quantities, the result is

(a) the formation of salt $+H_2O$ (b) the formation of salt + H_2 g

(c) the formation of salt + O_2 (g) (d) All above are correct (a)

15. Bleaching powder gives smell of chlorine because it-

(a) contains excess of chlorine (b) is a mixture of chlorine and slaked lime

(c) is unstable (d) gives chlorine on exposure to atmosphere (d)

ASSERTION-REASON TYPE QUESTIONS

In the following questions, two statements are given—one labeled Assertion (A) and the other labeled Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below:

(a) Both Assertion and Reason are true and Reason is the correct explanation of the Assertion.

(b) Both Assertion and Reason are true but Reason is not the correct explanation of the

Assertion.

(c) Assertion is true but the Reason is false.

(d) Assertion is false and Reason are true.

1. Assertion: Salts of strong acids and weak bases are basic in nature.

Reason: pH value of such salt is more than 7. (d)

2. Assertion: On heating, colour of hydrated copper sulphate changes from blue to white.

Reason: Copper sulphate is a crystalline salt. (a)

3. Assertion: Most of factories wastes are considered acidic in nature.

Reason: Usually bases are added to all factory wastes before discharging into the water bodies (a)

4. Assertion: H_2CO_3 is a strong acid.

Reason: A strong acid dissociates completely or almost completely in water.

(d)

5. Assertion: Salts are the products of an acid-base reaction.

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

6. Assertion: Plaster of Paris is used by doctors by setting fractured bones.

Reason: When Plaster of Paris is mixed with water and applied around the fractured limbs, it sets into a hard mass. (a)

7. Assertion: Sodium hydroxide reacts with zinc to produce hydrogen gas.

Reason: Acids reacts with active metals to produce hydrogen gas. (b)

8. Assertion: Methanoic acid is present in Ant's sting.

Reason: The body part where ant bite is treated with dry baking soda. (c)

9. Assertion: Concentrated H_2SO_4 can be diluted by adding water dropwise to acid.

Reason: Concentrated H_2SO_4 has a more affinity for water. (d)

10. Assertion: If the pH inside the mouth decreases below 5.5, the decay of tooth enamel begins.

Reason: The bacteria present in mouth degrades the sugar and left-over food particles and produce acids that remains in the mouth after eating. (a)

SHORT ANSWER TYPE QUESTIONS

1. Name the natural source of each of the following acid

(i) Citric acid (ii) Oxalic acid

(iii) Lactic acid (iv) Tartaric acid

Ans. (i) Lemon and orange (ii) Tomatoes and Guava

(iii) Sour milk (curd) (iv) Tamarind

2. A student detected the pH of four unknown solution A, B, C and D as follows 11, 5, 7 and 2. Predict the nature of the solution.

Ans. A is basic _B' is acidic _C' is natural and _D' is strongly acidic.

3. How will you test for the gas which is liberated when hydrochloric acid reacts with an active metal?

Ans. Bring a burning matchstick near the gas. It burns with 'pop' sound showing that it is hydrogen.

4. (a) Write the name given to bases that are highly soluble in water. Give an example.

(b) How is tooth decay related to pH? How can it be prevented?

(c) Why does bee sting cause pain and irritation? Rubbing of baking soda on the sting area gives relief. How?

Ans. (a) Alkali, e.g. NaOH (Sodium hydroxide).

(b) Lower the pH more will be tooth decay. Acid reacts with Ca3 (PO4)2 and cause tooth decay. It can be prevented by brushing teeth after every meal.

(c) It is due to formic acid. Sodium hydrogen carbonates (Baking soda) neutralizes formic acid giving relief

5. A white powder is added while baking breads and cakes to make them soft and fluffy. Write the name of the powder. Name its main ingredients. Explain the function of each ingredient. Write the chemical reaction taking place when the powder is heated during baking.

Ans. Baking powder. It consists of sodium hydrogen carbonates and tartaric acid. Sodium hydrogen carbonates gives CO2, which makes cake soft and fluffy. Tartaric acid neutralizes the bitterness due to sodium carbonate produced.

2NaHCO3 (s)---------- > Na2C03 (s) + CO2 (g) + H20 (l)

6. A student dropped few pieces of marble in dilute hydrochloric acid, contained in a test-tube. The evolved gas was then passed through lime water. What change would be observed in lime water? What will happen if excess of gas is passed through lime water? With the help of balanced chemical equations for all the changes explain the observations.

Ans. CaCO3 (s) + 2HCI (dilute) -----> CaCl2 (s)+CO2 (g) + H,0 (1)

Lime water turns milky due to liberation of CO2.

Ca (OH)2 (aq) + C02 (g) --------> CaCO3 (s) + H20 (l)

If excess of CO% gas is passed through lime water, milkiness will disappear due to the formation of Ca $(HCO3)_2$ (aq) which is soluble in water.

CaCO3 (s) + CO2 (g) + H20 (I) ---------->Ca $(HCO3)_2$ (aq)

7. 15 mL of water and 10 mL of Sulphuric acid are to be mixed in a beaker

(i) State the method that should be followed with reason.

(i) What is this process called?

Ans. (i) The acid is to be added slowly in water to prevent the mixture to be splashed. The reaction is highly exothermic; therefore, constant cooling should be done.

(ii) The process is called dilution.

8. Choose strong acids and weak acids from the following: CH3COOH, H2SO4, H2CO3, HNO3

Ans. H2SO4 and HNO3 are strong acids. CH3COOH and H2CO3 are weak acids.

9. A white colored powder is used by doctors for supporting fractured bones.

(a) Write chemical name and formula of the powder.

(b) When this white powder is mixed with water a hard solid mass is obtained. Write balance chemical equation for the change.

Ans. (a) Calcium sulphate hemihydrate (CaSO4.1/2 H20)

(b) CaSO4 .1/2 H20 + 3/2 H2O --------> CaSO4. 2H,0

10. How will you test for the gas which is liberated when hydrochloric acid reacts with an active metal?

Ans. Bring a burning matchstick near the gas. It burns with 'pop sound showing that it is hydrogen.

LONG ANSWER TYPE QUESTIONS

1. Explain the following chemical properties of acids by the help of balanced chemical equations.

1. When an acid reacts with a metal carbonate.

2. When an acid reacts with a metal bicarbonate.

3. When an acid reacts with a metal oxide.

Ans. 1. $CaCO_3 + 2HCI \rightarrow CaCl_2 + H_2O + CO_2$

2. $NaHCO_3 + HCI- > NaCl + H_20 + CO_2$

3. $Al_2O_3 + 6HCI \rightarrow 2AICI_3 + 3H_20$

2. A milkman adds a very small amount of baking soda to fresh milk.

a. Why does he shift the pH of the fresh milk from 6 to slightly alkaline?

b. Why does this milk take a long time to set as curd?

Ans. (a) Milk man will shift the pH of the fresh milk from 6 to slightly alkaline to avoid milk from getting sour due to formation of lactic acid.

(b) This milk will take long time to set into curd because the lactic acid produced here will first neutralises the pH then the pH is reduced to turn milk into curd.

3. Plaster of Paris should be stored in a moisture proof container. Explain why?

Ans. Plaster of Paris should be stored in moisture-proof container because moisture will affect plaster of Paris by slowing down the setting rate of the plaster due to hydration which will turn plaster useless.

4. What is a neutralisation reaction? Give two examples.

Ans. The reaction of the acid + base gives salt + water, which is known as neutralization reaction.

Examples: $NaOH + HCl \rightarrow NaCl + H2O$

$Mg(OH)2 + H2CO3 \rightarrow MgCO3 + 2H2O$

5. Give two important uses of washing soda and baking soda.

Ans. Washing soda

1. It is used as an electrolyte
2. It be is used domestically as water softener for laundry purpose.

Baking soda -

1. It is used to test the garden soil for acidity. If bubbles are produced then the soil is too acidic.
2. It is used on washing car as it will remove dead bug bodies without damaging the colour or the paint on the Car.

VERY LONG ANSWER TYPE QUESTIONS-

1. (a) A metal compound 'A' reacts with dil. sulphuric acid to produce effervescence, The gas evolved extinguishes a burning candle. If one of the compounds formed in the above reaction is calcium sulphate, then name the compound 'A' and the gas evolved? Also, write a balanced chemical equation for the reaction that occurred.

(b) (i) How does antacid help to relieve indigestion in stomach? Name one antacid.

(ii) A farmer treats the soil with CaCO3. What is the nature of soil? Why does the farmer treat the soil With CaCO3

Ans (a) 'A' is CaCO3 (calcium carbonate). The gas liberated is CO2 as it extinguish a burning candle. A Calcium sulphate formed

$CaCO3 + H2SO4$ (dil.) --------- $CaSO4 + H2O + CO2$

(b) (i) Antacid neutralizes, excess of acid produced in the stomach. NaHCO3 is antacid.

(ii) The soil has acidic nature. The farmer wants to make the soil neutral by adding CaCO3 that has Basic nature which is good for crops.

2. State reason for the following statements:

(a) Tap water conducts electricity whereas distilled water does not.

(b) Dry hydrogen chloride gas does not turn blue litmus red whereas dilute hydrochloric acid does.

(c) During summer season, a milk man usually adds a very small amount of baking soda to fresh milk.

(d) For a dilution of acid, acid is added into water and not water into acid.

(e) Ammonia is a base but does not contain hydroxyl group.

Ans .

(A) Tap water contains ions due to which electricity is conducted, distilled water does not contain any ions to conduct electricity.

(b) Dry HCl gas will not form ions but dil.HCl gives H+ and Cl–.

(c) Baking soda solution will not allow milk to change into lactic acid that makes milk taste sour.

(d) Adding water to acid is highly exothermic in nature that will causes burn if splashed out. Thus, water is added very slowly to acid with cooling.

(e) Ammonia dissolves in water to give NH4OH and forms OH–. Thus, it is basic in nature.

3. A student dropped few pieces of marble in A dilute hydrochloric acid contained in a test tube. The evolved gas was passed through lime water.

(a) What change would be observed in lime water?

(b) Write balanced chemical equation for the change

Ans. (a) Lime water will turn milky due to formation of calcium carbonate (CaCO3).

(b) $Ca(OH)_2$ (aq) + CO_2 (g) → $CaCo_3$ (s) + H_2O(1) Lime water

4. Explain the reaction of dilute HCl on the following substance with the help of chemical equation:

(a) Magnesium ribbon (b) Sodium hydroxide (c) Crushed egg shells

Ans (a) Mg(s) +2HCI(dil)- →$MgCl_2$ (aq) + H_2(g) Hydrogen gas will be released in this reaction

(b) NaOH(aq) + HCI(dil)- → NaCl(aq) +H_2O(|) Sodium chloride and water will be formed

(c) $CaC0_3$ (s) + 2HCl(dil) ⟶ $CaCl_2$ (s)+ H_20(aq) + + CO_2(g)

Crushed egg shell contains $CaCO_3$ which reacts with dil HCI to produce brisk effervescence due to CO, and eggshells become soft.

5. (a) Define indicator. Name two indicators obtained from plants.

(b) Write a balanced chemical equation for the reaction taking place when sodium oxide reacts with water. How will this solution behave towards phenolphthalein and red litmus paper?

(c) State what happens when sodium hydroxide solution reacts with hydrochloric acid.

Ans. (a) Indicator is a substance which give different colour or odour in acid and base medium e.g., litmus and turmeric are indicators obtained from plants.

(b) $Na_2O(s) + H_2O(l) \rightarrow 2NaOH(aq)$

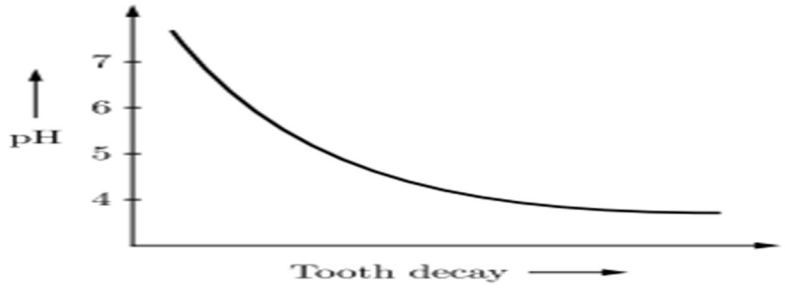
Solution will turn phenolphthalein pink and red litmus paper blue.

(c) Sodium chloride and water are formed:

$NaOH(aq) + HCl(aq) \rightarrow NaCl(aq) + H2O$

CASE BASED QUESTIONS

CBQ: - 1. Tooth decay starts when the pH of the mouth is lower than 5.5. Tooth enamel, made up of calcium phosphate is the hardest substance in the body. It does not dissolve in water, but is corroded when the pH in the mouth is below 5.5. Bacteria present in the mouth produce acids by degradation of sugar and food particles remaining in the mouth after eating. The best way to prevent this is to clean the mouth after eating food. Using toothpastes, which are generally basic, for cleaning the teeth can neutralise the excess acid and prevent tooth decay.



1. How does tooth decay be prevented?

2. What is the name Teeth enamel is made of a substance?

3. Tooth decay in the mouth starts when?

4. The hardest substance in the body is?

5. Which of the following substance(s) is added by farmers if the soil is acidic?

ANS. 1. using basic toothpaste.

2. Calcium phosphate

3. pH of mouth is below 5.5

4. Tooth enamel

5. Slaked lime

CBQ -2. Acidic solutions have excess of hydrogen ions. Even the acidic solutions contain hydroxide ions which come from the ionisation of water but the concentration of hydroxide ions in acidic solutions is much less than that of hydrogen ions. The basic solution has excess of hydroxide ions. Even the basic solutions have hydrogen ions in them which come from the ionisation of water but the concentration of hydrogen ions in basic solutions is much less than that of hydroxide ions. In 1909 Sorenson devised a scale (known as pH scale) on which the strength of acid solutions as well as basic solutions could be represented by making use of the hydrogen ion concentrations in them. Sorensen linked the hydrogen ion concentrations of acid and base solutions to the simple numbers 0 to14 on his pH scale. The pH of a solution is inversely proportional to the concentration of hydrogen ions in it. In everyday life, pH plays an important role on daily basis like in gardening and farming, the best crops are usually obtained with neutral or slightly acidic soil (pH 6.5 to 7.0), tooth decay starts when the pH of mouth is lower than 5.5. Bee-sting leaves an acid which causes pain and irritation etc

1. Rain is called an acid rain when the pH is?

2. During indigestion, which acid is produced by the stomach that causes irritation and pain?

3. The basic salt that gives relief on the stung area is

4. Which of the following type of medicines is used for the treatment of hyperacidity in the stomach?

5. When a few drops of phenolphthalein is added to a solution having pH 8.5, then the colour?

ANS. 1. below 5.6

2. Hydrochloric acid

3. baking soda

4. Antacid

5. changes to pink

CBQ -3. For making baking powder, which is a mixture of baking soda (sodium hydrogen carbonate) and a mild edible acid such as tartaric acid. When baking powder is heated or mixed in water, the following reaction takes place:

$NaHCO_3 + H^+ \text{----------} > CO_2 + H_2O$ + sodium salt of acid

Sodium salt of acid Carbon dioxide produced during the reaction causes bread or cake to rise making them soft and spongy. Sodium hydrogen carbonate is also an ingredient in antacids. Being alkaline, it neutralises excess acid in the stomach and provides relief. It is also used in soda-acid fire extinguishers.

1. What is the chemical name of baking soda?

2. What is the constitute in Baking powder?

3. Which ingredient is used in anti-acids which gives relief in stomach by neutralising excess acid?

4. What is the nature of baking soda?

ANS. 1. Sodium hydrogen carbonate

2. Baking soda and tartaric acid

3. Magnesium hydroxide

4.Neutral

CHAPTER 3

METALS AND NON-METALS

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Chapter- METALS AND NON-METALS

Metals and Non-metals

Elements can be classified into the following two groups depending on their physical and

chemical properties:

1. Metals
2. Non-metals

Metals:

- The elements which are hard, shiny can be beaten into sheets, drawn into wires and are good conductor of heat and electricity are generally metals. For example: iron, copper, gold etc.
- In nature most metals occur in the combined state as minerals and they are reactive.
- Only a few unreactive metals like gold, silver, platinum are found as free metals in the earth's crust.
- Minerals from which metals can be profitably extracted are called ores. For example: calcium occurs in limestone (calcium carbonate) or iron in the ore haematite.

Non-metals:

- The elements which are brittle, dull cannot be beaten into sheets or drawn into wires and are poor conductors of heat and electricity are generally non-metals. For example: oxygen and nitrogen occur in free state in air and in combined state in earth's crust. Sulphur occurs both in free and the combined state in earth's crust.
- The noble gases, helium, neon, argon, krypton, xenon occurs only in Free State.

Physical properties of Metals:

- Metals are solids at room temperature, except mercury, which is liquid at room temperature.
- They are generally hard and strong but sodium and potassium are soft solids and can be cut with a knife.
- They are good conductor of heat and electricity. Copper is the best conductor of electricity followed by gold and aluminum.
- Metals such as gold, silver and copper all have lustre, that is they have an ability to shine and reflect light. Therefore, they are lustrous.

- The property by virtue of which metal can be beaten into sheets is called malleability. We use aluminum foil to pack food.
- The property by which metals can be drawn into wires is called ductility. Metals like copper, silver and aluminum can be drawn into wires.
- Metals are sonorous. They produce sound when struck.
- With the exceptions of sodium, potassium and mercury most of the metals have high melting and boiling point.
- Metals have high densities.
- Most metals have high tensile strength.

Physical properties of Non-metals:

- Non-metals are gases or solid at room temperature, except bromine which is liquid at room temperature.
- Non-metals do not have lustre except iodine and graphite.
- They are bad conductor of heat and electricity.
- Non-metals are brittle that is they are neither malleable nor ductile.
- They usually have low densities.
- Non-metals have low melting point and boiling point.
- Non-metals are non-sonorous.

Metalloids:

The elements which possess the properties of metals and non-metals are called metalloids.
For example: boron, silicon, germanium, tellurium, arsenic and antimony are metalloids.

Metals	Non-metals
Metals are lustrous, that is, they have a property to shine.	They are not lustrous, that is, they do not have shining surface. except, graphite and iodine
All metals exist as solids except mercury which is liquid at room temperature.	They are generally soft, except diamond.
They can be drawn into wires, this is known as Ductility.	They are non-ductile.
Metals can be converted into sheets, this is known as Malleability, except mercury	They are non-malleable

They are good conductors of electricity and heat. Except Lead and mercury.	They are poor conductors of electricity and heat. Exception-graphite is good conductor of electricity
They have high density and high melting point. Exception-sodium and potassium have low melting points	They have low density compared to metals and low melting point except Diamond which has high melting point

Chemical properties of Metals and Non-metals:

Metals along with hydrogen (a non-metal) are arranged in order to their activity in a series, called the activity series.

Reaction with oxygen:

Reaction of metals with oxygen:

Metals react with oxygen under different conditions to form basic oxides. These basic oxides react with water to form bases which turn red litmus into blue. Sodium and potassium react with oxygen vigorously at room temperature.

$$4Na + O_2 \longrightarrow 2Na_2O$$

To prevent this oxidation, sodium and potassium are stored under kerosene. Magnesium reacted with oxygen only if ignited. It gives a bright dazzling flame and forms a white powder of magnesium oxide.

$$2Mg + O_2 \longrightarrow 2MgO$$

Iron metal does not burn in dry air even on strong heating. In moist air, iron get oxidize to form iron oxide (rust)

$$4Fe + 3O_2 \longrightarrow 2Fe_2O_3$$
$$Fe_2O_3 + nH_2O \longrightarrow Fe_2O_3.nH_2O$$

Reaction of non-metals with oxygen:

Non-metals react with oxygen to form acidic or neutral oxides.

$$C + O_2 \longrightarrow CO_2$$
$$S + O_2 \longrightarrow SO_2$$

Other oxides like carbon monoxide (CO) and nitrous oxide (N2O) are neutral.

Reaction with water:

Reaction of metal with water:

Metal react with water to form oxides or hydroxides along with hydrogen.
Different metals react at different temperature.
Sodium, potassium and calcium react vigorously with cold water to form metal hydroxides.

$$2Na + 2H_2O \text{ -----> } 2NaOH + H_2$$

Metal from magnesium to iron react with steam (but not water) to form metal oxide and hydrogen gas.

$$2Mg + H_2O \text{ -----> } 2MgO + H_2$$

Tin, lead, copper, silver and gold do not react with water or steam.

Reaction of non-metal with water:

Non-metals do not generally react with water.

Reaction with dilute acids:

Reaction of metals with dilute acids:

Metals react with dilute acids to form their salt and liberate hydrogen gas. The evolution of hydrogen gas can be tested by bringing a burning splinter near the mouth of the test tube. Hydrogen gas will put off the splinter with a pop sound.

$$2Na + 2HCl \text{ ------> } 2NaCl + H_2$$
$$Zn + H_2SO_4 \text{ ------> } ZnSO4 + H_2$$

Metals below hydrogen (copper, silver, gold and platinum) do not react with dilute acids as they are less reactive than hydrogen. So, they cannot displace hydrogen from dilute acids.

Reaction of non-metals with dilute acids:

Non-metals do not react with dilute acids.

Displacement reactions:

A more reactive metal displaces a less reactive metal from its compound in aqueous solution. Such a reaction is known as displacement reaction.
For example: When iron nail put in copper sulphate solution then color of solution

changes from blue to light green and a reddish brown coating of copper is seen on iron nail.

Fe	+	$CuSO_4$	--->	$FeSO_4$	+	Cu
Iron		copper sulphate (blue)		iron suphate (green)		copper

Iron sulphate	+	copper		no reaction

Because copper is less reactive than iron so cannot displace it.

Uses of metals and non-metals:

Uses of metals:

1. Copper and aluminum are used to make wires for carrying electric currents.
2. Zinc is used for galvanizing iron to protect iron from rusting.
3. Silver, gold and platinum are used make jewelry.
4. Iron, copper and aluminum metals are used to make utensils for cooking and for manufacturing machines parts.
5. Mercury is used in thermometer.
6. Lead is mainly used for making electrodes for automobile batteries and for making alloys.

Uses of non-metals:

1. Hydrogen is used in manufacture of ammonia, industrial chemicals.
2. Liquid nitrogen is used in refrigerant, in storing human organs at low temperature.
3. Sulphur is used in manufacture of sulphuric acid, Sulphur dioxide gas, Sulphur drugs etc.
4. Sulphur is used for vulcanization of rubber and making gunpowder.
5. Phosphorus is used in the manufacture of fertilizers.
6. Silicon is used for making semiconductors foe which microchips are made.
7. Chlorine is used for disinfecting drinking water.
8. Oxygen is used in breathing support system for patients.

Reactivity Series

The series in which metals are arranged in the decreasing order of reactivity, it is known as Reactivity Series.

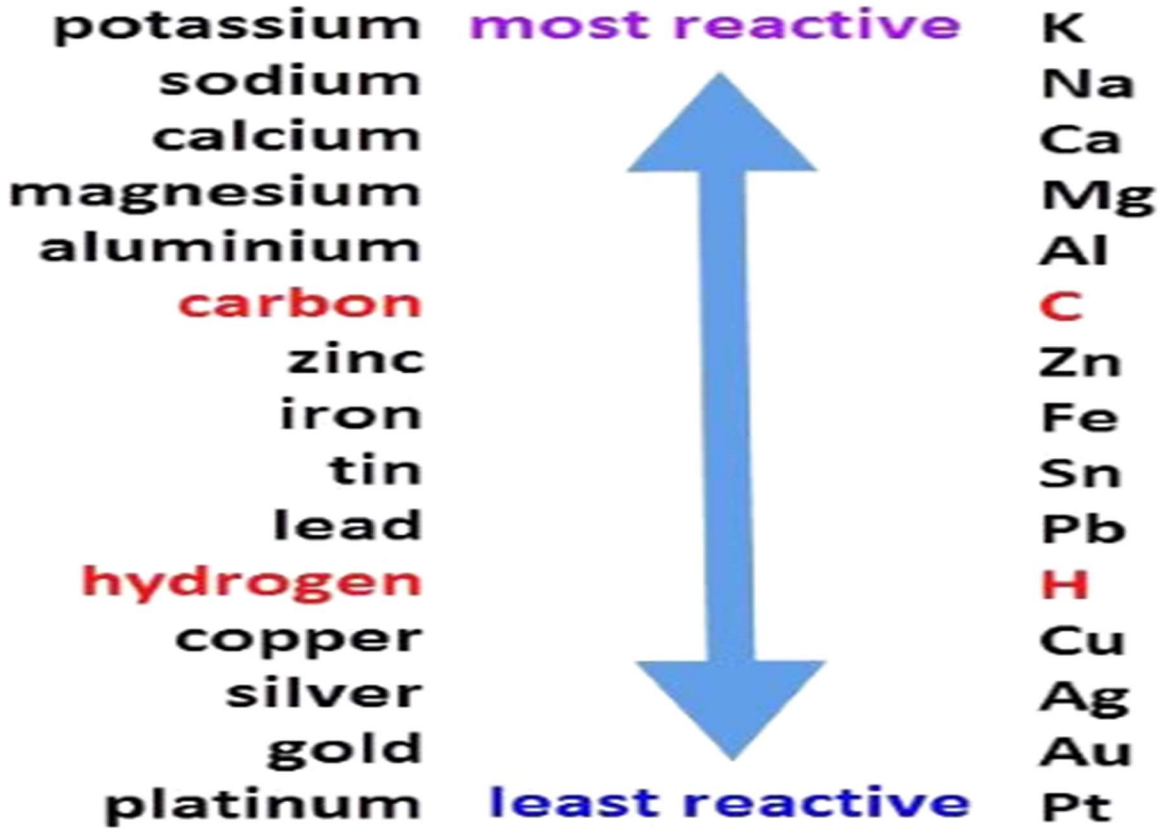
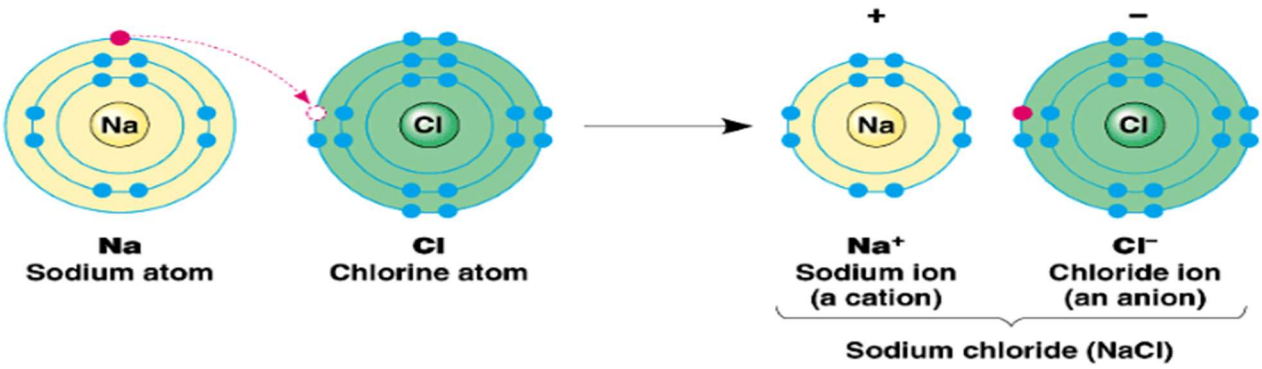


Fig.1. Reactivity Series

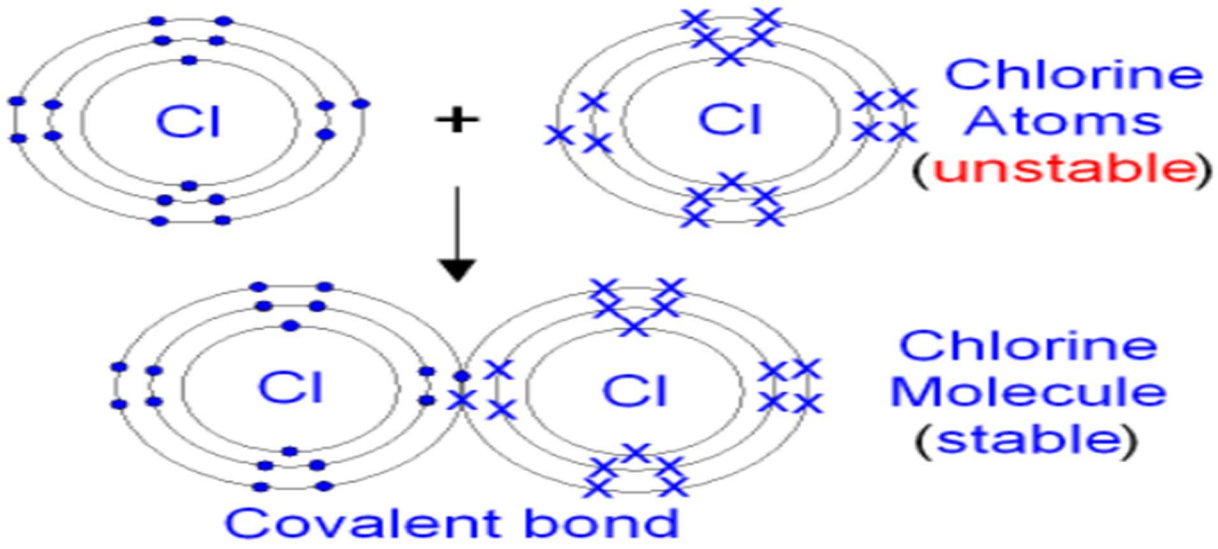
Ionic Compounds

Compounds formed due to the transfer of electrons from a metal to a non-metal are known as Ionic Compounds.



Covalent Bond

Bond formed by sharing of electrons between the two atoms. They share their valence electrons to gain stability.

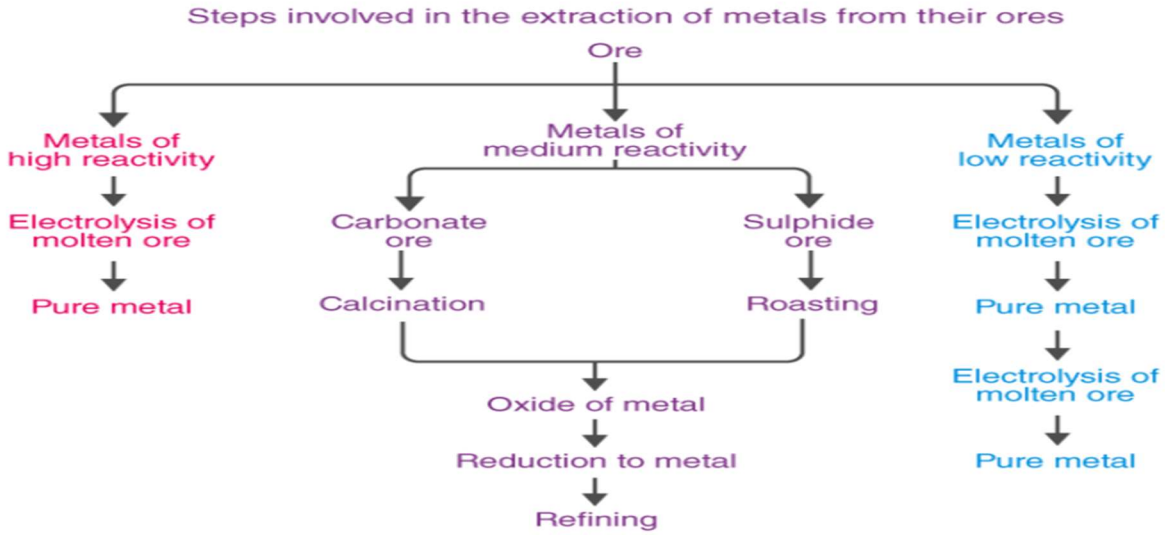


Properties of Ionic Compounds

- They are generally hard and solid.
- They have a high melting and boiling point.
- They are soluble in water but insoluble in inorganic solvents such as ether etc.
- They are conductors of electricity in molten and solution state.

Occurrence of Metals

Elements or compounds which occurs naturally in earth crust are known as Minerals. Minerals from which pure metals can be extracted are known as Mineral Ores.



<u>Extraction of pure metals from its ores/steps for extraction of metals from its ore</u>

- The first step is enrichment of the ore.

- Second step includes extraction of metals
- Third steps involve refining of metal

Gangue - Ores contain different impurities in it such as sand, soil etc. These impurities are known as Gangue.

Extracting Metals which are low in activity series

Metals which are low in activity series are unreactive. The oxides of such metals can be reduced to metals by heating alone. For Example, Cinnabar (HgS)

$$2HgS(s) + 3O_2(g) \xrightarrow{Heat} 2HgO(s) + 2SO_2(g)$$

$$2HgO(s) \xrightarrow{Heat} 2Hg(l) + O_2(g)$$

Extracting Metals in the middle of the Activity Series

These metals are moderately reactive. They exist as sulphides or carbonates in nature. Before reduction, metal sulphides and carbonates must be converted into metal oxides. Sulphide ores are converted into oxides by heating strongly in presence of excess air, this is known as Roasting. Carbonate ores are converted into oxides by heating in limited air. This is known as Calcination.

Roasting

$$2ZnS(s) + 3O_2(g) \xrightarrow{Heat} 2ZnO(s) + 2SO_2(g)$$

Calcination

$$ZnCO_3(s) \xrightarrow{Heat} ZnO(s) + CO_2(g)$$

Reduction-metal oxides can be reduced to metals using reducing agent such as such as Carbon.

Extracting metals towards the top of the activity series

The metals are highly reactive. They cannot be obtained by heating. For Example, Sodium, magnesium and calcium are obtained by the electrolysis of their molten chlorides.

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

At anode $2Cl^- \rightarrow Cl_2 + 2e^-$

Refining of Metals

Refining of impure metal is done using electrolytic refining. Impure copper is used as anode and strip of pure copper is used as Cathode. Acidified copper

sulphate is used as electrolyte. When electric current is passed through this, impure metal from the anode gets deposited in the electrolyte solution, whereas pure metal from the electrolyte is deposited at cathode.

Deposition of insoluble residue formed from the dissolution of anode during commercial electrolysis.

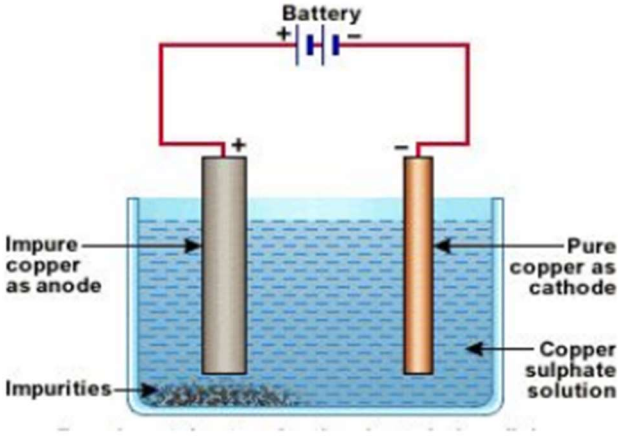


Fig.2. Electrolytic refining

Corrosion

Metals when exposed to moist air for a long period of time, they become corroded. This is known as Corrosion. For Example, Silver reacts with moist air and becomes black in colour due to silver sulphide coating.

$$\text{Iron + oxygen} \rightarrow \text{Iron (III) oxide}$$

$$Fe + O_2 \rightarrow Fe_2O_3$$

Prevention of Corrosion

- Rusting of iron can be prevented by oiling, galvanizing, painting, greasing etc.
- To protect steel and iron from rusting, a thin layer of zinc are coated on them, this is known as Galvanization.

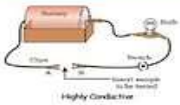
Alloy

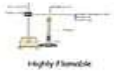
Mixture of two or more metals or metal and non-metal is known as Alloy. For Example,

- Brass is an alloy of copper and zinc.
- Bronze in an alloy of copper and tin.
- Solder is an alloy of lead and tin.
- Amalgam is one metal is mercury.

Metals

Properties





- They are Solids
- High M.P. and B.P.
- High Density
- Malleable and Ductile
- Good Conductor of heat and electricity.

Chemical Properties

$Metal + O_2 \longrightarrow Metal\ Oxide$

$2Mg + O_2 \longrightarrow 2MgO$

$Metal + Water \longrightarrow Metal\ Oxide + Hydrogen$

$2Na + H_2O \longrightarrow Na_2O + H_2$

$Metal + Dilute\ Acid \longrightarrow Salt + H_2$

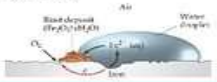
$Mg + 2HCl \longrightarrow MgCl_2 + H_2$

$Metal + Cl_2 \longrightarrow Metal\ Chloride$

$Metal + H_2 \longrightarrow Metal\ Hydride$

Corrosions

A process in which metal reacts with substace present in the atmosphere to form surface compounds.



Formation of Ionic Bond

When a Metal and a non-metal elements are continued by the transferring of their elections to form an ionic compound. e.g. Formation of Sodium Chloride

$Na \longrightarrow Na^+ + e^-$

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

Non - Metals

Properties

- Can be solids, liquids or gases
- Low M.P. and B.P.
- Brittle
- Non-malleable and non- ductile

Chemical Properties

$Non - Metal + O_2 \longrightarrow Non\text{-}Metal\ Oxide$

$C(s) + O_2(g) \longrightarrow CO_2(g)$

$Non - Metal + stream \longrightarrow H2 + Non\text{-}metal\ Oxide$

$C(s) + 2H_2O(g) \longrightarrow CO_2(g) + 2H_2$

$Non - Metal + acid \longrightarrow No - reaction$

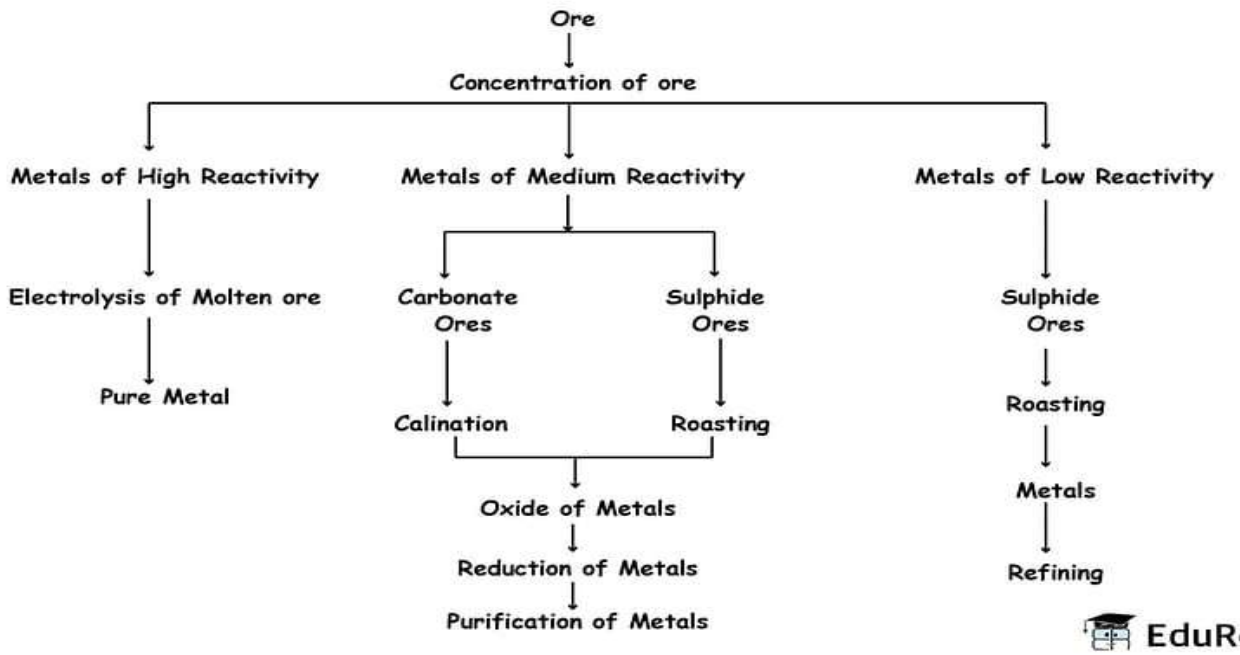
$Non - Metal + Cl_2 \longrightarrow Non\text{-}metal\ chloride$

Activity series of metals or Reactivity

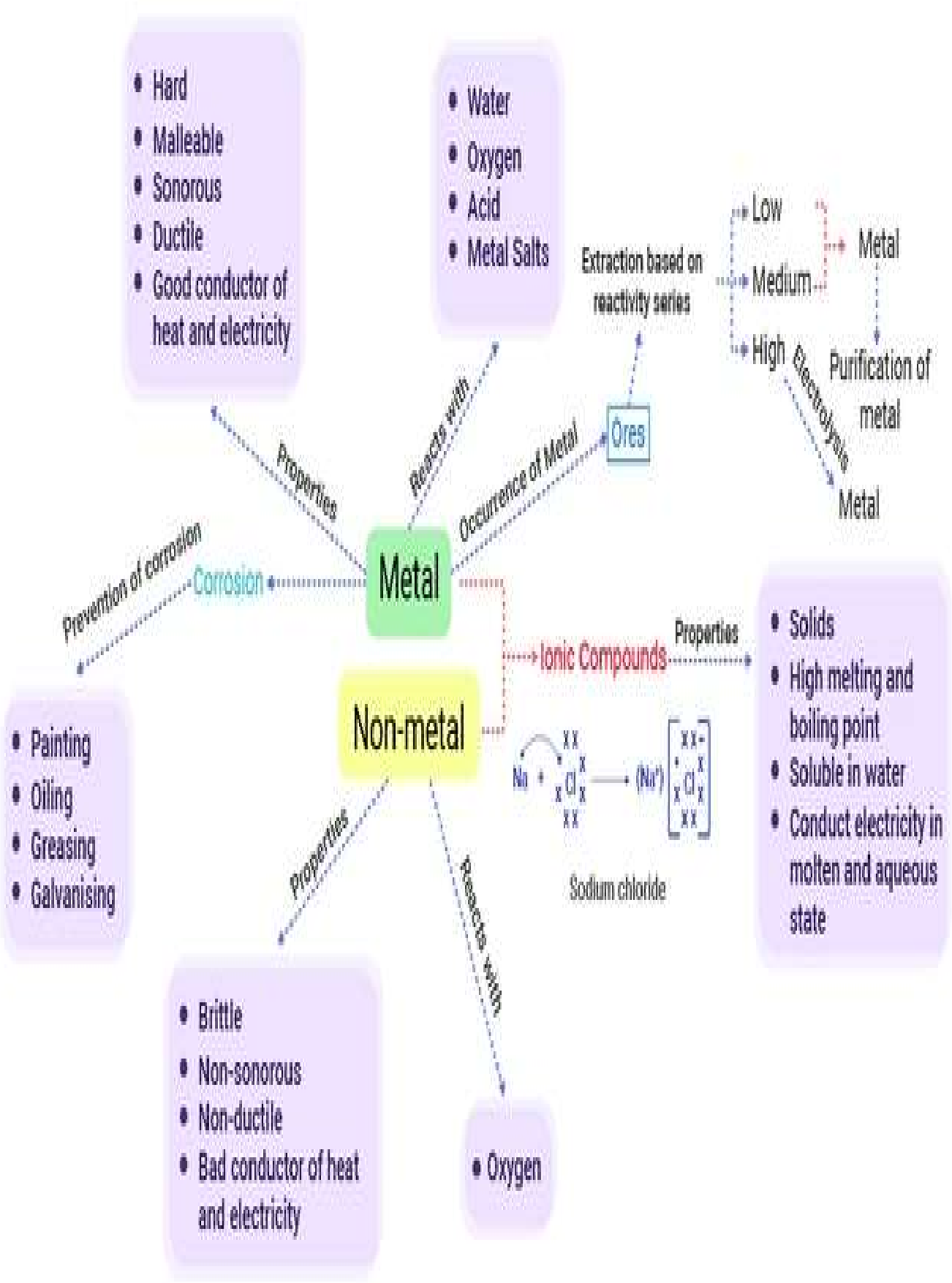
The series of metals in decreasing order of reactivity

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

Extraction of Metals



MIND MAP


Hard
Malleable
Sonorous
Ductile
Good conductor of heat and electricity
Water
Oxygen
Acid
Metal Salts
Extraction based on reactivity series
Low
Medium
High
Metal
Purification of metal
Electrolysis
Metal
Properties
Reacts with
Occurrence of Metal
Ores
Prevention of corrosion
Corrosion
Metal
Ionic Compounds
Properties
Solids
High melting and boiling point
Soluble in water
Conduct electricity in molten and aqueous state
Painting
Oiling
Greasing
Galvanising
Non-metal
Sodium chloride
Properties
Reacts with
Brittle
Non-sonorous
Non-ductile
Bad conductor of heat and electricity
Oxygen

Multiple Choice Questions:

1. 1. The non-metal which is liquid at room temperature is:

a) Mercury

b) Bromine

c) Carbon

d) Helium

Answer: (b) Bromine

Explanation: Bromine is the only non-metal which exists as a liquid at room temperature.

2. The number of protons in an atom of an element A is 19 then, the number of electrons in its ion A^+ is:

a) 18

b) 19

c) 20

d) 21

Answer: (a) 18

Explanation: In the neutral atom of an element,

3. Bauxite is an ore of

a) Iron

b) Aluminium

c) Mercury

d) Copper

Answer: (b) Aluminium

Explanation: Bauxite is a commercial ore of aluminium which consists largely of hydrated aluminium oxide, $Al_2O_3.2H_2O$.

4. The metal which is liquid at room temperature is

a) Bromine

b) Mercury

c) Iodine

d) Potassium

Answer: (b) Mercury

Explanation: Mercury is the only metal which exists as a liquid at room temperature.

5. The sulphide ores are converted into oxides by heating strongly in the presence of excess air. This process is known as

a) Roasting

b) Smelting

c) Calcination

d) Refining

Answer: (a) Roasting

Explanation: The process of heating the sulphide ore strongly in the presence of air to convert it into metal oxide, is known as roasting.

6. In electrolytic refining, the cathode is made up of

a) Pure metal

b) Impure metal

c) Alloy

d) Metallic salt

Answer: (a) Pure metal

Explanation: In electrolytic refining of a metal, the cathode is made up of pure metal whereas the anode is made up of impure metal.

7. In the given reaction, Al_2O_3 + NaOH → ……X…… + H_2O

What is element X?

a) $NaAlO_2$

b) Na_3Al

c) Na_2O_3

d) $NaAl_2O_3$

Answer: (a) $NaAlO_2$

Explanation: Aluminium oxide is amphoteric in nature, i.e., it reacts with acids as well as bases to form salt and water.

Here, aluminium oxide behaves as an acid as it reacts with NaOH, a base and forms sodium aluminate ($NaAlO_2$) and water:

$$Al_2O_3 + NaOH \rightarrow 2NaAlO_2 + H2O$$

8. Which of the following represent the correct order of decreasing reactivity?

a) Mg > Al > Zn > Fe

b) Mg > Zn > Al > Fe

c) Al > Zn > Fe > Mg

d) Mg > Fe > Zn > Al

Answer: (a) Mg > Al > Zn > Fe

Explanation: The decreasing order of the reactivity of the common metals is given below:

Li, K, Na, Ba, Ca, Mg, Al, Mn, Zn, Fe, Ni, Sn, Pb, [H], Cu, Hg, Ag, Au, Pt

9. An element reacts with oxygen to give a compound with a high melting point. This compound is also soluble in water. The element is likely to be

(a) Ca (b) C (c) Si (d) Fe

Answer: (a) Ca

Explanation:

Calcium reacts with oxygen to give calcium oxide (CaO) which is having a high melting point and dissolves in water to form calcium hydroxide ($Ca(OH)_2$) along with the release of large amount of thermal energy.

10. Which of the following pairs will give displacement reactions?

(a) NaCl solution and copper metal

(b) $MgCl_2$ solution and aluminium metal

(c) $FeSO_4$ solution and silver metal

(d) $AgNO_3$ solution and copper metal

Answer: (d) $AgNO_3$ solution and copper metal

Explanation: Copper (Cu) being more reactive than silver (Ag), displaces silver from silver nitrate ($AgNO_3$) to form copper nitrate

$$\mathbf{2AgNO_3 + Cu \rightarrow Cu(NO_3)_2 + 2Ag}$$

11. Which among the following is the most abundant metal found in the earth's crust?

(a) Magnesium

(b) Aluminium

(c) Oxygen

(d) Iron

Answer: (b) Aluminium

Explanation: Aluminium is the most abundant metal found in the earth's crust.

12. Which of the following pairs of reactants will go undergo a displacement reaction?

(a) $CuSO_4$ + Fe

(b) $ZnSO_4$ + Fe

(c) $MgSO_4$ + Fe

(d) Ca $(SO_4)_2$ + Fe

Answer: (a) $CuSO_4$ + Fe

Explanation: As per the reactivity series of metals, iron is more reactive than copper metal so it can displace copper from copper sulphate solution and form iron (II) sulphate and copper:

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

(a) Copper (b) Aluminum (c) Zinc (d) Bauxite

Answer: (c) Zinc

Explanation: In this method a thin layer of zinc metal is deposited over the surface of steel or iron objects, which does not corrode on exposure to damp air and prevents the coated metals from rusting.

14. Which of the following alloys contains a non-metal as one of its constituents?

(a) Steel

(b) Brass

(c) Amalgam

(d) Bronze

Answer: (a) Steel

Explanation: Stainless steel is an alloy of iron (a metal) and carbon (a non-metal).

15. An element X is soft and can be cut with the help of a knife. It is very reactive to air and cannot be kept open in the air. It reacts vigorously with water. Identify the element from the following:

(a) Mg

(b) Na

(c) P

(d) Ca

Answer: (b) Na

Explanation: Na is a metal which is soft enough to be cut with a knife. It is so reactive that it reacts vigorously with air or moisture and catches fire when kept in open. So, to prevent it from coming in contact with oxygen and moisture, it is kept in kerosene

Short answers:

1. Why is gold used for making jewellery?

Gold does not easily react with other substances. It is an unreactive metal and once polishes, it retains their shine for a long time, therefore, it is used for making jewellery.

2. What do you mean by corrosion?

Corrosion is used to describe the process by which minerals such as metals are slowly eaten away when exposed to air and moisture.

3. No gas is released when sulphur is added to dilute HCl?

No gas is releases when sulphur is added to dilute HCl because non-metals do not react with dilute HCl and sulphur is a non-metal.

4. Why are electrical cables made from copper?

Since copper is a good conductor of electricity, it is used in electrical cables.

5. Why do copper vessels develop a greenish layer when exposed to moist air?

Copper vessel gets corroded in the presence of moist air that is carbon dioxide and water to form green coating of a substance called basic copper carbonate.

6. Which non-metal is considered to be backbone of the electronics industry?

Silicon is considered to be the backbone of electronics industry.

7. Why is sodium metal stored under kerosene?

Sodium metal which react vigorously with the oxygen present in air at room temperature to form sodium oxide. Hence, sodium is stored under kerosene to prevent its reaction with oxygen and moisture present in air.

8. Write the difference between metal oxides and non-metal oxides?

Metal oxides formed are basic in nature, when dissolved in water they form bases which turn red litmus into blue whereas non-metal oxides are acidic in nature, when dissolve in water they form acids which turn blue litmus into red.

9. Silver is more likely to tarnish near a petroleum refinery than in a place far away? Explain why?

Silver does not get easily corroded in unpolluted air, however, if the air is polluted with sulphur compounds such as hydrogen sulphide then silver reacts with it to form a black coating of silver sulphide.

10. What are noble metals?

Silver and gold are present at the bottom of the reactivity series of metals. They are unreactive metals and do not react with water, acids and alkalis. They therefore, occur n free state in nature. So, they are noble metals.

Short Answer Questions

Question 1) Name two metals which react violently with cold water. Write any observation you would make when such a metal is dropped into water. How would you identify the gas evolved, if any, during the reactions?
Answer

Metals at the top of the reactivity series (Sodium potassium) react readily (violently) with cold water forming hydroxides with the liberation of H2, the heat evolved is sufficient for the hydrogen to catch fire.
Na(s) + $2H_2O$(l)? NaOH(aq) + H_2(g) + large amount of heat energy catches fire
K(s) + $2H_2O$(l)? KOH (aq) + H_2(g) + large amount of heat energy
The gas evolved during these reactions burns with a popping sound which confirms that the gas is hydrogen (H2).
Question 2) Why do metals not evolve hydrogen gas with nitric acid?
Answer

Hydrogen gas is not evolved when a metal reacts with nitric acid because nitric acid is a strong oxidising agent.it oxidises with the hydrogen produced to forn water and the nitric acid itself gets reduced to any of nitrogen oxide (N_2O, NO, NO_2).
Question 3) A metal that exists as a liquid at room temperature is obtained by heating sulphide in the presence of air. Identify the metal and its ore and give the reaction involved.
Answer

Hg is the metal and the ore is HgS. It is called Cinnabar.

HgS + O2 ------> Hg + SO_2

Question 4) Name a metal which is poor conductor of electricity and a non-metal which is good conductor of electricity.
Answer

Tungsten and Bismuth are metals which is poor conductor of electricity
Graphite are non-metal which is good conductor of electricity.

Question 5) Describe briefly the method to obtain mercury from cinnabar. Write the chemical equation for the reactions involved in the process.
Answer

Cinnabar is the main ore of mercury. Mercury is obtained from its ore by Roasting. when cinnabar is heated in air, it is first converted into mercuric oxide. Mercuric oxide is then reduced to mercury on further heating.

$2HgS(s) + 3O_2(g) + Heat? 2HgO(s) + 2SO_2(g)$

$2HgO(s) + Heat \rightarrow 2Hg(l) + O_2(g)$

Or

The reaction of metal 'X' with Fe_2O_3 is highly exothermic and is used to join railway tracks. Identify the metal 'X'. Write the chemical equation of the reaction.

Question 6) Name the constituents of bronze and write its two uses.
Answer

Copper with 12% time. Sometimes aluminum /nickel/zinc are also mixed
Coins & medals, Church bell

Question 7) An alloy has low melting point and is therefore used for electrical fuse. Name the alloy and write its constituents.
Answer

Solder (Tin + Lead)

Question 8) Differentiate between roasting and calcinations processes giving one example of each.
Answer

Roasting is a process of converting sulphide ores into oxides by heating strongly in the presence of excess air.
Roasting: **$2ZnS(s) + 3O_2(g) \rightarrow 2ZnO(s) + 2SO_2(g)$**
Calcination is a process of converting carbonate ores into oxides by heating strongly in limited air.
Calcination: **$ZnCO_3(s) \rightarrow ZnO(s) + CO_2(g)$.**

Question 9) Metals replace hydrogen from dilute acids, whereas non-metals do not. Why?
Answer

Non-metals do not displace hydrogen from dilute acids is because unlike metals, non-metals do not tend to lose electrons but to gain electrons. Metals tend to lose electrons. These electrons, which are readily lost by reactive metals like sodium, potassium etc are accepted by hydrogen ions of the acids, reducing them to hydrogen gas (H_2).

Question 10) Why aluminum oxide is considered an amphoteric oxide?
Answer :- Aluminium oxide is called Amphoteric oxide because it has both acidic and basic properties.
Basic property:
$Al_2O_3 + H^+ \text{----} > Al^{3+} + H_2O$
Acidic properties:
$Al_2O_3 + OH^- + H_2O \text{----} > [Al(OH)_4]^-$

Question 11) Explain with the help of an activity that metals conduct electricity. Draw a diagram for the same.
Answer

We need Bulb, Battery, Metal Nail and wires

1) Connect one of bulb with nail by wire
2) connect second end of a bulb with the wire to the battery
3) connect battery with the metal nail by wire

We will be observed Bulb will glow.
And this proves Metals conduct electricity.

Question 12) Name a metal which has very low melting point and a non-metal which has very high melting point.
Answer

Caesium and gallium metals have low melting point. Diamond a allotrope of carbon has very high melting point which is a non-metal.

Question 13) What happens when a piece of:

(a) Aluminium metal is added to dilute hydrochloric acid.
(b) Zinc metal is added to copper sulphate solution.
(c) Silver metal is added to copper sulphate solution.
Also write balanced chemical equation, if the reaction occurs.
Answer

a) Aluminium is more reactive than hydrogen and is placed above hydrogen in the reactivity series. Thus, when aluminium metal is added to dilute HCl, it displaces hydrogen from the acid and forms aluminium chloride and hydrogen gas. Following is the chemical equation for the reaction

$2Al\ (s) + 6HCl\ (aq) \rightarrow 2AlCl_3\ (s) + 3H_2\ (g)$

b) $Zn + CuSO_4 \rightarrow ZnO_4 + Cu$

c) $Ag + CuSO_4$ ->No reaction

Question 14) Write balanced chemical equation for the reaction of:
(a) aluminum when heated in air. Write the name of product.
(b) iron with steam and name the products obtained.
(c) calcium with cold water. Why does calcium start float in water?
Answer

a) $4Al(s)+3O_2(g)\text{-->}2Al_2O_3(s)$
product Name is - aluminum oxide

b) $Fe + H_2O$ ---- > $Fe(OH)_2$
Iron hydroxide

c) Actually, when calcium reacts with water, the reaction is less vigorous and it forms calcium hydroxide with release of hydrogen gas, but the heat evolved is not sufficient for hydrogen gas to catch fire and so it sticks over the surface of calcium hydroxide and the wall of container which do not let the calcium hydroxide to sink and it continues to float on the water surface .

The reaction involved is :
$Ca + 2H_2O$ --> $Ca(OH)_2 + H_2$

Question 15) Iron displaces copper from copper sulphate solution, zinc displaces iron from iron sulphate solution and copper displaces silver from silver nitrate solution. On the basis of these reactions arrange the four metals involved in order of their reactivity. Give balanced chemical equations in each case.
Answer

The reactivity order is as follows:
Zinc
Iron
Copper
Silver

The reactions are:
$Fe(s) + CuSO_4(aq)$ -> $Cu(s) + FeSO_4(aq)$
$Zn(s) + FeSO_4(aq)$ -> $Fe(s) + ZnSO_4(aq)$
$Cu(s) + 2AgNO_3(aq)$ -> $2Ag(s) + Cu(NO_3)_2(aq)$
Question 16) Write balanced chemical equations for the following reactions:
(a) Calcium carbonate on reaction with hydrochloric acid gives calcium chloride, water and carbon dioxide.
(b) Nitrogen reacts with hydrogen under pressure to form ammonia.
(c) Carbon disulphide burns in air to give carbon dioxide and sulphur dioxide.
Answer

a) $CaCO_3 + 2HCl$ -> $CaCl_2 + CO_2 + H_2O$

b) $N_2 + 3H_2$ -> $2NH_3$

c) $CS_2 + 3O_2$ -> $2SO_2 + CO_2$

Question 17) Write chemical equations for the following reactions:
(a) A piece of calcium metal is dropped in water.
(b) Steam is passed over red hot iron.
(c) Zinc sulphide is heated in air.

Answer

$Ca(s) + 2H_2O(l) \rightarrow Ca(OH)_2(aq) + H_2(g)$

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

$2ZnS(s) + 3O_2 \rightarrow 2ZnO(s) + 2SO_2(g)$

Question 18) Distinguish between the following:
(a) Electrolytic reduction and electrolytic refining.
(b) Mineral and ore.
(c) Alloys and amalgams.

Answer

a)

Electrolytic Refining	Electrolytic Reduction
This method is used for refining less reactive metals such as copper and silver.	This method is used for extraction of reactive metals like sodium and potassium from their ores.
The aqueous solution of the salt is used as an electrolyte.	The molten salt of the metal is used as an electrolyte.

b)

Minerals	Ores
All the naturally occurring substances of metals which are present in the earth's crust are known as Minerals.	Ores are usually used to extract metals economically. A large amount of metals are present.
All Minerals are not ores.	All ores are minerals.
Minerals are native form in which metals exist.	Ores are mineral deposits.

c)

Alloys	Ores
An alloy is a homogeneous metallic solution composed of two or more elements. One of the elements in the alloys is essentially a metal, while the other element or elements may be metals or non-metals like carbon, silicon, sulphur or boron	Alloys of mercury with other metals like sodium, potassium, gold and zinc...etc. are called amalgam
Alloys are harder and tougher than the base metal and are resistant to corrosion.	Silver-tin amalgams are useful for the dental cavities.
Duralumin consists of Al: 95% Cu: 4% Mn: 0.5%	

ASSERTION-REASONINIG TYPE QUESTIONS(1MARK)

Following questions consist of two statements, Assertion(A) and Reason(R). Answer these questions selecting the appropriate option given below.

(a) Both A and R are true but R is not the correct explanation A

(b) Both A and R are true and R is the correct explanation A

(c) A is true but R is false

(d) A is false but R is true

1. Assertion(A): Aluminum could react with sodium hydroxide while copper will not.

   Reason(R): Aluminum is more reactive than copper.

2. Assertion(A): Gold and silver are found in free state in nature.

   Reason(R): Gold and silver are least reactive metal.

3. Assertion(A): Magnesium oxide can be dissolved in organic solvent like ether.

   Reason(R): Magnesium oxide is an ionic compound.

4. Assertion(A): Calcium floats on water.

Reason(R): Calcium reacts with cold water.

5. Assertion(A): Iron gets corroded in the presence of moisture and oxygen.

   Reason(R): Galvanization is a method to prevent the rusting of iron

6. Assertion(A): Hydrogen gas is not evolved when most metal react with nitric acid.

   Reason(R): Nitric acid is a strong oxidizing agent

7. Assertion(A): C and N do not react with dil. HCl and dil. H_2SO_4

   Reason(R): Metals do not react with dil. HCl and dil. H_2SO_4.

8. Assertion(A): Aluminium oxide and zinc oxide are acidic in nature

   Reason(R): Amphoteric nature means that the substance has both acidic and basic character

9. Assertion(A): The oxides of sulphur and phosphorus are acidic in nature.

   Reason(R) : Metal oxides are basic in nature.

10. Assertion(A): MgO exists in liquid state.

    Reason(R): The electrostatic forces of attraction between Mg^{2+} and O^{2-} ions constitute an ionic bond.

ASSERTION – REASONING TYPE QUESTIONS (1 MARK)

1. (b)Both A and R are true but R is not the correct explanation of A
2. (a)Both A and R are true and R is the correct explanation of A
3. (d)A is false but R is true
4. (b)Both A and R are true but R is not the correct explanation of A
5. (b)Both A and R are true but R is not the correct explanation of A
6. (a)Both A and R are true and R is the correct explanation of A
7. (c) A is true but R is false
8. (d)A is false but R is true
9. (b) Both A and R are true but R is not the correct explanation of A
10. (d)A is false but R is true

LONG QUESTION TYPE QUESTIONS (5 MARKS)

1. Riya and Ayush were working in laboratory. Riya put a copper coin in silver nitrate solution and Ayush put a silver coin in copper nitrate solution. Both were waiting for some time to get the result.

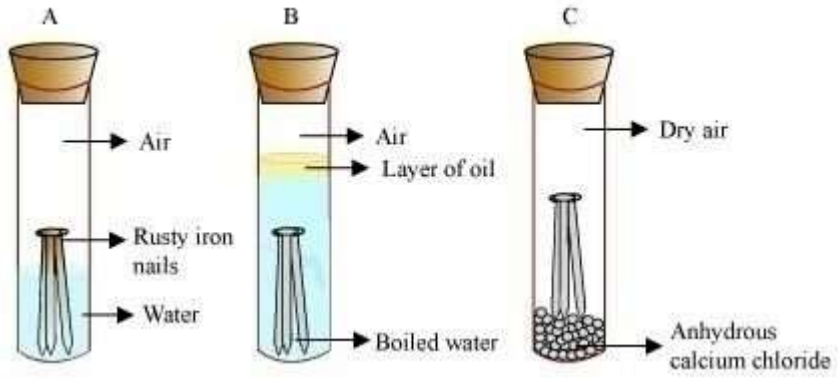
   i. Who will observe a colour change and why?

   ii. What will be the change in colour of the coin and solution?

iii. Write a balanced chemical equation for this reaction.

iv. What name is given to such reactions?

2 Observe the following setup and answer the following questions



a) What is the role of anhydrous calcium chloride?

b) If instead of boiled distilled water, distilled water is used in the second tube. Will the result be same? Support

your answer.

c) What is the role of layer of oil in the second tube?

d) What conclusion we can draw from this experiment.

e) Give 2 methods to prevent rusting of iron

3. (i) Given below are the steps for extraction of copper from its ore. Write the reaction involved.

(a)Roasting of copper (I) sulphide

(b)Reduction of copper (I) oxide with copper (I) sulphide.

(c)Electrolytic refining

(ii) Draw a neat and well labelled diagram for electrolytic refining of copper.

4. An element A burns with golden flame in air. It reacts with another element B, atomic number 17 to give a product C. An aqueous solution of product C on electrolysis gives a compound D and liberates hydrogen.

Identify A, B, C and D. Also write down the equations for the reactions involved.

LONG ANSWER TYPE QUESTIONS (answers)

1. (i) Riya will observe a colour change as copper is more reactive then silver

(ii) colour of solution will become blue and the coin will become greenish in Colour.

(iii) Cu +AgNO3 CuNO3 + Ag

(iv) such reactions are called double displacement reactions

2. (i) Anhydrous Calcium chloride absorbs the moisture from the air present in tube third test tube and acts as a dehydrating agent

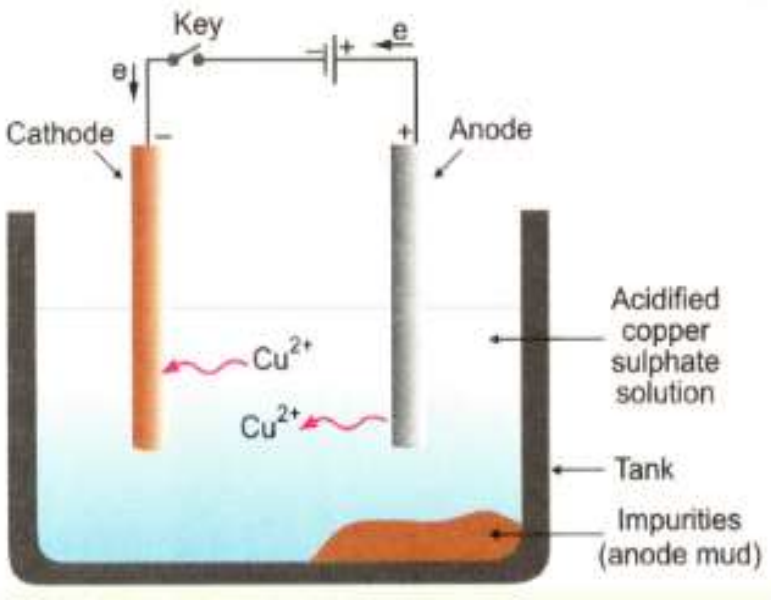
(ii) No as normal distilled water has some amount of oxygen in it while in boiled water no oxygen is present

(iii) Oil prevent oxygen present in air from mixing with water

(iv) Presence of both oxygen and moisture is required for rusting

(v) Galvanization, Painting, Oiling, Alloying (any two)

3. (i) 2Cu2S + 3O2 heat 2 Cu2O + 2SO2 Copper sulphide



(ii) 2Cu2O + Cu2S Heat 6 Cu + SO2. copper oxide

(iii) At anode Cu Cu2+ + 2e-

At cathode Cu2+ + 2e- Cu

4. A- sodium (Na), B- chlorine, C- Sodium chloride 2Na + CL2 2NaCl

D- sodium hydroxide 2NaCl + 2H2O 2NaOH + Cl2 + H2

CASE STUDY-BASED QUESTIONS (4 MARKS)

1. Ionic compound is a chemical compound in which ions are held together by ionic bond. An ionic bond is the type of bond in which two oppositely charged ions are held together. We know that metal atoms have loosely bound valence electrons and non-metals need electrons in their outermost shell to attains noble gas configuration. So, metal loses electron which are accepted by metals to form ionic compounds.

These compounds are generally solids, are hard and have high melting and boiling point.

i. Show the formation of sodium oxide using electron dot structures.

ii. List any two properties of ionic compound

iii. Give example of a solvent in which ionic compounds can be dissolved and one in which it cannot be dissolved

2. Metals as we know are very useful in all the fields, industries in particular. Iron is used for construction, aluminum and copper are used for cooking utensils, electrical wires, etc. some metals are constituents of useful alloys like copper is used for making brass and bronze, iron is used for making steel, etc. Nonmetals are no less in any way. Oxygen present in air essential for respiration as well as for combustion. Nonmetals form a large number of compounds which are extremely useful like ammonia, Sulphuric acid nitric acid etc.

i. Why are aluminum and copper used for making electric wire?

ii. Name the non-metal used in making steel

iii. Name two alloys of copper.

iv. What do we call the respiration for which oxygen is essential?

3. On the basis of reactivity of different metals with oxygen, water and acids as well as displacement reactions, the metals have been arranged in the decreasing order of their reactivities. This arrangement is known as activity series or reactivity series of metals. The basis of reactivity is the tendency of metals to lose electrons. If a metal can lose electrons easily to form positive ions, it will react readily with other substances. Therefore, it will be a reactive metal. On the other hand, if a meal loses electrons less rapidly to form a positive ion, it will react slowly with other substances. Therefore, such a metal will be less reactive.

i. Which metals reacts vigorously with oxygen? (any two)

ii. Arrange the given metals in correct increasing order of reactivity for Na, Mg, Al, Cu

iii. Hydrogen gas is not evolved when a metal reacts with nitric acid. It is because HNO_3, is a strong oxidizing agent. It oxidizes the Hydrogen, produced to water and itself gets reduced to any of the nitrogen oxides (N_2O, NO, NO_2). But and metals react with very dilute HNO_3 to evolve H_2 gas.

iv. Name the metal which is at the bottom of the reactivity series

4 . Read the following and answer any four questions from (i) to (v).

On the basis of reactivity of different metals with oxygen, water and acids as well as displacement reactions, the metals have been arranged in the decreasing order of their reactivities. This arrangement is known as activity series or reactivity series of metals.
The basis of reactivity is the tendency of metals to lose electrons. If a metal

can lose electrons easily to form positive ions, it will react readily with other substances. Therefore, it will be a reactive metal. On the other hand, if a meal loses electrons less rapidly to form a positive ion, it will react slowly with other substances. Therefore, such a metal will be less reactive.

(I) Which of the following metals is less reactive than hydrogen?
(a)Copper (b)Zinc (c)Magnesium (d) Lead

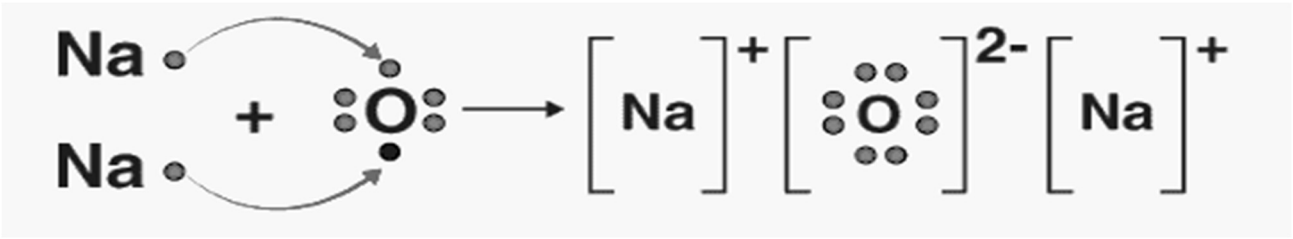
(ii) Which of the following metals is more reactive than hydrogen?
(a)Mercury (b)Platinum (c)Iron (d) Gold

(iii) Which of the following metals reacts vigorously with oxygen?
(a) Zinc (b) Magnesium (c) Sodium (d) Copper

(iv) Which of the following represents the correct order of reactivity for the given metals?
(a) Na > Mg > Al > Cu
(b) Mg > Na > Al > Cu
(c) Na > Mg > Cu > Al
(d) Mg > Al > Na > Cu

(v) Hydrogen gas is not evolved when a metal reacts with nitric acid. It is because HNO, is a strong oxidising agent. It oxidises the H, produced to water and itself gets reduced to any of the nitrogen oxides (N,O, NO, NO_2). But _____ and _____ react with very dilute HNO_3 to evolve H_2 gas.
(a) Pb, Cu
(b) Na, K
(C) Mg, Mn
(d) Al, Zn

CASE STUDY BASED QUESTIONS (answers)



1.

(ii) ionic compounds have high melting point as their particles are held together by strong electrostatic force

(iii) soluble in water and insoluble in kerosene, ether etc.

2. (i) aluminum and copper used for making electric wire because they are ductile and good conductor of electricity

(ii) carbon

(iii) brass and bronze

(iv) aerobic respiration

3. (i) Na, K

(ii) Cu, Al, Mg, Na

(iii) Mg, Mn

(iv) Au

4. (i) Answer: (a) Copper is placed below hydrogen in activity series therefore, it is less reactive than hydrogen.

(i) Answer: (c) Iron is placed above hydrogen in activity series therefore, it is more reactive than hydrogen.

(ii) Answer: (c)

(iii) Answer: (a)

(iv) Answer: (c)

CHAPTER 4

CARBON COMPOUNDS

Prepared by: - KUMARI SUNITA,

KV HINOO NO 1

CABON AND ITS COMPOUNDS

CARBON---- $^{6}C^{12}$

-Chemical Symbol-- C

-Atomic Number- 6

- Mass Number -----12

- Electronic Configuration- 2,4

- It is a non-metal.

- In earth's crust, carbon is 0.02% and found in form of minerals.

- Atmosphere has 0.03% of Carbon dioxide.

VERSATILE NATURE OF CARBON---

1.Catenation- Self linking property of carbon atom to form long chain.

2.Tetravalency- Valency of carbon is 4. It forms covalent bond.

3. Smaller size of carbon atom to hold shared pair of electrons by nucleus. So carbon compounds are stable.

Covalent Bond in Carbon-

The atomic number of carbon is 6 and its electronic configuration is 2, 4. To attain noble gas configuration it can-

1.Gain 4 electrons. But it would be difficult for nucleus to hold 4 extra electrons.

2.Lose 4 electrons. But it would require a large amount of energy to remove 4 electrons.

3. It is difficult thus for an atom of carbon to either gain or lose electrons.

4.Carbon attains the noble gas configuration by sharing its valence electrons with other atoms.

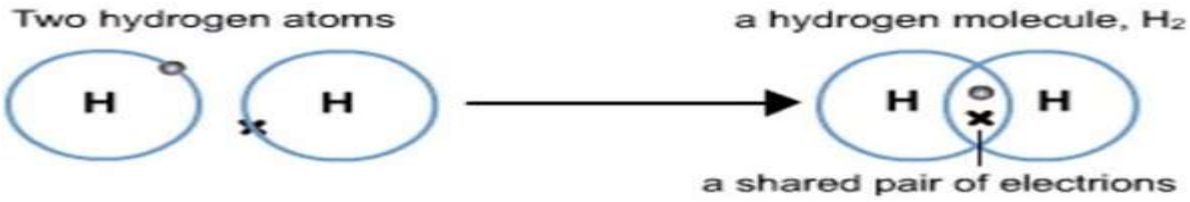
5. Bond formed by the sharing of an electrons is called covalent bond.

6. Bond may be – a) single Covalent bond - Ex -H2

b) Double Covalent bond- Ex- O2

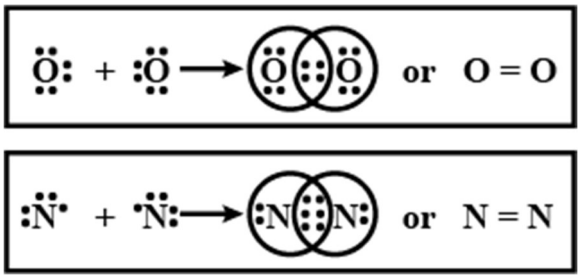
c) Triple Covalent Bond - Ex- N2

7. Formation of H_2, O_2 and N_2 is shown as below:



Single covalent bond in H_2 molecule

O_2 AND N_2



DOUBLE COVALENT BOND IN OXYGEN MOLECULE

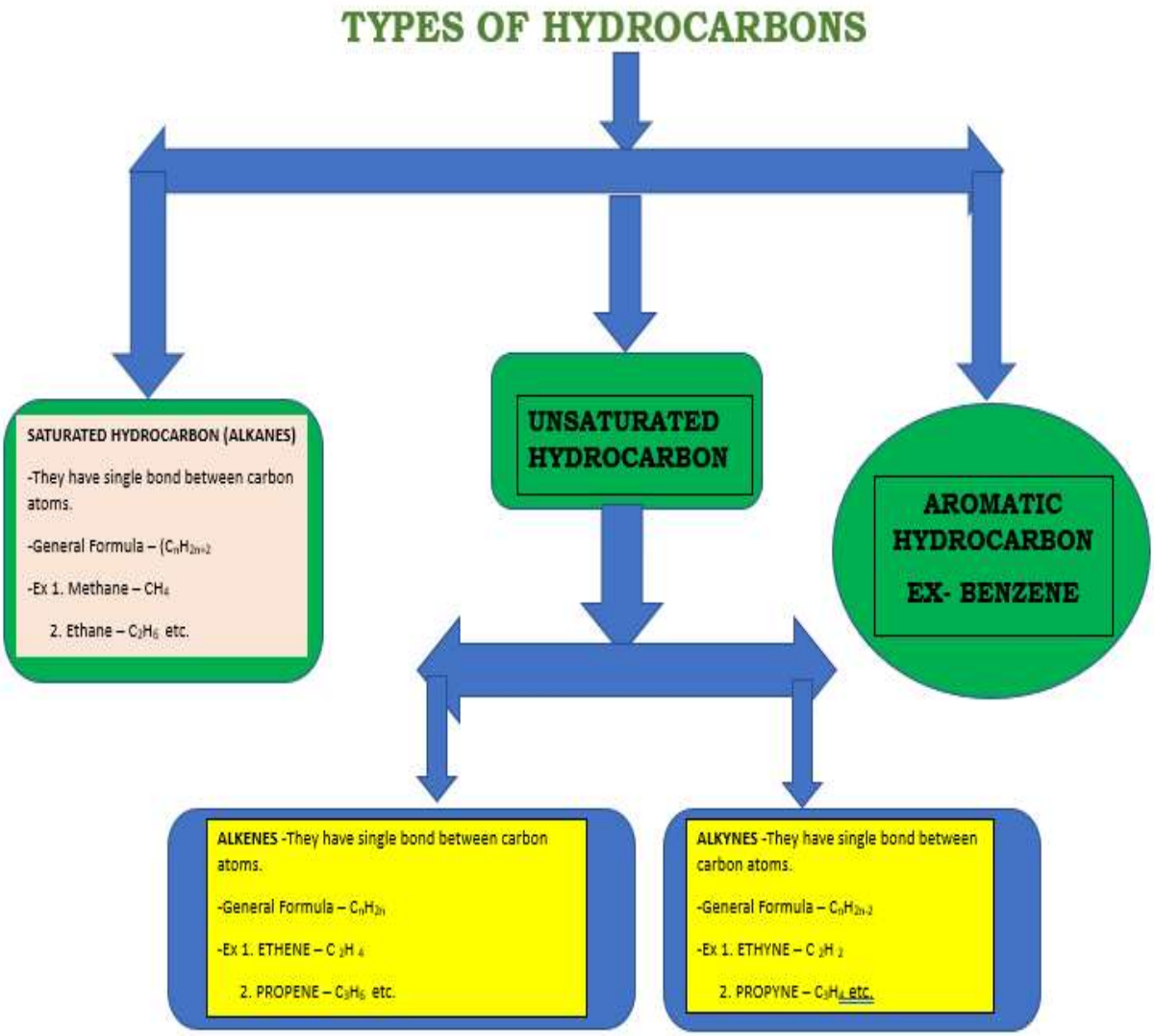
Triple Covalent Bond in Nitrogen molecule

8. Covalent compounds have low melting and boiling points due to weak intermolecular forces of attraction.

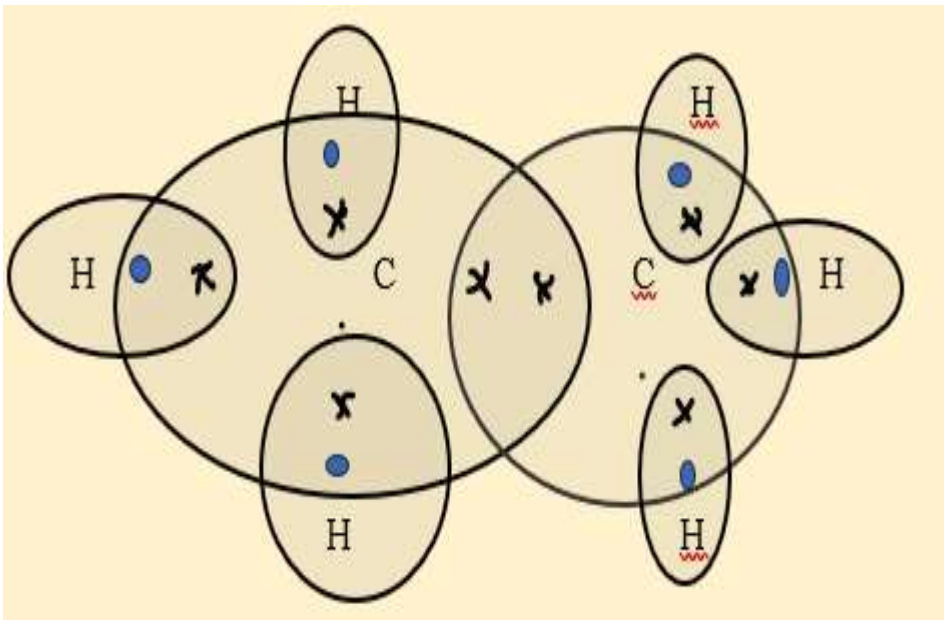
9. These compounds are generally poor conductor of electricity since no charged particles are formed .

HYDROCARBONS-

Compounds of Hydrogen and Carbon are called Hydrocaron.

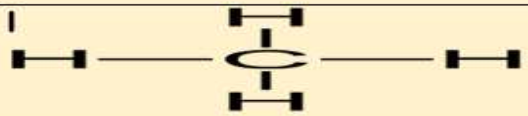
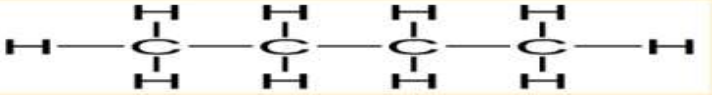
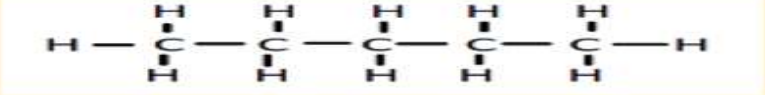


Electron dot structure of a saturated carbon compound, ethane is as follows:-

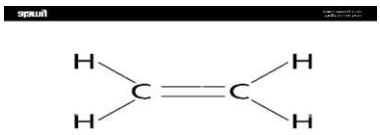
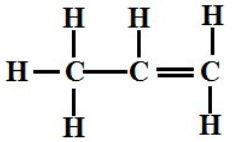


ETHANE

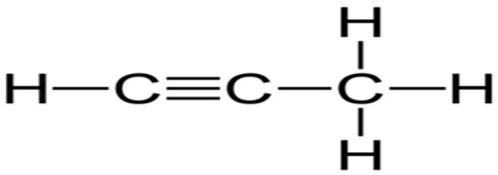
Formulae and Structures of Saturated Compounds of Carbon and Hydrogen--

No Of Carbon Atoms	Name	Formula	Structure
1	Methane	CH4	
2	Ethane	C2H6	
3	Propane	C3H8	
4	Butane	C4H10	
5	Pentane	C5H12	

Formulae and Structures of Unsaturated Compounds of Carbon and Hydrogen (Alkene)

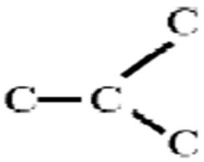
No of Carbon Atoms	Name	Formula	Structure
2	Ethene	C2H4	
3	Propene	C3H6	 PROPENE

Formulae and Structures of Unsaturated Compounds of Carbon and Hydrogen (Alkyne)-

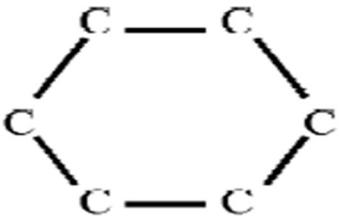
No Of Carbon Atoms	Name	Formula	Structure
2	Ethyne	C2H2	
3	Propyne	C3H4	

On the basis of structures the hydrocarbons can be:-

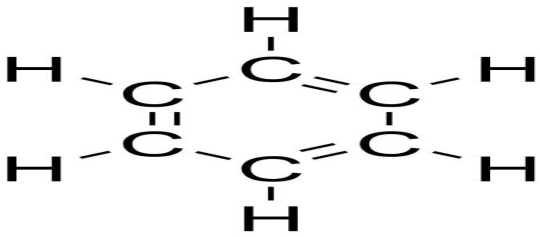
Straight chain



Branched



Cyclic saturated

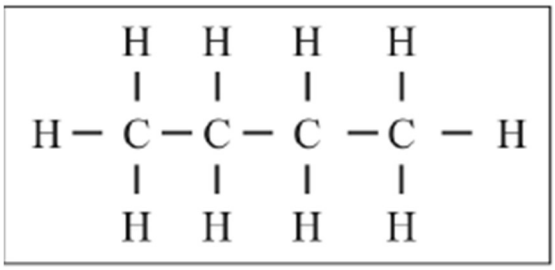


BENZENE

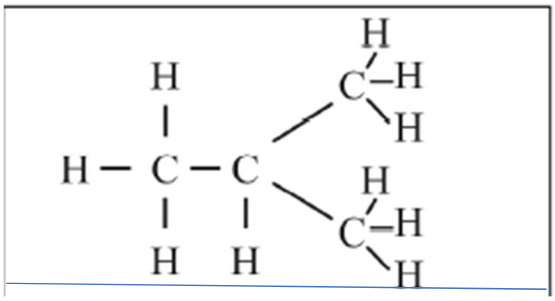
CYCLIC UNSATURATED

Isomerism :-

Carbon compounds having the same molecular formula but different structural formulae are called isomers. This property is called isomerism. Ex :- Butane – C4H10 has 2 isomers. They are Normal butane and Iso butane



n Butane



Iso Butane

Pentane (C5H12) -- has 3 isomers. They are Normal pentane, Iso pentane and Neo pentane.

Isomers of Pentane (C_5H_{12}) :

(*i*) $CH_3—CH_2—CH_2—CH_2—CH_3$

n-Pentane

(*ii*) $CH_3—CH(CH_3)—CH_2—CH_3$

2-methylbutane (Isopentane)

Heteroatom :

-In hydrocarbon chain, one or more hydrogen atoms can be replaced by other atoms in accordance with their valency. The element that replaces hydrogen is called a heteroatom.

Functional groups-

An atom or a group of atoms which decides the properties of a carbon compound is called a functional group.

HETERO ATOM	CLASS OF COMPOUNDS	FORMULA OF FUNCTIONAL GROUP
Cl/Br	Halo-(Chloro/Bromo) alkanes	-Cl, -Br (substitutes for hydrogen atom)
Oxygen	1. Alcohol	-OH
	2. Aldehyde	-CHO
	3. Ketone	>C = O
	4. Carboxylic acid	-COOH

Homologous Series:

-It is a family of organic compounds having the same functional

group in which the formula of successive members differs by –CH2 group. For example,

For alkanes -CH4, C2H6, C3H8, C4H10etc.

For alkenes-C2H4, C3H6, C4H8 and C5H10 etc.

- The chemical properties are imparted by the functional group thus all members have similar chemical properties. But the members have different physical properties.

- The melting and boiling points increase with increasing molecular mass.

Nomenclature of Carbon Compounds:

1.Identify the number of carbon atoms in the compound.

2.Functional group is indicated either by prefix or suffix.

3.If a suffix is added, then final 'e' is removed from the name eg. methanol

(methane-e = methane + ol).

S.No.	Class of Example compounds	Prefix/Suffix	Example	Structure
1.	Halo alkane	Prefix - Chloro, - Bromo	Chloropropane Bromopropane	$CH_3CH_2CH_2Cl$ $CH_3CH_2CH_2Br$
2.	Alcohol	Suffix – ol	Propanol	$CH_3CH_2CH_2OH$
3.	Aldehyde	Suffix – al	Propanal	CH_3CH_2CHO
4.	Ketone	Suffix - one	Propanone	CH_3COCH_3
5.	Carboxylic acid	Suffix - oic acid	Propanoic acid	CH_3CH_2COOH
6.	Alkenes	Suffix – ene	Propene	$CH_3CH= CH_2$
7.	Alkynes	Suffix – yne	Propyne	$CH_3C = CH$

Chemical properties of Carbon compounds:

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

Ex-$CH_4+O_2 \rightarrow CO_2+H_2O$+ heat and light

-Saturated hydrocarbon burns generally with a blue flame in good supply or air and with a yellow sooty flame in limited supply of air.

-Sooty flame is seen when unsaturated hydrocarbons are burnt.

-Burning of coal and petroleum emits oxides of Sulphur and nitrogen which are responsible for acid rain.

2.OXIDATION: Alcohols can be converted to carboxylic acids by oxidizing them using alkaline potassium permanganate or acidified potassium dichromate (they add oxygen to the reactant, thus are called oxidizing agents).

Alkaline $KMnO_4$ + heat

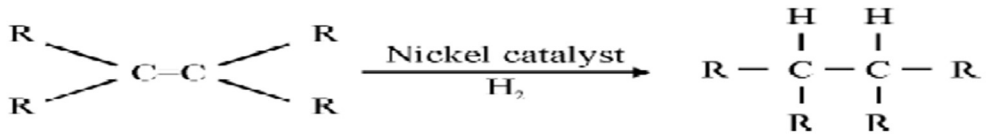
CH_3-CH_2-OH ----------→ CH_3COOH

Acidified $K_2Cr_2O_7$ + heat

3.ADDITION REACTION:

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

Vegetable oils are converted into vegetable ghee using this process.



Vegetable Oil Vegetable ghee

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

4. SUBSTITUTION REACTION:

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

CH_4+Cl_2 --------- → CH_3Cl+ HCl (sunlight required)

IMPORTANT CARBON COMPOUNDS: Ethanol and Ethanoic Acid

Ethanol---

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

CHEMICAL PROPERTIES OF ETHANOL(C_2H_5OH)--

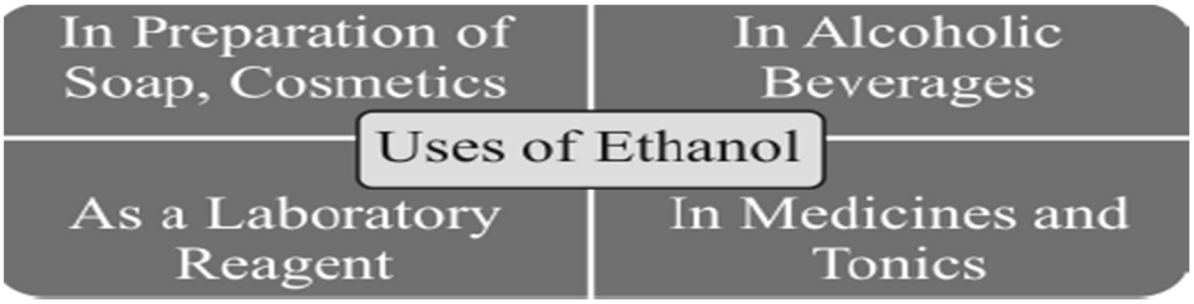
C_2H_5OH Reacts with ***Sodium*** to from **Sodium Ethoxide** and **Hydrogen**	When C_2H_5OH is **Heated** with **Concentrated Sulphuric Acid** at 443 k, It is Dehydrated to **Ethene**

$C_2H_5OH + Na \dashrightarrow C_2H_5ONa + H_2$

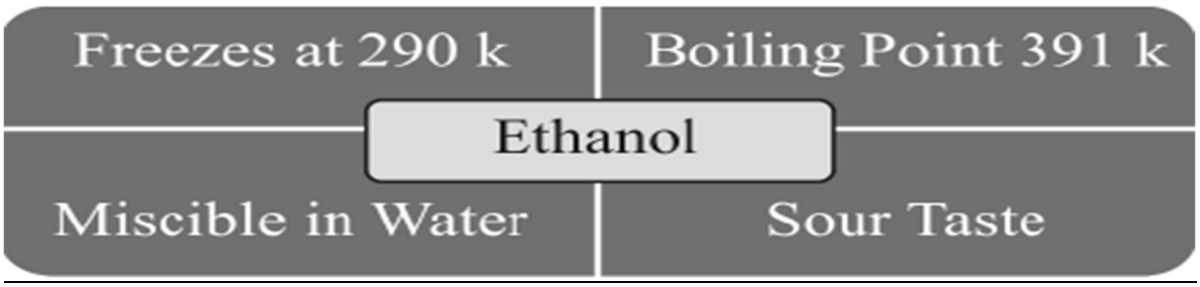
(Sodiun Ethaoxide)

Conc H2SO4 at 443 K

C2H4 +H2O (Ethene)



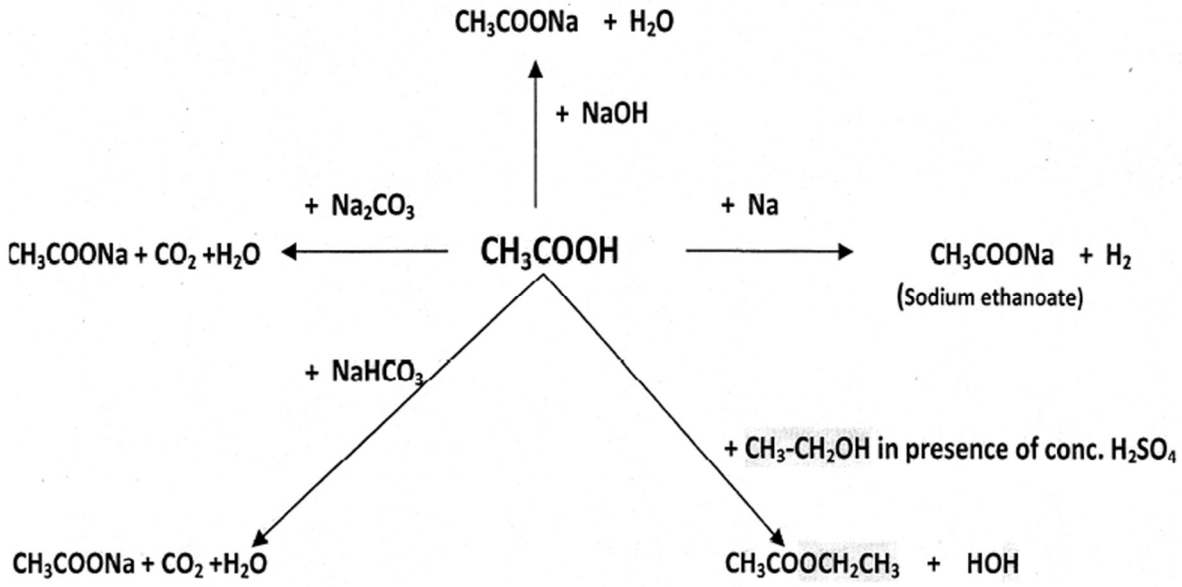
Ethanoic Acid (CH3COOH) / Acetic Acid: ---



- 5-8% solution of acetic acid in water is called vinegar.

- Pure acetic acid is called glacial acetic acid

		REACTS WITH	PRODUCTS
ETHANOIC ACID	1	SODIUM Na	SODIUM ETHANOATE AND HYDROGEN
	2	SODIUM CARBONATE Na_2CO_3	SODIUM ETHANOATE, CARBON DIOXIDE AND WATER
	3	SODIUM BICARBONATE $NaHCO_3$	SODIUM ETHANOATE, CARBON DIOXIDE AND WATER
	4	ETHANOL(IN PRSENCE OF CONC. SULPHURIC ACID) CH_3-CH_2OH	ESTER AND WATER



Sodium Ethanoate **Ester**

Esterification:

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

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

$$CH3COOCH2CH3 + NaOH \rightarrow CH3COONa + CH3\text{-}CH2OH$$

$$CH3COO\ CH2CH3 \xrightarrow[HEAT]{Dil.\ H_2SO_4} CH3COOH + CH3\text{-}CH2OH$$

*Alkaline hydrolysis of ester is also called saponification.

Soaps and Detergents

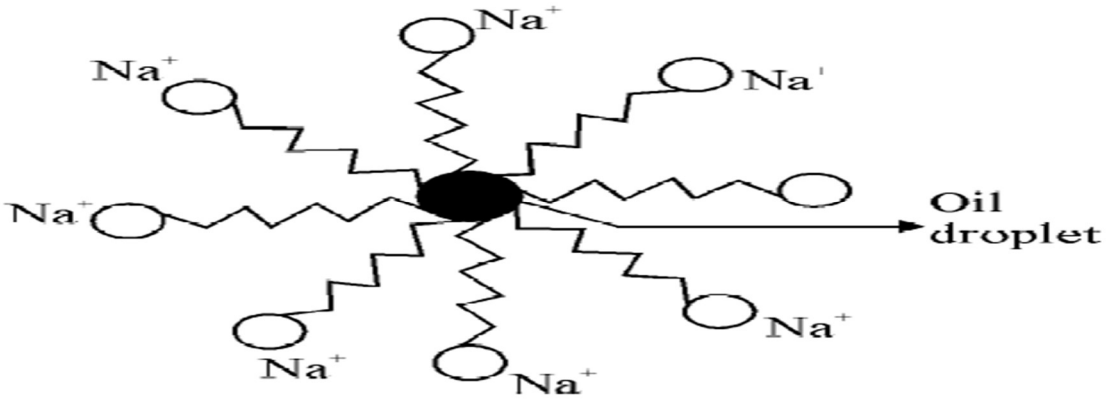
–Soap is sodium and potassium salt of carboxylic acids with long chain.

–Soaps are effective with soft water only and ineffective with hard water.

–Detergents are ammonium or sulphonate salts of carboxylic acids with long chain. They are effective with both soft as well as hard water. An ionic part (hydrophilic) and a long hydrocarbon chain (hydrophobic) part constitutes the soap molecule.

Structure of a Soap Molecule

Cleansing Action of Soaps: –Most dirt is oily in nature and the hydrophobic end attaches itself with dirt,while the ionic end is surrounded with molecules of water. This result in formation of structure called micelle.



–An emulsion is thus formed by soap molecule. The cloth needs to be mechanically agitated to remove the dirt particles from the cloth.

–Scum: The magnesium and calcium salts present in hard water reacts with soap molecule to form insoluble products called scum, thus obstructing the cleansing action. Use of detergents overcome this problem as the detergent molecule prevents the formation of insoluble product and thus clothes get cleaned.

LAST MINUTE REVISION NOTES--

Covalent bonding in carbon compounds:

Carbon has 4 electrons in its outermost shell. carbon tries to achieve a stable configuration by sharing electrons, rather than giving or taking them. The bond formed by sharing of electrons is called covalent bond. It can be seen in some compounds other than carbon also, like H2.

Versatile Nature of Carbon

1.Catenation – The ability of carbon to form bonds with other atoms of carbon is termed catenation. This gives rise to long chain carbon compounds.

2.Tetra-valency – Since carbon has a valency of four, it can form 4 bonds. Compounds of carbon are seen with oxygen, hydrogen, nitrogen, sulfur, chlorine and many other elements. The compounds of carbon containing only carbon and hydrogen are called hydrocarbons.

Saturated and Unsaturated Hydrocarbons

Unsaturated hydrocarbons are hydrocarbons that contain only single bond in them have double or triple covalent bond(s) between carbon atoms.

Saturated hydrocarbons-

The hydrocarbons containing only carbon carbon single bonds are called alkanes.

The hydrocarbons containing carbon carbon double bond(s) are called alkenes.

The hydrocarbons containing carbon carbon triple bond(s) are called alkynes.

Chains, Branches and Rings in Carbon Compounds & Isomers

We see that carbon compounds can either contain a straight chain, branches, or can be in the form of a ring.

ISOMERISM-

Phenomenon in which compounds have same molecular formula but different structures are called isomerism.

Ex- Butane have 2 isomers- n butane and iso butane

Functional Groups

We have seen that carbon forms bonds with a number of different elements like halogen, sulphur, nitrogen, oxygen, etc. In a hydrocarbon chain, one or more hydrogens can be replaced by these elements, such that the valency of carbon remains satisfied.

Depending upon the element or group of elements that form bonds with carbon, the properties of the compound changes. Such an element or group of elements is called a functional group. Some common functional groups and their names are given below:

Functional group	Prefix / suffix	Name
Halogen	Prefix-chloro, bromo, etc	Chloropropane, Bromopropane
Alcohol	Suffix – ol	Propanol
Aldehyde	Suffix – al	Propanal
Ketone	Suffix – one	Propanone
Carboxylic acid	Suffix – oic acid	Propanoic acid

Homologous Series- Homologous Series: It is a family of organic compounds having the same functional group in which the formula of successive members differs by –CH2 group. For example,

For alkanes-CH4, C2H6, C3H8, C4H10 etc.

For alkenes-C2H4, C3H6, C4H8 and C5H10 etc

Chemical Properties of Carbon Compounds-

1.Combustion – Carbon compounds burn in the presence of oxygen to give carbon dioxide along with release of heat and light. Eg. C+O2→CO2+heat and light.

2.Oxidation -

$$CH_3\text{-}CH_2\text{-}OH \xrightarrow[\text{Acidified } K_2Cr_2O_7 + \text{heat}]{\text{Alkaline } KMnO_4 + \text{heat}} CH_3COOH$$

–

3.Addition – Unsaturated hydrocarbons add hydrogen in the presence of catalysts such as palladium or nickel to give saturated hydrocarbons. This reaction is

commonly used in the hydrogenation of vegetable oils. Eg Vegetable oil---------→ Vegetable ghee

4.Substitution – when one type of atom or a group of atoms takes the place of another, it is called a substitution reaction. For eg, in the presence of sunlight, chlorine is added to hydrocarbons and replaces the hydrogen atoms one by one.

$$CH4+Cl2 \rightarrow CH3Cl+HCl \text{ (in the presence of sunlight)}$$

Properties of Ethanol and Ethanoic Acid-

Ethanol: Formula: CH3CH2OH

(i) Ethanol, C2H5OH is a colourless liquid having a pleasant smell.

(ii) It boils at 351 K.

(iii) It is miscible with water in all proportions.

(iv) It is a nonconductor of electricity (it does not contain ions)

(v) It is neutral to litmus.

Uses:

As an antifreeze in radiators of vehicles in cold countries.

1. As a solvent in the manufacture of paints, dyes, medicines, soaps and.
2. 2. As a solvent to prepare the tincture of iodine

Ethanoic Acid or Acetic Acid

(i) Molecular formula: CH3COOH

(ii) It dissolves in water, alcohol and ether.

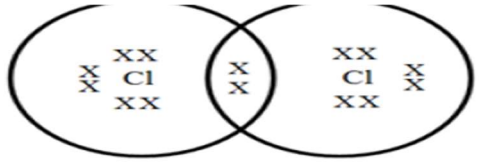
(iii) It often freezes during winter in cold climate and therefore it is named as glacial acetic acid.

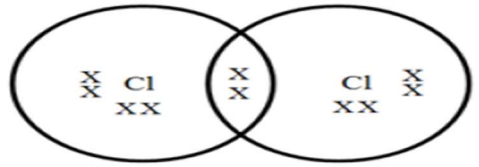
Soap and Detergent-

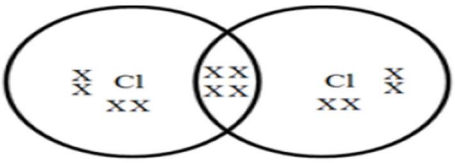
Soaps	Detergents
(i) These are sodium or potassium salts of long chain fatty acids.	(i) These are ammonium and sulphonate salts of long chain fatty acids.
(ii) Ionic part of the soap is $-COO^{-}Na^{+}$	(ii) Ionic part of detergent is $-OSO^{3-}Na^{+}$.
(iii) Their efficiency decreases in hard water	(iii) Their efficiency is unaffected in hard water.
(iv) Soaps are biodegradable.	(iv) Detergents are non-biodegradable.

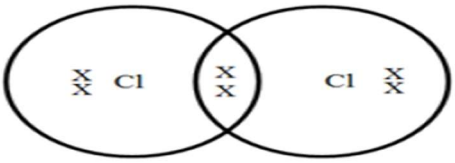
MULTIPLE CHOICE QUESTIONS (MCQ)---

1**. Which of the following structures correctly represents the electron dot structure of a chlorine molecule?**

a) 

b) 

c) 

d) 

2. While cooking, if the bottom of the vessel is getting blackened on the outside, it means that:

a) The food is not cooked completely

b) The fuel is not burning completely

c) The fuel is wet

d) The fuel is burning completely

3. Cation is formed when:

a) Atom gains electrons

b) Atom loses electrons

c) Proton is lost by the atom

d) Atom shares electrons

4. The property of self-linkage among identical atoms to form long chain compounds is known as:

a) Catenation

b) Isomerisation

c) Superposition

d) Halogenation

5. Pentane with molecular formula C5H12 has

(a) 12 covalent bonds

(b) 16 covalent bonds

(c) 18 covalent bonds

(d)15covalent bonds

6. Which of the following statements is incorrect regarding a homologous series?

(i) Compounds in a homologous series can have the same or different functional group.

(ii) Compounds in a homologous series have very less similarity in chemical properties.

(iii) Difference between the two successive compounds in a homologous series differ by a CH2 group.

(iv)Successive members in a homologous series differ in molecular mass by 14 units

(a) i and ii

(b) ii and iii

(c) iii and iv

(d) i and iv

7. Which of the following carbon compound, is saturated molecule?

(a) C6H12

(b) C2H2

(c) C5H10

(d) C4H10

8. Three of the four compounds belong to a homologous series. Identify the odd one out.

(a) C4H10

(b)C2H4

(c) C3H8

(d) C5H12

9. Which of the following is unsaturated molecule?

a) C3H8

b) C2H2

C) C5H12

d) C4H10

10. 3rd homologue of alkyne series is---

a) Propyne

b) propene

c) butyne

d) butane

11. Which of the following statements are correct for carbon compounds?

(i) Most carbon compounds are good conductors of electricity.

(ii) Most carbon compounds are poor conductors of electricity.

(iii) Force of attraction between molecules of carbon compounds is not very strong.

(iv) Force of attraction between molecules of carbon compounds is very strong.

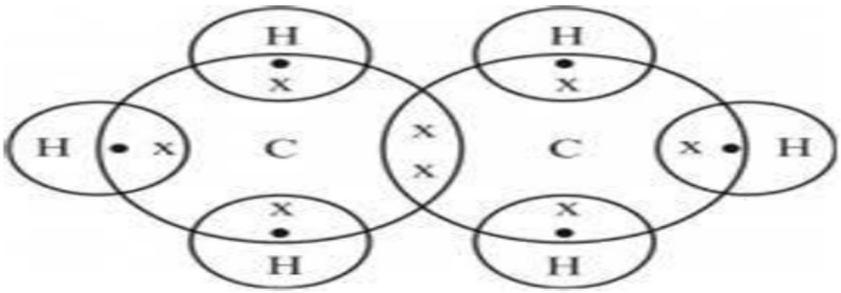
(a) (ii) and (iv)

(b) (ii) and (iii)

(c) (i) and (iv)

(d) (i) and (iii)

12. which of the following statements is correct about the given electron



dot structure

a. The compound has 8 bonds of which one is a double bond

b. The compound is formed of all single bonds of which one is a C-C bond.

c. The electrons in every shell of the atoms are shown in the structure.

d. Electron dot structure doesn't help to identify the bonds in a compound

13. Butanone is a four-carbon compound with the functional group

(a) Carboxylic acid.

(b) Aldehyde.

(c) Ketone.

(d) Alcohol

14. A student studies that vinegar, which is a diluted form of ethanoic acid, freezes during winter. What does this suggest about the physical properties of pure ethanoic acid?

(a) It has a low boiling point

(b) It has a low melting point

(c) It has a very high boiling point

(d) It has a very high melting point

15. Which of the following is the molecular formula of Cyclobutene?

a) C4H10

b) C4H6

c) C4H8

d) C4H4

ANSWER

1.a 2.b 3.b 4.a 5.b 6.a 7.d 8.b 9.b 10.c 11.b 12.b 13.c 14.b 15.c

ASSERTION REASON TYPE QUESTIONS:

Following questions consist of two statements – Assertion (A) and Reason (R). Answer these questions selecting the appropriate option given below:

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

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

(c) A is true but R is false.

(d) A is false but R is true

1) Assertion(A): Carbon compounds can form chain, branched and ring structures.

   Reason (R): Carbon exhibits the property of catenation.

2) Assertion (A): Covalent compounds are generally poor conductor of electricity.

   Reason (R): They consist of molecules and not ions which can transfer charge

3) Assertion(A): The functional group present in alcohols is – OH.

   Reason (R): It is the same group as present in water, hence water and Alcohol have similar properties.

4) Assertion: Ethanoic acid liberates hydrogen with Sodium metal.

   Reason: More reactive sodium displaces hydrogen from ethanoic acid.

5) Assertion: Vegetable oils are unsaturated, react with hydrogen in presence of nickel to form vegetable ghee.

   Reason: This reaction is saponification.

ANSWER-- 1) a 2)a 3)c 4) a 5)c

SHORT ANSWER TYPE QUESTIONS (2 MARKS)-

1) A hydrocarbon molecule has 4 carbon atoms. What would be its molecular formula in case it is (i) an alkane (ii) an alkene 2

2) Alkenes and alkynes are unsaturated. What does it mean? 2

3) List any two properties of homologous series. 2

4) In the electron dot structure of hydrogen molecules, each individual atom is not satisfying the octet. Justify. 2

5) How many saturated hydrocarbons can be made using three carbon atoms? and hydrogen atoms? Name them. 2

6) Carbon cannot make ionic compounds. Why? 2

7) Why does carbon form compounds mainly by covalent bonding? 2

8) Draw the electron dot structure of ethyne and also draw its structural formula. 2

9) Draw the electron dot structure of O2 and N2 molecules. 2

10) Atom of an element contains 5 electrons in the valence shell. This element exists as diatomic molecules, and is a major component of air.

(a) Identify the element.

(b) Show the bond formation between two atoms of this element. 3

(c) What is the nature of bond formed between the 2 atoms.

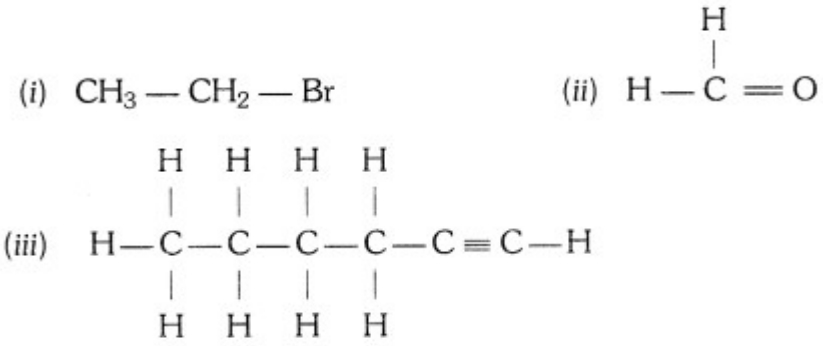
11. Draw the structures for the following compounds: 3

(i) Ethanoic acid

(ii) Bromopentane

(iii) Hexanal

12) name the following compounds ? 3



13) How would you distinguish experimentally between an alcohol and a carboxylic acid ? 3

14) What is hydrogenation? What is its industrial application? 3

15) Explain the cleansing action of soaps. 3

ANSWER—

1) (i) General formula of alkanes = CnH2n+2; if 2n+2 =10, n=4; so, formula will be C4H10

(ii) General formula of alkanes = CnH2n; So, if 2n=8, n=4; so, formula will be C4H8

2) Unsaturated molecules have carbon carbon double bonds or triple bonds. Alkenes and alkynes contain double or triple bond between carbon atoms, hence they are unsaturated. Unsaturated molecules are those in which more atoms can be added. (They undergo addition reaction)

3) i) All the compounds of a homologous series show similar chemical properties.

(ii) The members of a homologous series show a gradual change in their physical properties with increase in molecular mass.

4) For hydrogen atom as there is only a K shell ,it can occupy a maximum of two electrons.

5) Two Propane and cyclopropane.

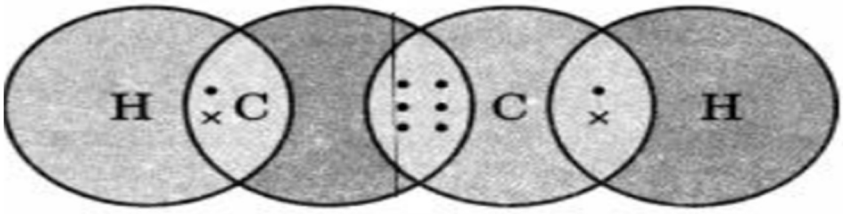
6) Due to small size and high effective nuclear charge, carbon cannot lose electrons to form C4+ ion and as carbon with 6 protons cannot afford four more electrons in its L shell, it cannot form C4- ions, As carbon cannot form an anion or cation, it cannot make ionic bonds.

7) Carbon atoms have 4 valence electrons in their valence shell, it needs to gain or lose 4 electrons to attain the noble gas configuration.

(i) It could gain four electrons forming anion C4- But it would be difficult for the nucleus with six protons to hold on to ten electrons.

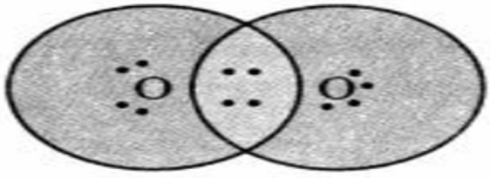
(ii) It could lose four electrons forming cation C4+. But it would require a large amount of energy to remove four electrons from its outermost shell. Therefore, carbon shares its valence electrons to complete its octet with other atoms to form covalent bonds.

8)



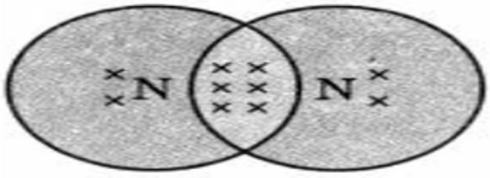
H—C≡C—H

9)



O═O

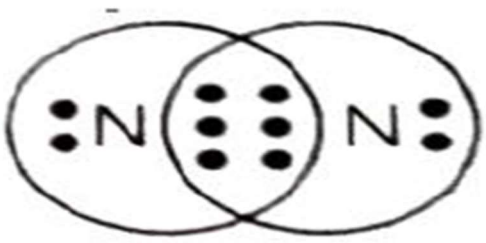
O_2 molecule



N≡N

N_2 molecule

10)(a) Nitrogen

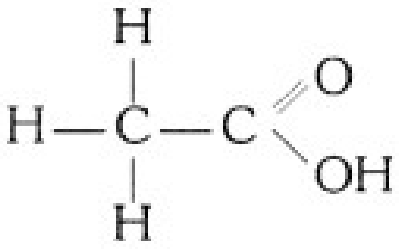


or :N≡N:

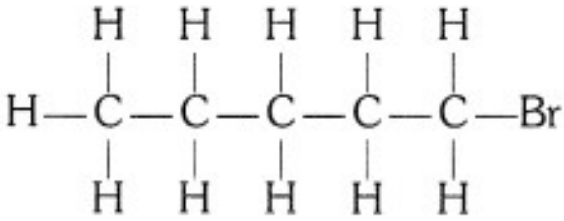
(b)

(c) Covalent bond

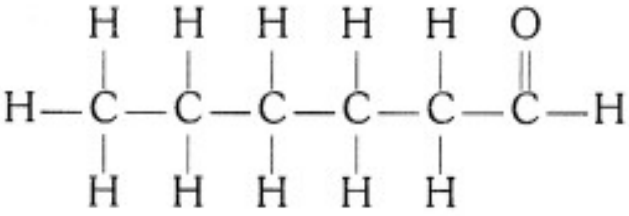
11) i) Ethanoic acid (CH3COOH)



ii) Bromopentane (C5H11Br)



iii)Hexanal ((C5H11CHO)



12) (i) Bromoethane

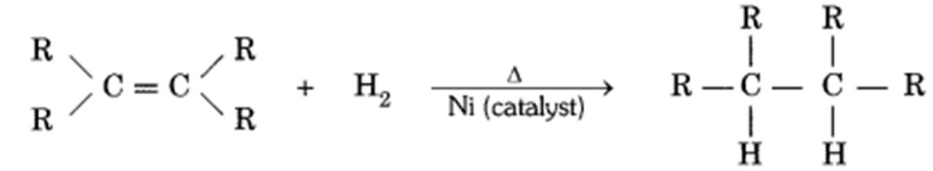
(ii) Methanal

(iii) 1 – Hexyne

13)

Test	Alcohol	Carboxylic acid
(i) Litmus test	No change in colour.	Blue litmus solution turns red.
(ii) Sodium hydrogen carbonate test	$C_2H_5OH + NaHCO_3 \rightarrow$ No reaction No brisk effervescence.	$CH_3COOH + NaHCO_3 \rightarrow CH_3COONa + H_2O + CO_2$ Brisk effervescence due to evolution of CO_2.
(iii) Alkaline potassium permanganate	On heating, pink colour disappears.	Does not happen so.

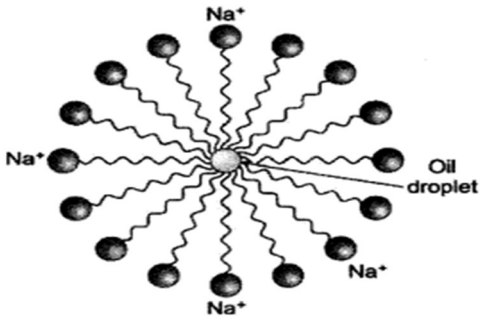
14) The addition of hydrogen to an unsaturated hydrocarbon to obtain a saturated hydro-carbon is called hydrogenation. The process of hydrogenation takes place in the presence of nickel (Ni) or palladium (Pd) metals as catalyst.



Unsaturated compound Saturated compound

Application: The process of hydrogenation has an important industrial application. It is used to prepare vegetable ghee (or vanaspati ghee) from vegetable oils.

15) When a dirty cloth is put in water containing dissolved soap, then the hydrocarbon end of the soap molecules in micelle attach to the oil or grease particles present on the surface of dirty cloth. In this way the soap micelle entraps the oily or greasy particles by using its hydrocarbon ends. The ionic ends of the soap molecules in the micelles, however, remain attached to water. When the dirty cloth is agitated in soap solution, the oily and greasy particles present on its surface and entrapped by soap micelles get dispersed in water due to which the soap water becomes dirty but the cloth gets cleaned. The cloth is cleaned thoroughly by rinsing in clean water a number of times.



Formation of micelles

LONG ANSWER TYPES QUESTIONS ---

1)Two elements A and B have the property C by which they can combine with more atoms of their same type. Element A is a component of the gas D that is a respiratory byproduct, while element B is the second most abundant element in the crust. 5

(a) Identify the elements A and B.

(b)What is the property C?

(c) Identify the gas D.

(d) Among A and B, which one shows the property C to a greater extent? Why?

2) A and B are two organic compounds with the same molecular formula C5H10.Write their names and structural formulae in case 5

(a) A is a cyclic compound.

(b) B is a straight chain compound.

(c) Among A and B, which one will have only single bonds?

(d) Will it be A or B that has both single and double bonds?

3) Define homologous series of organic compounds. List its two characteristics.

Write the name and formula of the first member of the series of alkene. 5

4) Explain the nature of the covalent bond using the bond formation in CH3Cl. 5

Covalent bond is formed by sharing of electrons so that the combining atoms complete their outermost shell.

5) Draw the electron dot structures for 5

(a) ethanoic acid

(b) propanone

(c) H2S

(d) F2.

(e) Cyclopentane

ANSWER

1)

(a) A is Carbon; B is Silicon.

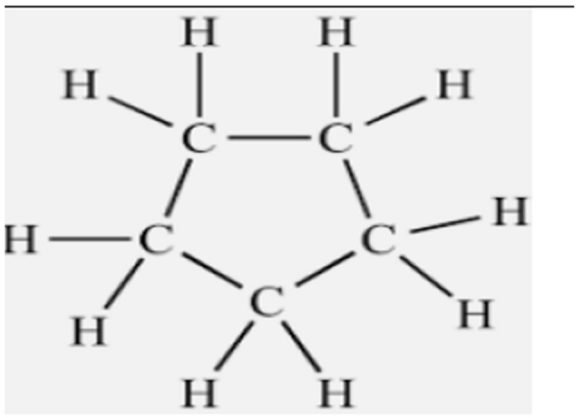
(b) Catenation.

(c) Carbon dioxide.

(d) A (Carbon) shows greater extent of catenation than B (Silicon)

Reason: Carbon atoms are smaller than that of silicon. So, carbon- carbon bonds are much stronger than silicon- silicon bonds.

2) (a) A is Cyclopentane.



(b) B is Pentene (c) A (Cyclopentane). (d) B (Pentene)

3) The series of organic compounds having same functional group and similar chemical Properties is called homologous series. Each member differs from successive member by —CH2— group. The difference in molecular weight between two successive members is 14u.

Characteristics:

(i) It has same general formula, from which, all members can be derived.

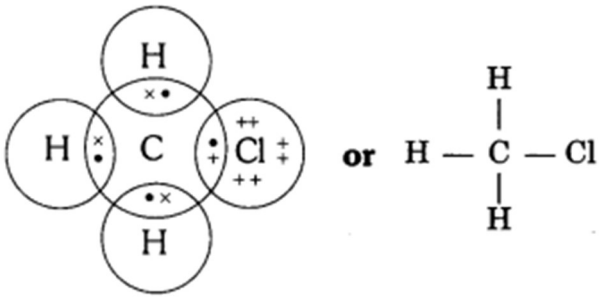
(ii) They have similar chemical properties.

C2H4, CH2=CH2, Ethene is first member of alkene series.

4) Covalent bond is formed by sharing of electrons so that the combining atoms complete their outermost shell.

In CH3Cl: C = 6, H = 1 and Cl = 17

And their electronic configuration is C – 2,4 H – 1 and Cl – 2, 8, 7

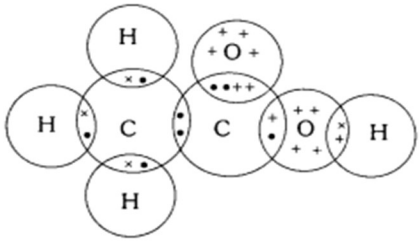


Three hydrogen atoms complete their shells by sharing three electrons (one electron each) of carbon atom. Chlorine completes its outer shell by sharing its one out of seven electrons with one electron of carbon atom.

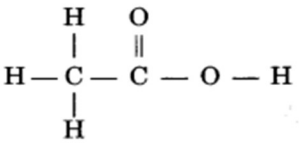
Thus, carbon atom shares all its four electrons with three hydrogen atoms and one of chlorine atom and completes its outermost shell and single covalent bonds are formed in CH3Cl.

5)

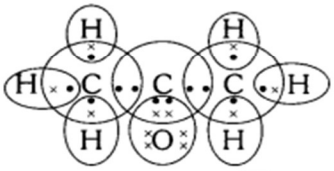
(*a*) **Ethanoic acid:**



or



(*b*) **Propanone** :



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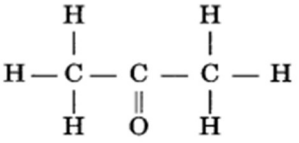
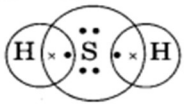
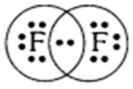


(*c*) **Hydrogen sulphide (H_2S) :**



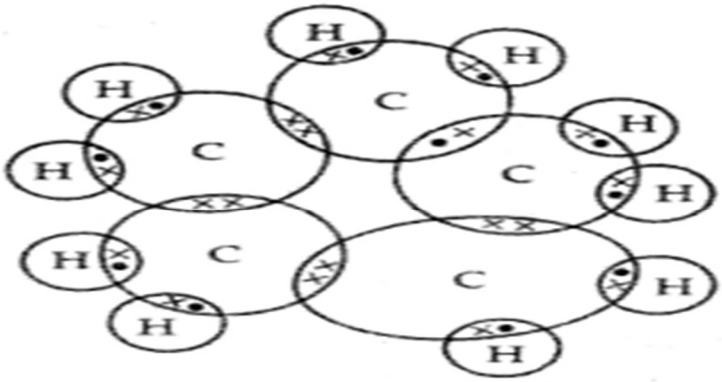
or H–S–H

(*d*) **Fluorine (F_2)** :



or F–F

(e) Cyclo pentane:



Electron dot structure of cyclopentane

CASE BASED QUESTIONS

1)Read the following carefully.

In covalent compounds atoms share valence electrons to satisfy the octet. Each atom shares one pair or two pairs or three pairs of electrons depending on their combining capacity. In electron dot structures only, number of valence electrons are shown around the symbols of constituent atoms. Carbon using its valency of four can make either single, double or triple bonds with other carbon atoms or any other atoms. Carbons self-linking property is called catenation. In hydrocarbons carbon makes aliphatic or cyclic molecules they are either saturated or unsaturated. Based on these facts. Read the following paragraph and answer the questions given below.

An element X combines with Y to form a colorless odorless gas, Z which turns lime water milky is the major constituent of all organic molecules. Five X atoms combines with hydrogens to form a cyclic saturated hydrocarbon J and aliphatic

unsaturated hydrocarbon Q.Q is used in gas welding.

a) Identify compound Z and draw its electron dot structure.

b) Write the chemical formula and IUPAC name of compound Q

c) What is the common name of Q

d) How many single covalent bonds are present in compound

2) Read the following and answer any four questions from (i) to (iv)

The compounds which have the same molecular formula but differ from each other in physical or chemical properties are called isomers and the phenomenon is called isomerism. When the isomerism is due to difference in the arrangement of atoms within the molecule, without any reference to space, the phenomenon is called structural isomerism. In other words. Structural isomers are compounds that have the same molecular formula but different structural formulas, i.e., they are different in the order in which different atoms are linked.In these compounds,

carbon atoms can be linked together in the form of straight chains,branched chains or even rings.

(i) Which of the following sets of compounds have same molecular formula?

(a) Butane and iso-butane

(b) Cyclohexane and hexene

(C) Propanal and propanone

(d) All of these

(ii) In order to form branching, an organic compound must have a minimum of

(a) four carbon atoms

(b) three carbon atoms

(c) five carbon atoms

(d) any number of carbon atoms.

(iii) Which of the following is an isomeric pair?

(a) Ethane and propane

(b) Ethane and ethene

(c) Propane and butane

(d) Butane and 2-methylpropane

(iv) Among the following the one having longest chain is

(a) neo-pentane

(b) iso-pentane

(C) 2-methylpentane

(d) 2,2-dimethylbutane.

3) Read the following and answer any four questions from 1(i) to (iv).

A series of organic compounds having the same functional group, with similar or almost identical chemical characteristics in which all the members can be represented by the same general formula and the two consecutive members of the series differ by -CH2 group or 14 mass unit in their molecular formulae is called a homologous series. For example, all the members of the alcohol family can be represented by the general formula, CnH2n+1OH where n may have the values 1, 2, 3, etc. The various members of a particular homologous series are called homologues. The physical properties such as density, melting point, boiling point,

solubility etc. of the members of a homologous series show almost regular variation in ascending and descending the series.

(i) Which one of the following is not a characteristic of members of a homologous series?

(a) They possess varying chemical properties.

(b) Their physical properties vary in a regular and predictable manner.

(c) Their formulae fit the general molecular formula

(d) Adjacent members differ by one carbon and two hydrogen atoms

(ii) All the members of homologous series of alkynes have the general formula

(a) CnH2n

(b) CnH2n+2

(c)CnH2n-2

(d) CnH2n-4

(iii) Which of the following statements is not correct?

(a) A common functional group is present in different members of a homologous series.

(b) Two consecutive members of a homologous series differ by a -CH3 group.

(c) The molecular mass of a compound in the series differs by 14 a.m.u. from that of its neighbor.

(d)All the members of a homologous series have common general methods of preparation.

(iv) Identify the correct statements:

(a) As the molecular mass increases in any homologous series, a gradation in physical properties is seen.

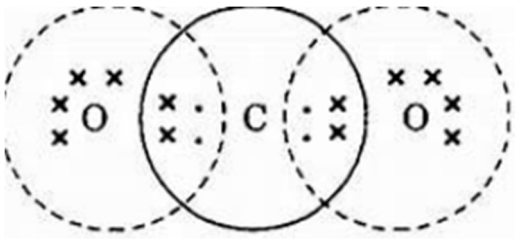
(b) The melting and boiling points decrease with increasing molecular mass.

(c) As the molecular mass increases in any homologous series, variation in Chemical properties is observed a gradation in physical properties is seen.

(d) Adjacent members in a homologous series differ by 18u.

Answer-

1) a) Z is CO_2 its electron dot structure is-



b) C_2H_2, ethyne

c) Acetylene

d) 15

2) (i) (d) All of these (ii) (a) four carbon atoms (iii) (d) Butane and 2-ethylpropane

(iv) (C) 2-methylpentane

3) (i) a

(ii) c

(iii) b

(iv) a

UNIT NAME: NATURAL PHENOMENA

CHAPTER 5

I.LIGHT-REFLECTION & REFRACTION

Prepared by: - DR. DEEPA KAUSHAL,

K.V TATANAGAR

Light Reflection and Refraction

Laws of Reflection

- The angle of incidence is equal to angle of reflection
- Incident ray, reflected ray and normal all lie in the same plane.

Spherical Mirrors

Most common type of curved mirrors are spherical mirrors. Mirrors in which reflecting surface are spherical in shape, is known as spherical mirrors. Reflecting surface of a mirror can be curved inwards or curved outwards. The one which is curved inward is known as concave mirror and the one which curved outwards is known as convex mirror.

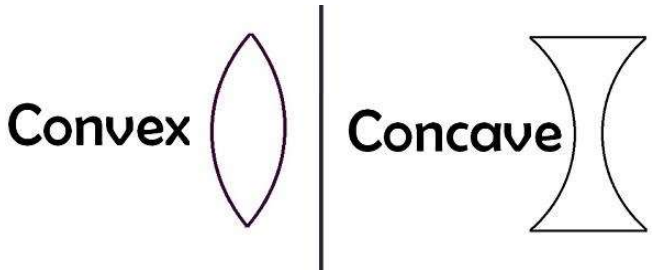


Fig.1. Spherical mirrors

Some Important Terms

- Pole- The centre of the reflecting surface in a spherical mirror is a pole. It is represented by P.
- Centre of curvature- Reflecting surface in a spherical mirror has a centre, this is known as centre of curvature. Centre of curvature in convex mirror lies behind the mirror whereas in concave mirror, it lies in front of the mirror.
- Radius of curvature- The radius of the reflecting surface of the spherical mirror is known as radius of curvature. It is represented by R.
- Principal axis- Straight line passing through the pole and centre of curvature in a spherical mirror is known as principal axis.
- Principal focus- The reflected rays appear to come from a point on the principal axis, this is known as principal focus.
- Focal length- The distance between the pole and the principal focus in a spherical mirror is known as focal length and it is represented by f.
- Aperture- The diameter of the reflecting surface is defined as aperture.

Note: Radius of curvature is twice the focal length (R=2f).

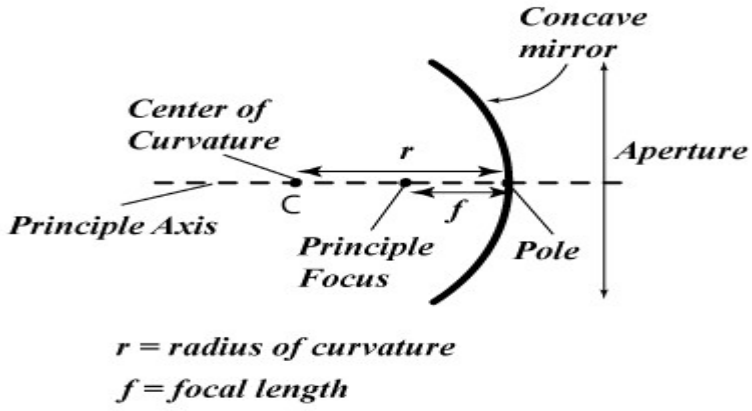
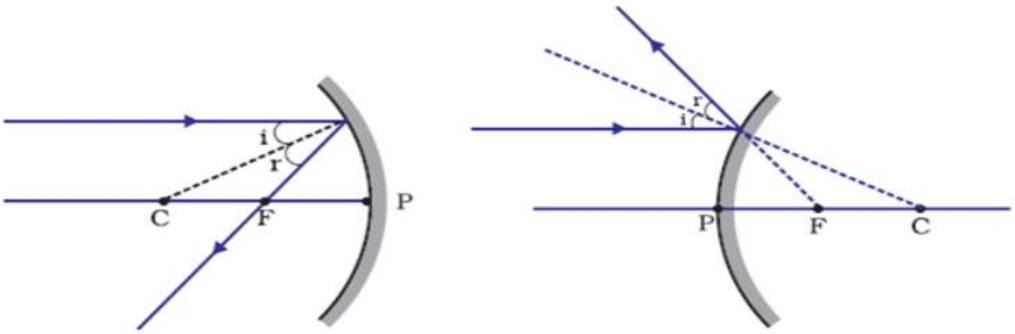


Fig.2. Image showing pole, principal axis, centre of curvature, aperture and principal focus in concave mirror

Representations of the images formed by Spherical Mirrors using Ray Diagrams

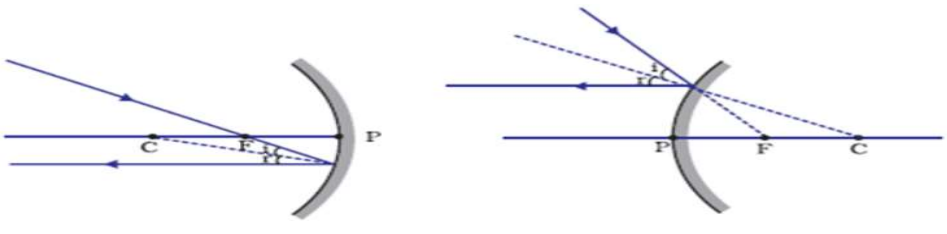
We draw the ray diagram to locate the image of an object formed. The intersection points of at least two reflected will give the position of image of the point object. The two rays that can be used to draw the ray diagram are-

- A ray parallel to the principal axis should pass through the focus after reflection in case of concave mirror, or appear to diverge in case of convex mirror.



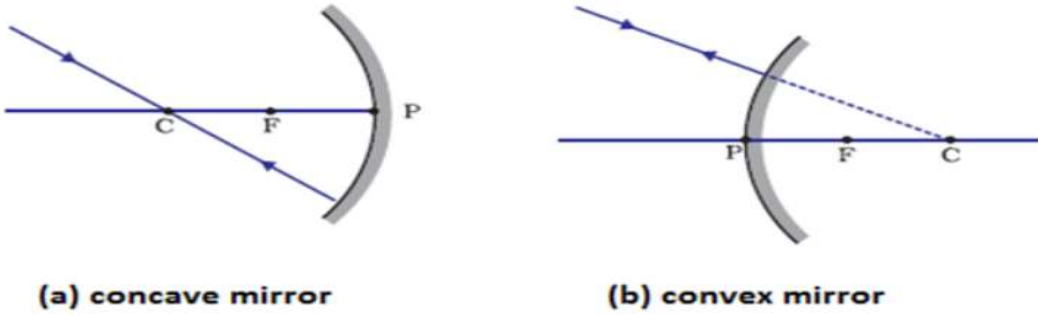
(a) concave mirror (b) convex mirror

- A ray passing through the focus of the concave mirror or directed towards the focus in case of convex mirror, should appear parallel to the principal axis after reflection.



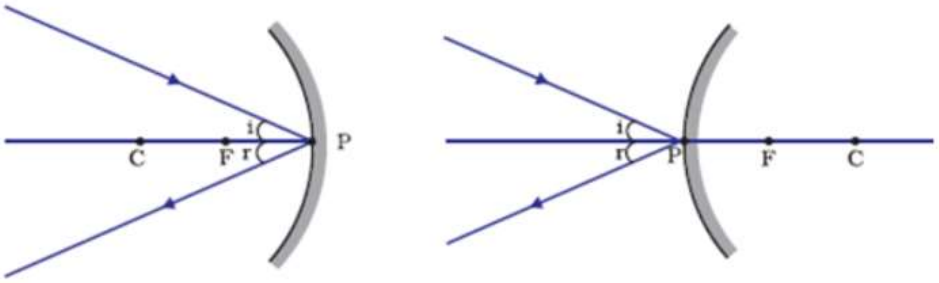
(a) concave mirror (b) convex mirror

- A ray which is passing through the centre of curvature in a concave mirror or directed in case of convex mirror, should reflect along the same path.



(a) concave mirror (b) convex mirror

- A ray when incident obliquely to principal axis on a concave or convex mirror is also reflected obliquely.



(a) concave mirror (b) convex mirror

Image formation by Concave Mirror

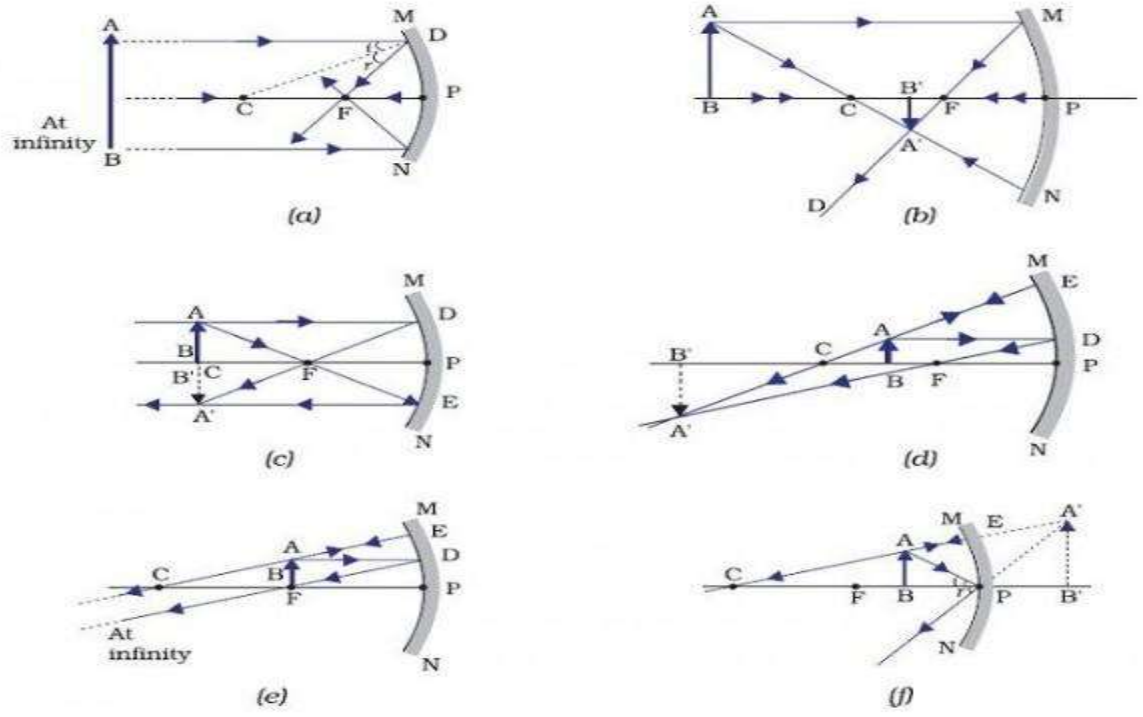


Fig. 3. Ray diagram for the image formation by concave mirror

Position of the object	Position of the image	Size of the image	Nature of the image
At infinity	At the focus F	Highly diminished	Real and inverted
Beyond C	Between F and C	Diminished	Real and inverted
At C	At C	Same size	Real and inverted
Between C and F	Beyond C	Enlarged	Real and inverted
At F	At infinity	Highly enlarged	Real and inverted
Between P and F	Behind the mirror	Enlarged	Virtual and erect

Table.1. Nature, relative size and position of the image formed by concave mirror

Position, nature, and the size of the image formed by a concave mirror is dependent on the position of the object in relation to P, C and F. Image formed can be real or virtual. The image can also be magnified, diminished or even of the same size.

Uses of Concave Mirror

Used in search lights, torches, head lights of the vehicles. Also used in shaving mirrors. Used by dentists also to see larger image of the teeth. Other use in solar furnaces.

Image formation by Convex Mirror

Two positions of the object are considered while understanding the image formed by convex mirror. Either the object should be at infinity or at finite distance from the mirror. Formation of the image by the convex mirror are as follows-

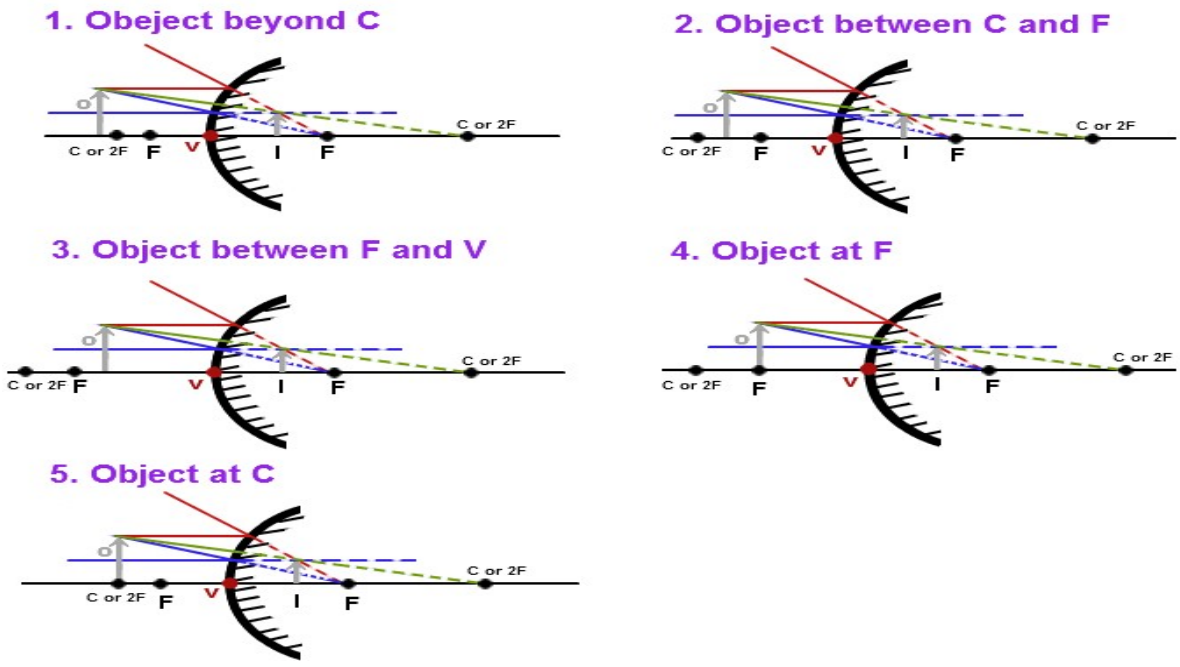


Fig. 5. Ray diagram for the image formation by convex mirror

Position of the object	Position of the image	Size of the image	Nature of the image
At infinity	At the focus F, behind the mirror	Highly diminished	Virtual and erect
Between infinity and the pole P of the mirror	Between P and F, behind the mirror	Diminished	Virtual and erect

Table.2. Nature, relative size and position of the image formed by convex mirror

Uses of Convex Mirror

They are used as rear-view mirrors. They are used to see the traffic behind. They are preferred as they give erect but diminished image.

Sign convention for reflection by spherical mirrors

New cartesian sign convention is used to give sign convention used for spherical mirrors. The conventions are as follows-

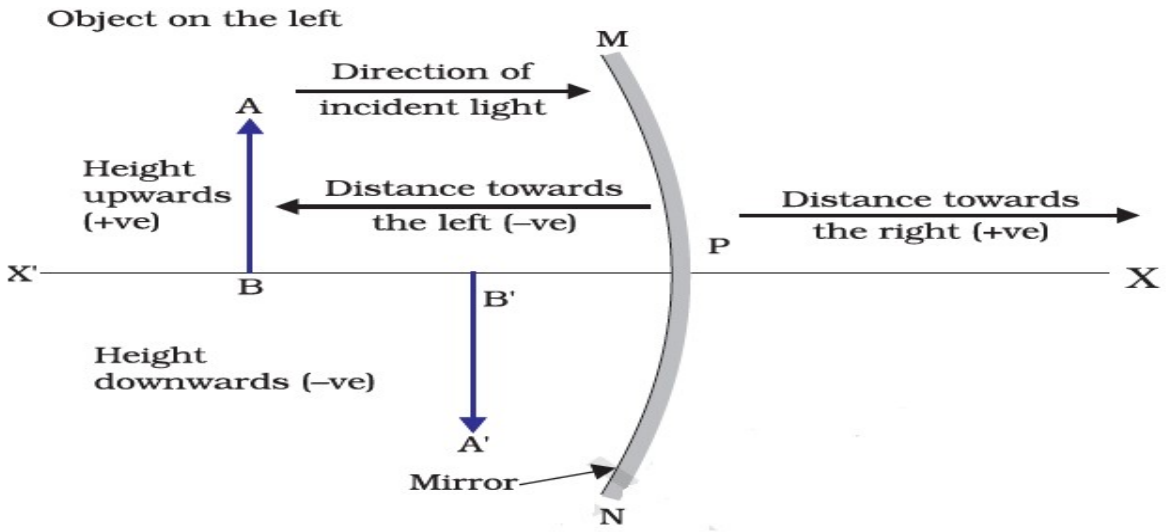
1. The object is always placed to the left of the mirror.

2. All distances parallel to the principal axis are measured from the pole of the mirror.

3. All the distances measured to the right of the origin (along + x-axis) are taken as positive while those measured to the left of the origin (along – x-axis) are taken as negative.

4. Distances measured perpendicular to and above the principal axis (along + y-axis) will be taken as positive.

5. Distances measured perpendicular to and below the principal axis (along –y-axis) will be taken as negative.



Mirror formula and magnification

The distance of the object from its pole is known as object distance (u), whereas distance from the pole of the mirror is known as image distance (v). The mirror formula is given by-

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

It is applicable for spherical mirrors in all positions of the object.

Magnification

It is defined as relative extent to which an object is magnified in comparison to its object size.

$$m = \frac{h_i}{h_o} = -\frac{v}{u}$$

Where m is the magnification, h_o is the height of the object and h_i is the height of the image. However, it is to be taken as negative for real images. A negative sign in the value of magnification indicates that the nature of the image is real. A positive sign in the value of the magnification indicates the virtual nature of the image.

Refraction of light

Bending of the light rays as it passes from one medium to another medium is known as refraction of light.

Laws of Refraction

- Incident ray, refracted ray and normal all lie in the same plane.
- The ratio of sine of angle of incidence to the sine of angle of refraction is constant. This law is also known as Snell's law of refraction.

$$\frac{\sin i}{\sin r} = constant$$

Refractive Index

When light passes from one medium to another medium, it changes its direction. The extent to which the direction changes is expressed in terms of refractive index. The value of refractive index is dependent on the speed of light in two media. v_1 is the speed of light in medium 1 and v_2 is the speed of light in medium 2. The refractive index of medium 2 with respect to medium 1 is represented as n_{21}.

$$n_{21} = \frac{\text{Speed of light in medium 1}}{\text{Speed of light in medium 2}} = \frac{v_1}{v_2}$$

If medium 1 is vacuum or air, then the refractive index of medium 2 with respect to vacuum is known as absolute refractive index of the medium.

$$n_m = \frac{\text{Speed of light in air}}{\text{Speed of light in the medium}} = \frac{c}{v}$$

Where c is the speed of light in air, v is the speed of light in other medium and n_m is the refractive index of the medium.

Refraction by Spherical Lenses

Lenses are defined as transparent materials which are bounded by two surfaces, out of which one or both can be spherical. When both the two spherical surfaces bulge outwards, it is known as convex lens. They converge the light rays. When the two spherical surfaces bulge inwards, they are known as concave lens. They are known as diverging lens. The centre of these spherical surfaces is known as centre of curvature, represented by C.

Any imaginary straight line passing through the centre of curvature of a lens is known as principal axis. The centre point is known as optical centre. The effective diameter of the spherical lens is known as aperture.

Image formation by lenses

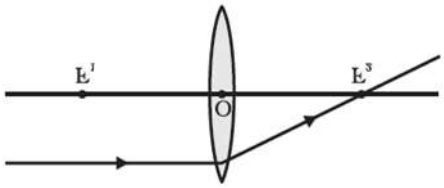
Nature, relative size, and position of the image formed by convex lens are given below in the form of table-

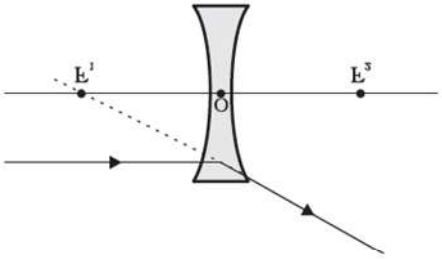
Position of the object	Position of the image	Relative size of the image	Nature of the image
At infinity	At focus F_2	Highly diminished	Real and inverted
Beyond $2F_1$	Between F_2 and $2F_2$	Diminished	Real and inverted
At $2F_1$	At $2F_2$	Same size	Real and inverted
Between F_1 and $2F_1$	Beyond $2F_2$	Enlarged	Real and inverted
At focus F_1	At infinity	Infinitely large	Real and inverted
Between focus F_1 and optical centre O	On the same side of the lens as the object	Enlarged	Virtual and erect

Image formation in Lenses using Ray Diagrams

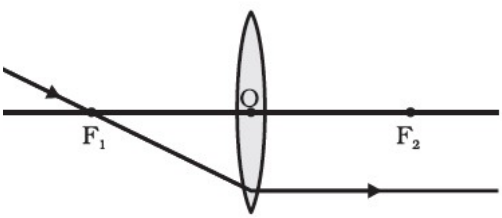
Rules for drawing the ray diagrams are as follows-

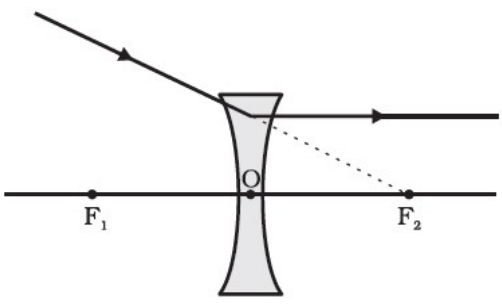
1. A ray of light which is parallel to the principal axis will pass through the principal focus after refraction from the convex lens.





2. A ray of light passing through principal focus, will emerge parallel to principal axis after refraction from the convex lens.





3. A light ray passing through optical centre will emerge out without any deviation.

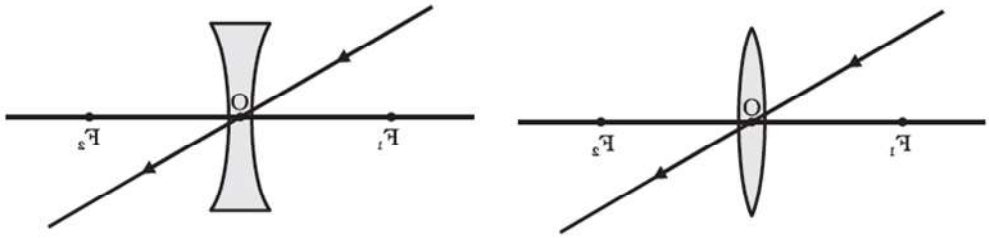


Image formed by the Convex Lens for various positions of the object

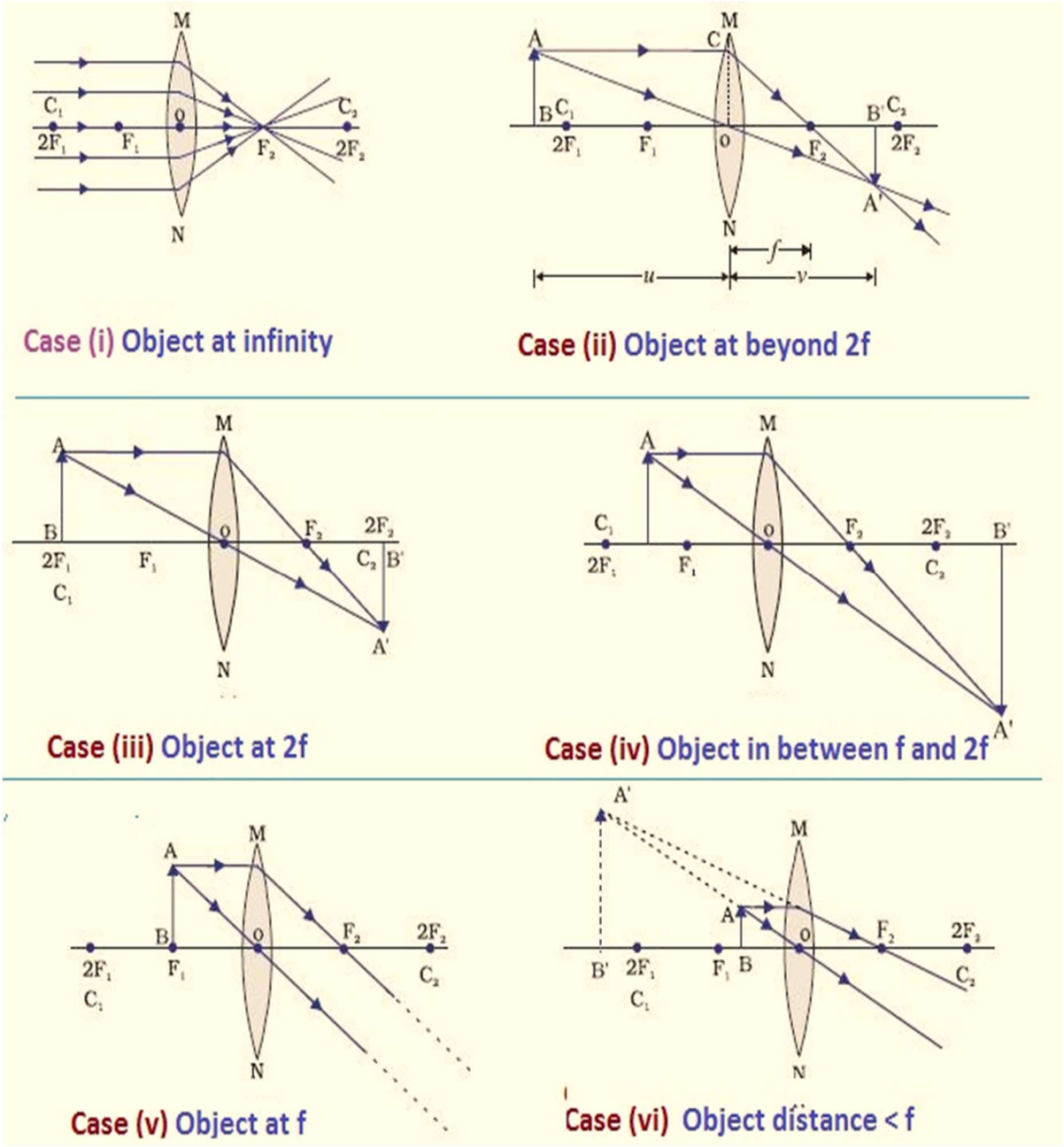
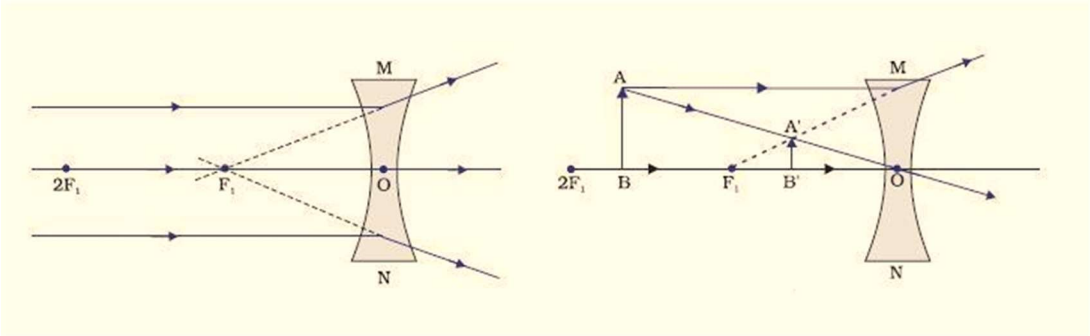


Image formed by the Concave Lens



Sign convention for Spherical Lenses

Sign convention are used as similar for spherical mirrors. But the focal length of a convex lens is positive and that of concave lens in negative.

Lens formula and magnification

The lens formula is given as

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

Where, u is object distance, v is image distance and f is focal length.

The ratio of the height of an image to the height of an object is defined as magnification.

Magnification is represented by m, h_0 is the height of the object and h_i is the height of the image.

$$m = \frac{h_i}{h_o} = \frac{v}{u}$$

Power of a Lens

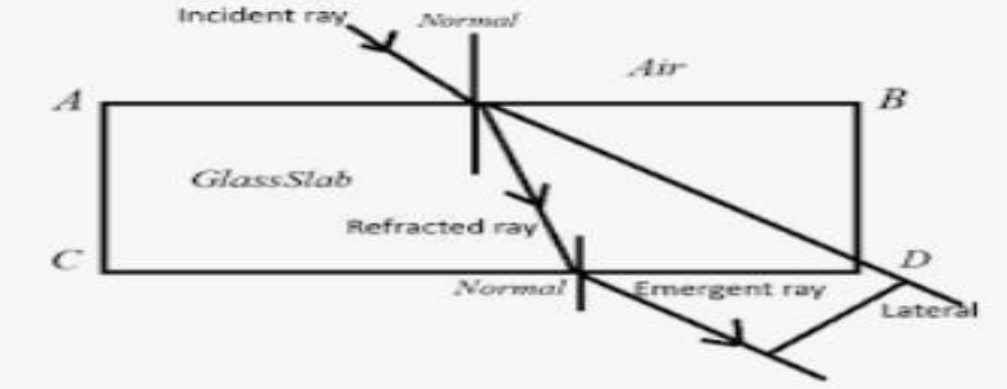
The degree of convergence or divergence of light rays is expressed in terms of power. So, the reciprocal of focal length is known as its power. It is represented by letter P. The power is given by-

P = 1/f

The SI unit of power is dioptre. It is represented by D. Power of concave lens is negative and power of convex lens is positive.

Refraction through a Rectangular Glass Slab

When light ray enters into a glass slab, then the emergent ray is parallel to the incident ray. This perpendicular distance between the emergent ray and incident ray when the light passes out of a glass slab is called lateral displacement.



i = angle of incidence, r = angle of refraction and e = angle of emergence

Angle of incidence = Angle of emergence, i.e. ∠ ∠i = e

Question 1. **The laws of reflection hold true for**

(a) plane mirrors only

(b) concave mirrors only

(c) convex mirrors only

(d) all reflecting surface

Answer:

(d) The laws of reflection hold true for all reflecting surface.

Question 2. List four characteristics of the images formed by plane mirrors.

Answer:

Characteristics of the image formed by a plane mirror are

(i) image distance is same as that of object distance

(ii) image formed is virtual and erect

(iii) image formed is of the same size as that of the object

(iv) image formed is laterally inverted (left appears right and right appears left).

Question 3. State the two laws of reflection of light.

Answer:

Laws of reflection of light states that

(i) The angle of incidence is equal to the angle of reflection.

(ii) The incident ray, the reflected ray and the normal to the mirror at the point of incidence all lie in the same plane.

Question 4. When an object is kept within the focus of a concave mirror, an enlarged image is formed behind the mirror. This image is

(a) real

(b) inverted

(c) virtual and inverted

(d) virtual and erect

Answer:

(d) When an object is placed between the principal focus and pole of a concave mirror, an

enlarged virtual and erect image is formed behind the mirror.

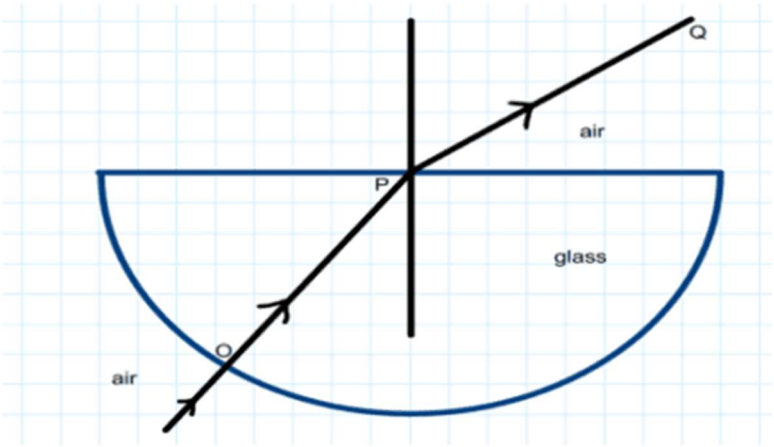
Question 5. What is the magnification of the images formed by plane mirrors and why?

Answer:

Magnification of images formed by plane mirrors is unity because for plane mirrors, the size of the image formed is equal to that of the object.

Question 6

The angle of incidence from air to glass at point O on the hemispherical glass slab is _____.



a. 45°

b. 0°

c. 90°

d. 180°

Ans. Option (b)

Question 7 Rays from the sun converge at a point 15 cm in front of a concave mirror. Where should an object be placed so that the size of its image is equal to the size of the object?

a. 30 cm in front of the mirror

b. 15 cm in front of the mirror

c. Between 15 cm and 30 cm in front of the mirror

d. More than 30 cm in front of the mirror

Ans. Option (a) [Sun rays converge at 15 cm means the focal length is 15 cm. So image is placed at 2f = 2 x 15 = 30 cm]

The following questions consist of two statements – Assertion (A) and Reason (R). Answer these questions by selecting the appropriate options given below:

Question 8 Assertion (A): Refractive index has no units.

Reason (R): The refractive index is the ratio of two similar quantities.

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

b. Both A and R are true and R is not the correct explanation of A.

c. A is true but R is false.

d. A is false but R is true.

Ans. Option (a)

Question 9 Assertion (A): A convex mirror is used as a rearview/driver's mirror.

Reason (R): Convex mirrors have a wider field of view as they are curved outwards. They also give an erect, though the diminished image.

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

b. Both A and R are true and R is not the correct explanation of A.

c. A is true but R is false.

d. A is false but R is true.

Ans. Option (a)

Question 10 Rohit wants to have an erect image of an object using a converging mirror of focal length 40 cm.

a. Specify the range of distance where the object can be placed in front of the mirror. Justify.

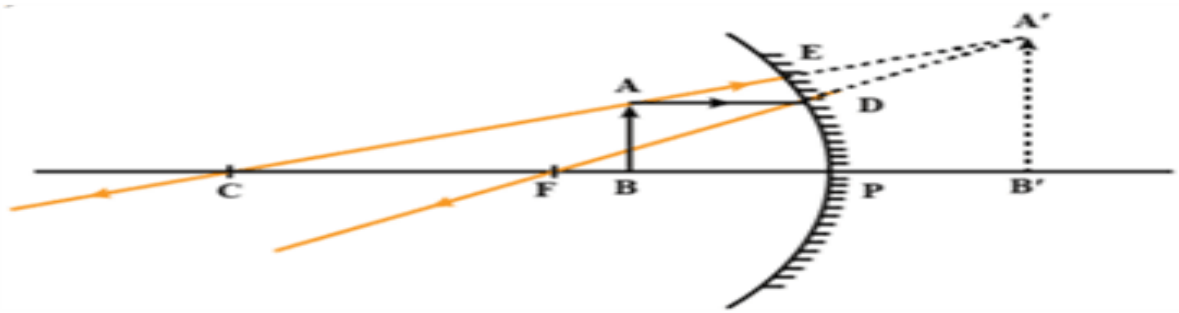
b. Will the image be smaller or larger than the object? Draw a ray diagram to show the image formation in this case.

c. Where will the image of this object be, if it is placed 80 cm in front of the mirror?

d. State one use of the mirror based on the above kind of image formation.

Ans. a. The object has to be placed at a distance between 0-40 cm. This is because when the object is placed between F and P, the image formed is virtual, erect, and magnified.

b. Image will be larger than the object.



c. The image will be formed at C.

d. Uses of a concave (converging) mirror:

- Used as a shaving mirror.
- Used by dentists to get an enlarged image of teeth.
- Used in solar furnaces to concentrate sunlight.
- Used in torches, searchlights, and vehicle headlights to get powerful parallel beams of light.

Question 11 The image of an object formed by a mirror is real, inverted, and is of magnification -1. If the image is at a distance of 30 cm from the mirror, where is the object placed? Find the position of the image if the object is now moved 20 cm toward the mirror. What is the nature of the image obtained? Justify your answer with the help of a ray diagram.

Ans.

$$m = -\frac{v}{u}$$
$$\Rightarrow -1 = \frac{-(-30)}{u}$$
$$\Rightarrow u = -30 \text{ cm}$$

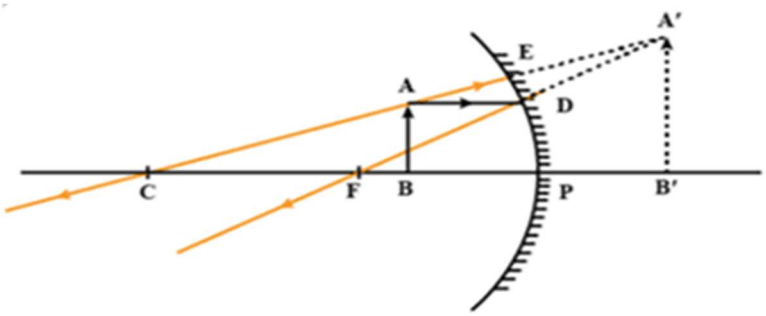
Using mirror formula: u = -30 cm, v = -30 cm

$$\frac{1}{f} = \frac{1}{v} + \frac{1}{u}$$
$$\Rightarrow \frac{1}{f} = \frac{1}{-30} + \frac{1}{-30}$$
$$\Rightarrow f = -15 \text{ cm}$$

Using mirror formula: u' = -10 cm, f = -15 cm

$$\frac{1}{f} = \frac{1}{v} + \frac{1}{u}$$
$$\Rightarrow \frac{1}{-15} = \frac{1}{v} + \frac{1}{-10}$$
$$\Rightarrow v = 30 \text{ cm}$$

Nature of image: Virtual, erect, and magnified.



Question 12 Write the laws of refraction of light. Explain the same with the help of a ray diagram, when a ray of light passes through a rectangular glass slab.

Or,

Why does a light ray incident on a rectangular glass slab immersed in any medium emerges parallel to itself? Explain using a diagram.

Ans. Laws of refraction of light:

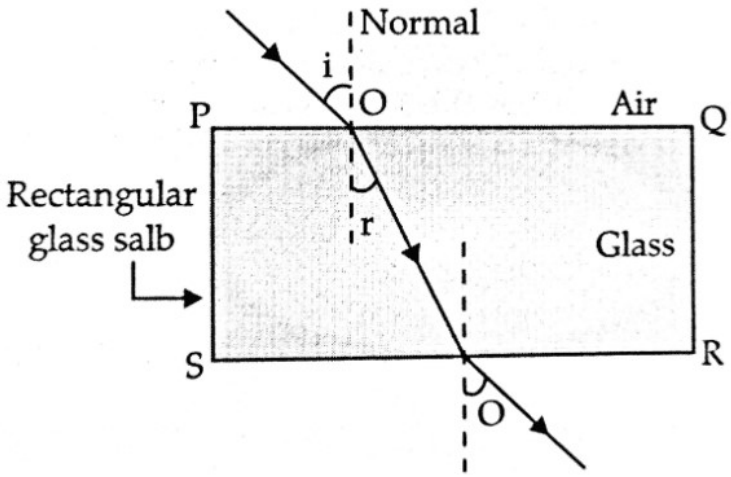
- i. The incident ray, the refracted ray, and the normal to the interface of two transparent media at the point of incidence, all lie in the same plane.
- ii. The ratio of the sine of the angle of incidence to the sine of the angle of refraction is a constant, for the light of a given color and for the given pair of media. This law is also known as Snell's law of refraction. (This is true for angle $0° < i < 90°$)

If i is the angle of incidence and r is the angle of refraction, then,

$\frac{\sin i}{\sin r}$ = constant

This constant value is called the refractive index of the second medium with respect to the first.

Refraction of light through a rectangular glass slab:



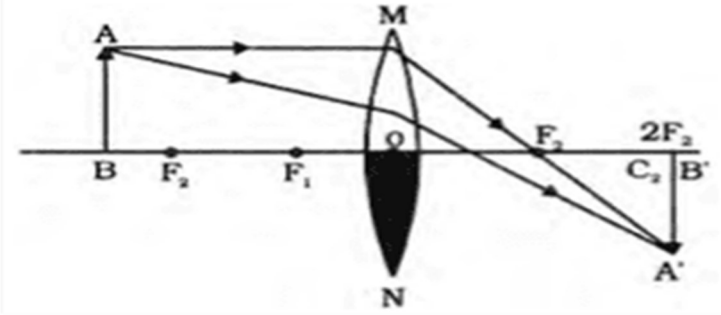
In a rectangular glass slab, the emergent rays are parallel to the incident ray because the extent of bending of the ray of light at the opposite parallel faces of the rectangular glass slab are equal and opposite, so the emergent ray is parallel to the incident ray.

Question 13

i. One half of a convex lens of focal length 10 cm is covered with black paper. Can such a lens produce an image of a complete object placed at a distance of 30 cm from the lens? Draw a ray diagram to justify your answer.

ii. A 5 cm tall object is placed on the principal axis of a convex lens of focal length 50 cm at a distance of 40 cm from it. Find the nature, position, and size of the image.

Ans. i. Yes, the lens will produce a complete image of the object but the brightness/intensity of the image will be less.



ii.

u= -40 cm, f= 50 cm, h= 5cm, v=?, h' =?

Using lens formula,

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

$$\Rightarrow \frac{1}{v} = \frac{1}{f} + \frac{1}{u} = \frac{1}{50} + \frac{1}{-40} = \frac{4-5}{200} = \frac{-1}{200}$$

$\Rightarrow$ v = -200 cm

Nature of image is virtual, erect and magnified (As object is placed at 40 cm i.e., within focus)

Now,

$$m = \frac{v}{u} = \frac{h'}{h}$$

$$\Rightarrow \frac{-200}{-40} = \frac{h'}{5}$$

$\Rightarrow$ h' = 25 cm

Question 14 Define the power of a lens. What is its unit? One student uses a lens of a focal length of 50 cm and another of -50 cm. What is the nature of the lens and its power used by each of them?

Ans. The power of a lens is defined as the reciprocal of its focal length.

$P = {}^{1}/_{f\ (\text{in m})} = {}^{100}/_{f\ (\text{in cm})}$

Unit of power is dioptre (D).

The lens is convex in the first case and concave in the second case.

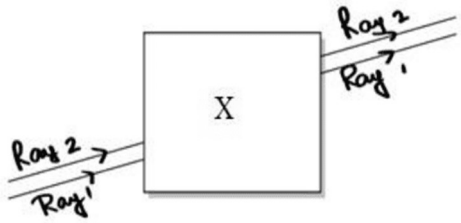
$P_1 = {}^{100}/_{50} = 2$ D

$P_2 = {}^{100}/_{(-50)} = -2$ D

Case-Based Questions

Question 15

Noor, a young student, was trying to demonstrate some properties of light in her science project work. She kept 'X' inside the box (as shown in the figure) and with the help of a laser pointer made light rays pass through the holes on one side of the box. She had a small butter paper screen to see the spots of light being cast as they emerged.



16.1. What could be the 'X' that she placed inside the box to make the rays behave as shown?

a. converging lens

b. parallel-sided glass block

c. plane mirror

d. triangular prism

Ans. Option (b)

16.2. She measured the angles of incidence for both the rays on the left side of the box to be 48.6°. She knew the refractive index of the material 'X' inside the box was 1.5. What will be the approximate value of the angle of refraction?

a. 45° b. 40° c. 30° d. 60°

(Use the value sin 48.6° = 0.75)

Ans. Option (c).

[Refractive index = sin i/ sin r

$\Rightarrow 1.5 = \sin 48.6°/\sin r$

$\Rightarrow 1.5 = 0.75/\sin r$

$\Rightarrow \sin r = 0.75/1.5 = ½ = \sin 30$

$\Rightarrow r = 30$ Degree

16.3. Her friend noted the following observations from this demonstration:

1. Glass is optically rarer than air.
2. Air and glass allow light to pass through them with the same velocity.
3. Air is optically rarer than glass.
4. The speed of light through a denser medium is faster than that of a rarer medium.
5. The ratio of the sin of the angle of incidence in the first medium to the ratio of the sin of the angle of refraction in the second medium gives the refractive index of the second material with respect to the first one.

Which one of the following combinations of the above statements given below is correct?

a. II, IV, and V are correct. b. III and IV are correct.

c. I, IV, and V are correct. d. III and V are correct.

Ans. Option (d)

16.4. If the object inside the box was made of a material with a refractive index less than 1.5 then the

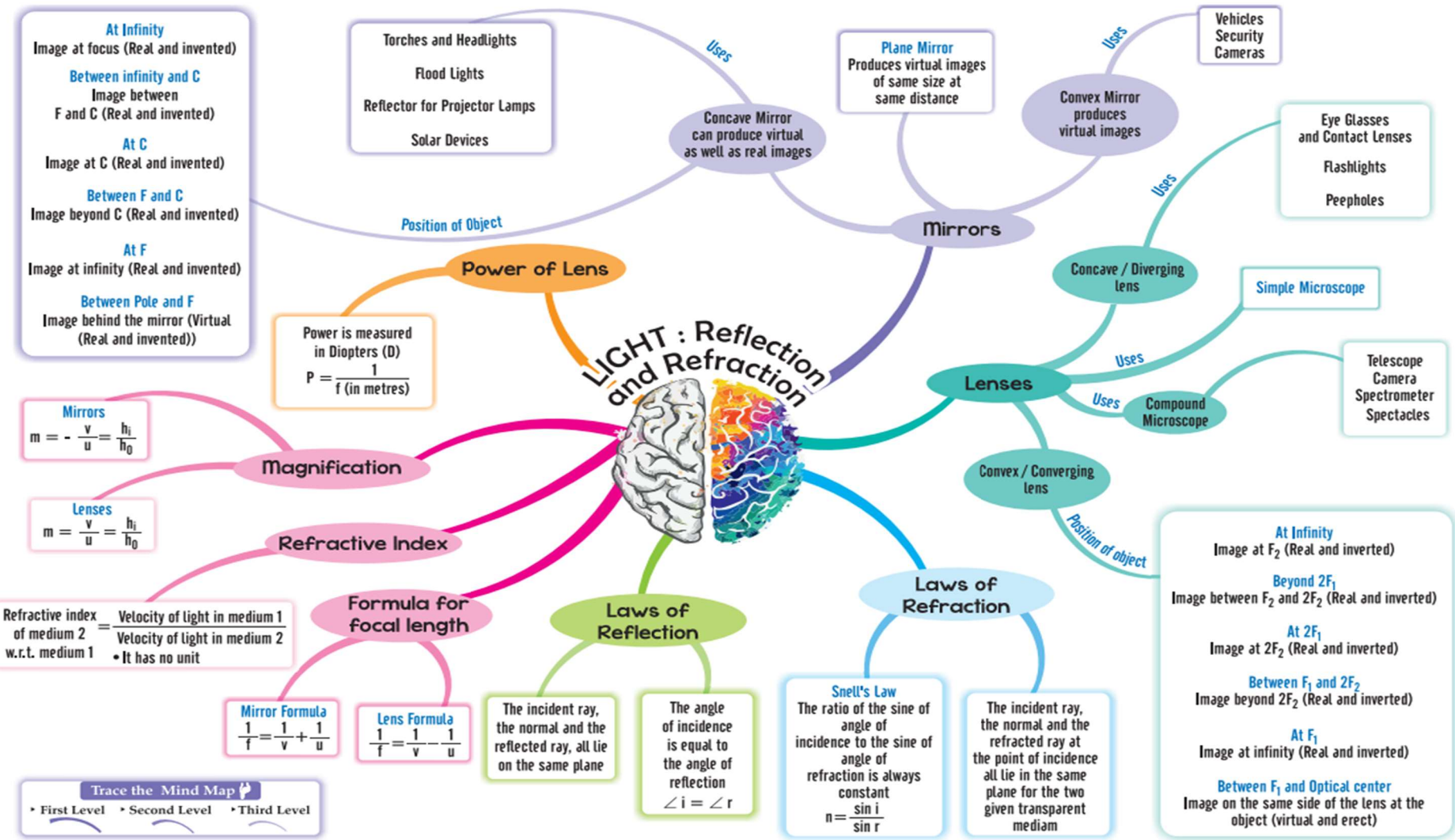
a. Lateral shift of the rays would have been less

b. Lateral shift of the rays would have been more

c. Lateral shift of the rays would remain the same as before

d. There is not enough information to comment on any of the above statements

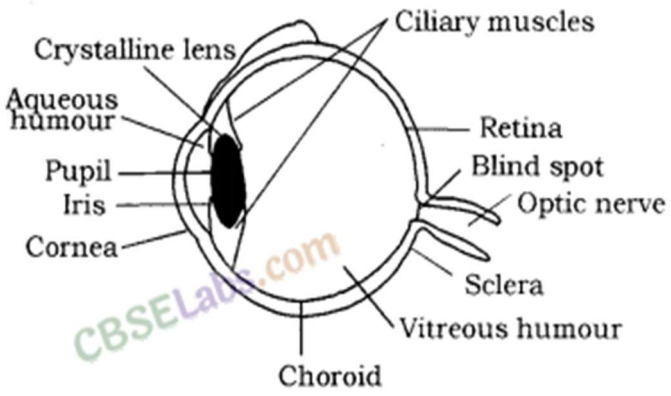
Ans. Option (a)


LIGHT : Reflection and Refraction
Mirrors
Concave Mirror can produce virtual as well as real images
Uses
Torches and Headlights
Flood Lights
Reflector for Projector Lamps
Solar Devices
Position of Object
At Infinity
Image at focus (Real and invented)
Between infinity and C
Image between F and C (Real and invented)
At C
Image at C (Real and invented)
Between F and C
Image beyond C (Real and invented)
At F
Image at infinity (Real and invented)
Between Pole and F
Image behind the mirror (Virtual (Real and invented))
Plane Mirror
Produces virtual images of same size at same distance
Convex Mirror produces virtual images
Uses
Vehicles
Security Cameras
Lenses
Concave / Diverging lens
Uses
Eye Glasses and Contact Lenses
Flashlights
Peepholes
Simple Microscope
Compound Microscope
Telescope
Camera
Spectrometer
Spectacles
Convex / Converging lens
Position of object
At Infinity
Image at F_2 (Real and inverted)
Beyond $2F_1$
Image between F_2 and $2F_2$ (Real and inverted)
At $2F_1$
Image at $2F_2$ (Real and inverted)
Between F_1 and $2F_2$
Image beyond $2F_2$ (Real and inverted)
At F_1
Image at infinity (Real and inverted)
Between F_1 and Optical center
Image on the same side of the lens at the object (virtual and erect)
Power of Lens
Power is measured in Diopters (D)
$P = \frac{1}{f \text{ (in metres)}}$
Magnification
Mirrors
$m = -\frac{v}{u} = \frac{h_i}{h_0}$
Lenses
$m = \frac{v}{u} = \frac{h_i}{h_0}$
Refractive Index
Refractive index of medium 2 w.r.t. medium 1 $= \frac{\text{Velocity of light in medium 1}}{\text{Velocity of light in medium 2}}$
• It has no unit
Formula for focal length
Mirror Formula
$\frac{1}{f} = \frac{1}{v} + \frac{1}{u}$
Lens Formula
$\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$
Laws of Reflection
The incident ray, the normal and the reflected ray, all lie on the same plane
The angle of incidence is equal to the angle of reflection
$\angle i = \angle r$
Laws of Refraction
Snell's Law
The ratio of the sine of angle of incidence to the sine of angle of refraction is always constant
$n = \frac{\sin i}{\sin r}$
The incident ray, the normal and the refracted ray at the point of incidence all lie in the same plane for the two given transparent mediam
Trace the Mind Map
First Level
Second Level
Third Level

II. Human Eye and Colourful World

Human Eye

- It is one of the sensitive sense organs present in living organisms. It acts like a **Camera**.
- The image is formed on light sensitive screen known as **Retina**.
- Thin membrane through which light enters the eye is known as **Cornea**.
- The eyeball is spherical in shape.
- Presence of the crystalline lens helps in adjusting objects at different distances on the retina.
- The dark muscular structure that controls the size of the pupil is known as **Iris**. Thus, pupil regulates the amount of light entering the eye.
- Real, inverted image is formed on the retina. Retina contain light sensitive cells known as **Rods and Cons**. The light sensitive cells send signals to the brain via optic nerve.



Power of Accommodation

Focal lens of the eye lens can be decreased or increased. The lens become thin when the muscles are relaxed. This increases the focal length. This helps to see the distant objects. Similarly, when the eye lens become thick, focal length decreases and we are able to see nearby objects.

So, power of accommodation is defined as ability of the lens to adjust the focal length.

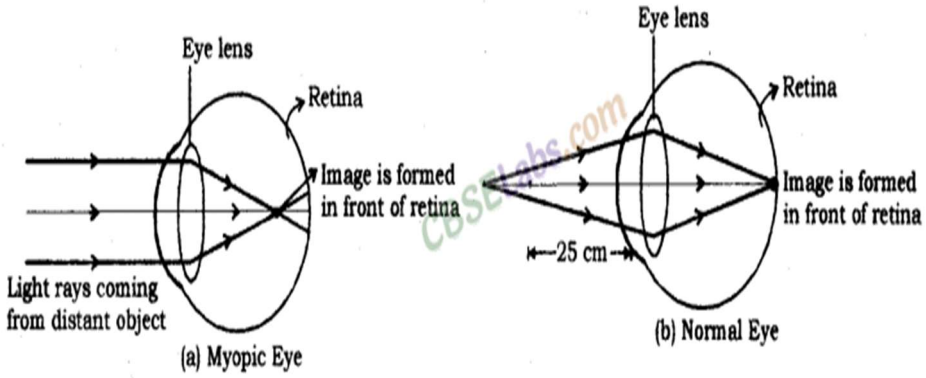
- The minimum distance at which the particular object can be seen clearly is known as least distance of distinct vision. This is also called **Near Point of the Eye**. For young individuals, near point is about 25 cm. The farthest point to which an object can be seen is known as **Far Point of the Eye**. This is about 25 cm to infinity.

- In old age people, the lens becomes milky and cloudy, this is known as **Cataract**. This can leads to complete or partial loss of vision.

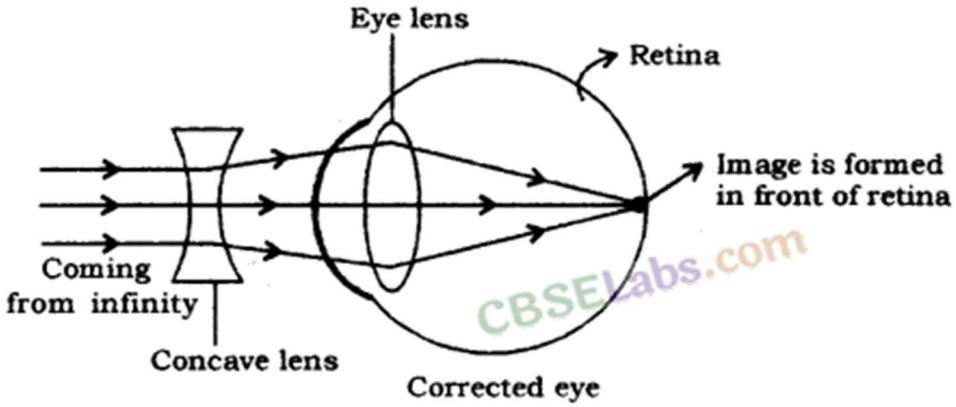
Defects of the Vision and their Correction

The three common defects of vision are as follows-

- **Myopia (also known as Near Sightedness)**. In this case, distant objects cannot be seen clearly but nearby objects are clearly visible. Image is not formed on the retina, instead it is formed in front of the retina. Using concave lens of suitable power can be used to correct this defect.



Correction: Since a concave lens has an ability to diverge incoming rays, it is used to correct this defect of vision. The image is allowed to format the retina by using a concave lens of suitable power as shown in the given figure.



- **Hypermetropia** also known as **Far-sightedness**. Nearby objects are not seen clearly whereas distant objects can be seen clearly. Image is formed behind the retina instead on the retina. Convex lens of appropriate power can be used to correct this defect.

Correction: Since a convex lens has the ability to converge incoming rays, it can be used to correct this defect of vision, as you already have seen in the animation. The ray diagram for the corrective measure for a hypermetropic eye is shown in the given figure.

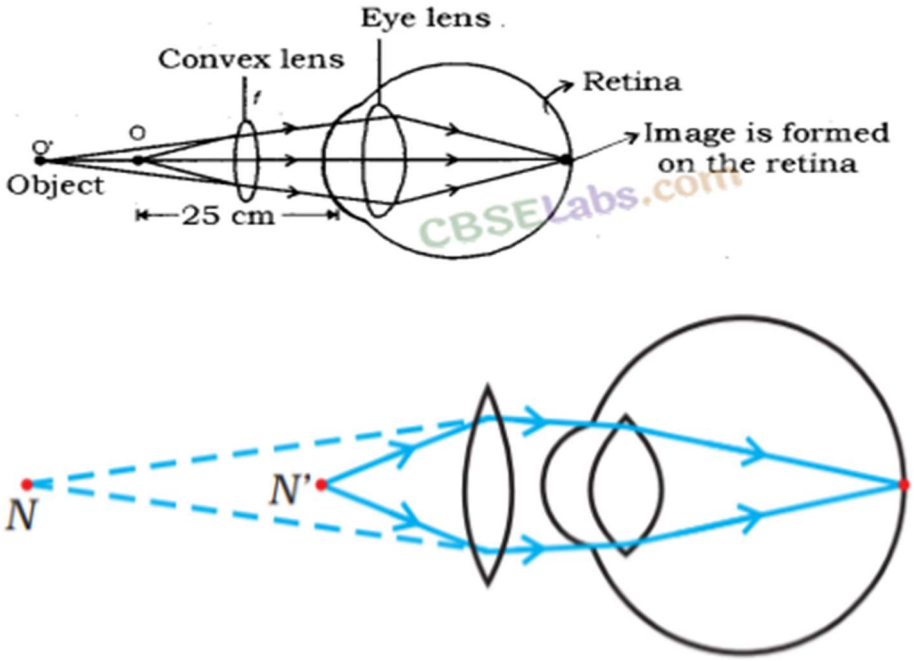


Fig.2. Correction of Hypermetropia

- **Presbyopia:** It is a kind of defect in human eye which occurs due to ageing. It happens due to the following reasons
  (i) decrease in flexibility of eye lens.
  (ii) gradual weakening of ciliary muscles.
  In this, a person may suffer from both myopia and hypermetropia.
- **Correction:** By using a bifocal lens with appropriate power. Bifocal lenses consist of both concave and convex lens, upper position consists of the concave lens and lower portion consists of a convex lens.
- **Astigmatism:** It is a kind of defect in human eye due to which a person cannot see (focus) simultaneously horizontal and vertical lines both.
- **Correction:** By using a cylindrical lens.
- **Cataract:** Due to the membrane growth over eye lens, the eye lens becomes hazy or even opaque. This leads to a decrease or loss of vision. This problem is called a cataract. It can be corrected only by surgery.

Dispersion of White Light by Glass Prism

When light falls on the prism it splits the incident light into band of colours. The sequence of colours observed are VIBGYOR (Violet, Indigo, Blue, Green, Yellow, Orange and Red). This band of colour is known as **Spectrum**. So, this splitting of incident light into different colours is known as **Dispersion**. This splitting is due to bending of light rays at different angles. Violet light bends most whereas red light bends least. The phenomenon of rainbow is also due to dispersion of light.

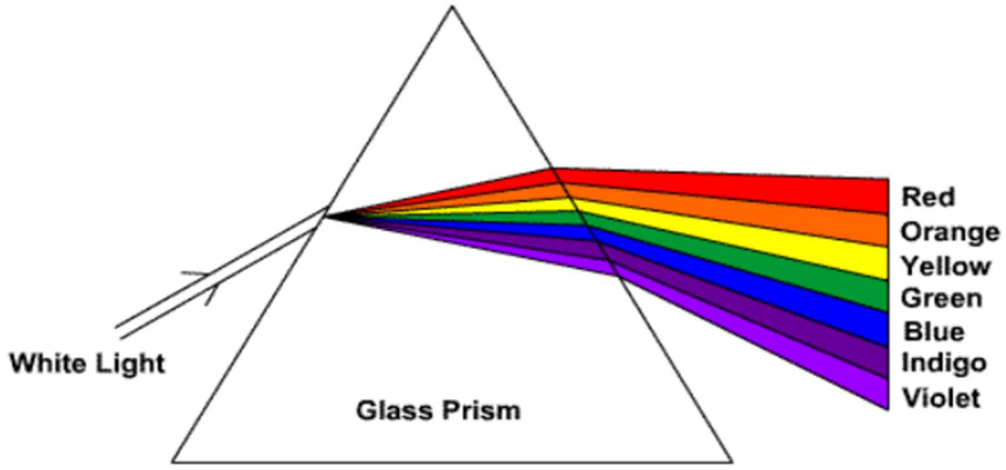


Fig.3. Dispersion of White Light through Prism

The band of these seven colours formed because of dispersion of light is known as **Spectrum**.

Total Internal Reflection

When a light passes from denser to rarer medium and angle of incidence is greater than critical angle, the light will reflect in the denser medium. This is known as **Total Internal Reflection**.

Condition for Total Internal Reflection

- Light should pass from denser to rarer medium
- Angle of incidence should be greater than the critical angle.

Critical angle is defined as angle of incidence for which angle of refraction is 90 degrees

Power of the correcting convex lens:
The Lens formula, $1/v - 1/u = 1/f$ can be used to calculate the focal length and hence, the power of the myopia correcting lens.
In this case,
Object distance, u = ∞
Image distance, v =
person's far point Focal length, f =?

Hence, lens formula becomes

$$\frac{1}{\text{far point}} - \frac{1}{\infty} = \frac{1}{\text{focal length}}$$

$$\frac{1}{\text{far point}} - 0 = \frac{1}{\text{focal length}}$$

In case of a concave lens, the image is formed in front of the lens i.e., on the same side of the object.
Focal length = -Far point
Now, power of the required lens (P) = 1/f (in m)

Presbyopia: It is a kind of defect in human eye which occurs due to ageing. It happens due to the following reasons
(i) decrease in flexibility of eye lens.
(ii) gradual weakening of ciliary muscles.
In this, a person may suffer from both myopia and hypermetropia.

Correction: By using a bifocal lens with appropriate power. Bifocal lenses consist of both concave and convex lens, upper position consists of the concave lens and lower portion consists of a convex lens.

Astigmatism: It is a kind of defect in human eye due to which a person cannot see (focus) simultaneously horizontal and vertical lines both.

Correction: By using a cylindrical lens.

Cataract: Due to the membrane growth over eye lens, the eye lens becomes hazy or even opaque. This leads to a decrease or loss of vision. This problem is called a cataract. It can be corrected only by surgery

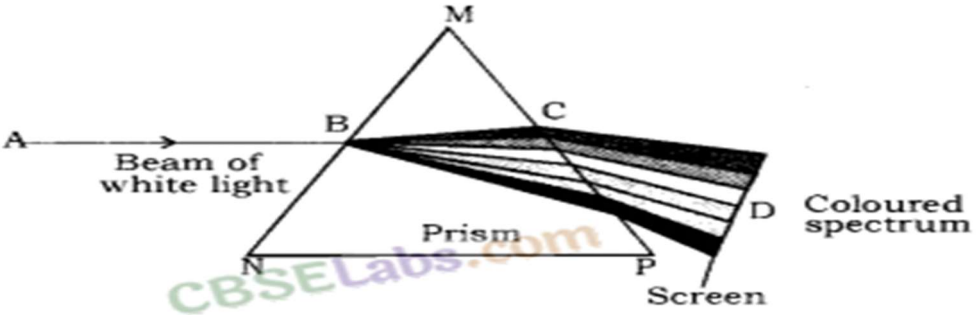
Refraction of light through a prism: When a ray of light is incident on a rectangular glass slab, after refracting through the slab, it gets displaced laterally. As a result, the emergent ray comes out parallel to the incident ray. Unlike a rectangular slab, the side of a glass prism are inclined at an angle called the angle of prism.

Prism: A prism has two triangular bases and three

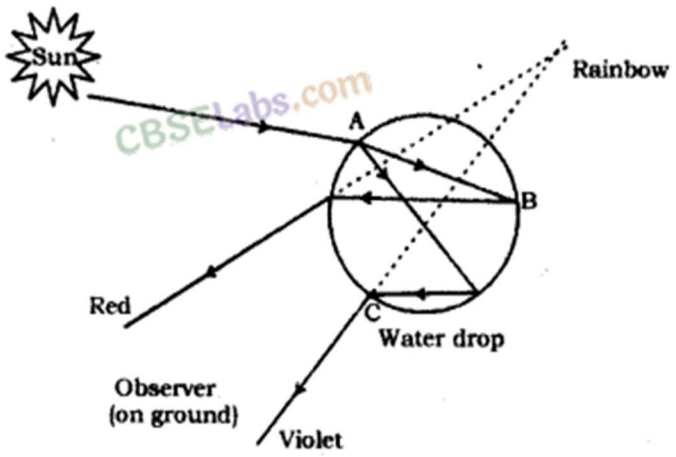
Angle of Prism: Angle between two lateral faces is

Angle of Deviation: The angle between the incident deviation.

Dispersion of white light by a glass prism: The phenomenon of splitting of white light into its seven constituent colours when it passes through a glass prism is called dispersion of white light. The various colours seen are Violet, Indigo, Blue, Green, Yellow, Orange and Red. The sequence of colours remembers as VIBGYOR. The band of seven colours is called the spectrum. The different component colour of light bends at a different angle with respect to the incident angle. The violet light bends the least while the red bends most.



Formation of the rainbow: The water droplets act like small prism. They refract and disperse the incident sunlight, then reflect it internally, and finally refract it again when it comes out of the raindrop. Due to the dispersion of light and internal reflection, different colours reach the observer's eye.
Red colour appears on top and violet at the bottom of rainbow.
A rainbow is always formed in a direction opposite to that of Sun.
At 'A' – Refraction and dispersion take place.
At 'B' – Internal reflection takes place.
At 'C' – Refraction and dispersion take place.



Atmospheric Refraction

Twinkling of Stars

When star light enters the atmosphere, it undergoes refraction. Due to this refractive index changes as the light bends towards the normal. The apparent position of the stars appears slightly different from the actual position. Since the physical conditions of the earth's atmosphere are not stationary, the apparent positions of stars keep on changing. That is why they appear to twinkle.

Why planets do not twinkle?

Planets are closer to earth and are seen as extended source of light i.e. the collection of large number of point sized sources of light. Therefore, the total amount of light entering our eyes from all individual point source will nullify the twinkling effect.

Why, the duration of day becomes approximately 4 minutes shorter if there is no atmosphere on earth:

Actual sun rise happens when it is below the horizon in the morning. The rays of light from the sun below the horizon reach our eyes because of refraction of light. Similarly, the sun can be seen about few minutes after the actual sun set. Thus, the duration of, day time will increase by 4 minutes.
This is due to atmospheric refraction. Because of this sun is visible about 2 minutes earlier than actual sunrise and about 2 minutes after the actual sun set.

Advance Sunlight and Delayed Sunset

The sun is visible 2 minutes before the actual sunrise or sunset appears 2 minutes after the actual sunset has taken place is due to atmospheric refraction.

Tyndall Effect

When beam of light strikes tiny water droplets, suspended particles of dust etc. (called as **Colloidal Particles**), the path of the beam becomes visible. This is known as **Tyndall Effect**. The colour of scattered light depends upon the size of colloidal particles. Very fine particles scatter mainly blue light while particles of larger size scatter light of longer wavelengths.

Why sky appears blue in colour?

The colour of the sky appears blue due to scattering of light. When the sunlight passes through the atmosphere, fine particles in air will scatter the blue colour more strongly than red.

Why sky appears red in colour during sunrise and sunset?

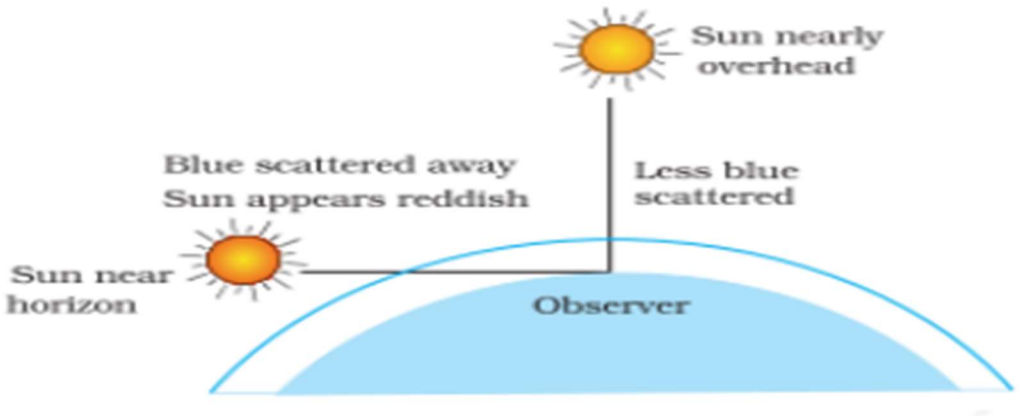
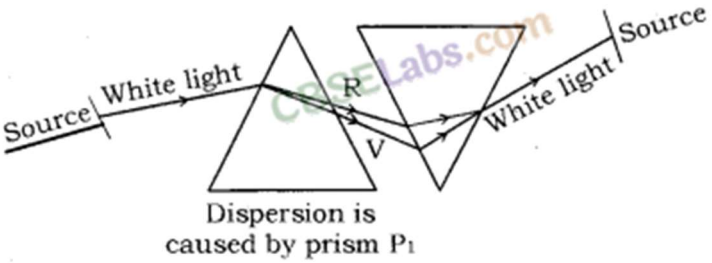


Fig.4. Reddening of Sun at rise and set

During sunrise and sunset, light from the Sun near the horizon passes through thicker layers of air and larger distance in the earth's atmosphere before reaching our eyes. Light from the Sun overhead would travel relatively shorter distance, resulting in white appearance of sun. Near the horizon, most of the blue light and shorter wavelengths are scattered away by the particles. Therefore, the light that reaches our eyes is of longer wavelengths, hence the reddish appearance.

Issac Newton: He was the first, who obtained spectrum of sunlight by using glass prism. He tried to split the spectrum of white light more by using another similar prism, but he could not get any more colours.
He repeated the experiment using second prism in inverted position with respect to the first prism. It allowed all the colours of spectrum to pass through second prism. He found white light emerges on the other side of second prism.



Dispersion is caused by prism P_1

He concluded that Sun is made up of seven visible colour VIBGYOR.

VSA QUESTIONS

Question 1.
State one function of iris in human eye.
Answer: Function of iris: Iris regulates the amount of light entering the eye by adjusting the size of the pupil.

Question 2.
State one function of pupil in human eye.
Answer: The amount of light entering the eye can be controlled by the pupil. If the intensity of outside light is low, then the pupil expands to allow more light to enter the eye. On the other hand, if outside intensity of light is high, then the pupil contracts so that less light enters the eye.

Question 3.
State one role of ciliary muscles in the human eye.
Answer: The focal length of eye-lens can be changed by changing its shape by the action of ciliary muscles.

Question 4.
The sky appears dark instead of blue to an astronaut. State its reason.
Answer: There is no atmosphere containing air in space to scatter sunlight. As there is no scattering of light in space, the scattered light does not reach the eyes and the sky appears dark instead of blue to an astronaut in outer space.

SA QUESTIONS

Question 5.
Name the type of particles which act as prisms in the formation of rainbow in the sky.
Answer: The rain drops in the atmosphere act like many small prisms. As white sunlight enters and leaves these rain drops, the white light splits into an arch of seven colours of rainbow.

Question 6.

(a) What is meant by the power of accommodation of an eye?
(b) A person with a myopic eye cannot see objects beyond 1.2 m directly. What should be the type of the corrective lens used? What would be its power?
Answer:
(a) The ability of an eye to focus the distant objects as well as the nearby objects on the retina by changing the focal length or converging power of its lens is called power of accommodation.
A normal eye has a power of accommodation which enables objects as far as infinity and as close as
25 cm to be focussed on the retina.

(b) Myopic eye
v = 1.2 m = -120 cm;
u = (infinity);
P of the corrective lens = ?
By Lens formula,

$$\frac{1}{v} - \frac{1}{u} = \frac{1}{f} \quad \Rightarrow \quad \frac{1}{-120} - \frac{1}{\infty} = \frac{1}{f}$$

$$\Rightarrow \quad \frac{-1}{120} - 0 = \frac{1}{f} \qquad \left(\frac{1}{\infty} = 0\right) \quad \Rightarrow \quad \frac{-1}{120} = \frac{1}{f}$$

$$\therefore \quad f = -120 \text{ cm}$$

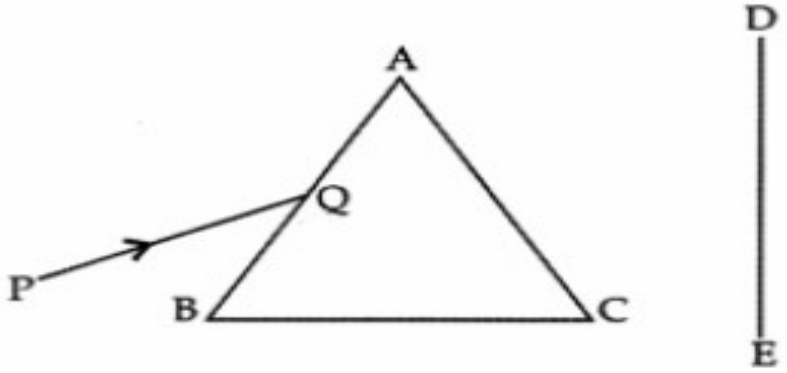
Thus, the corrective lens for the above defect is concave lens (as focal length has -ve sign) of focal length of 120 cm.

$$P = \frac{1}{f \text{ (in metres)}} = \frac{1 \times 100}{-120} = -0.83 \text{ D}$$

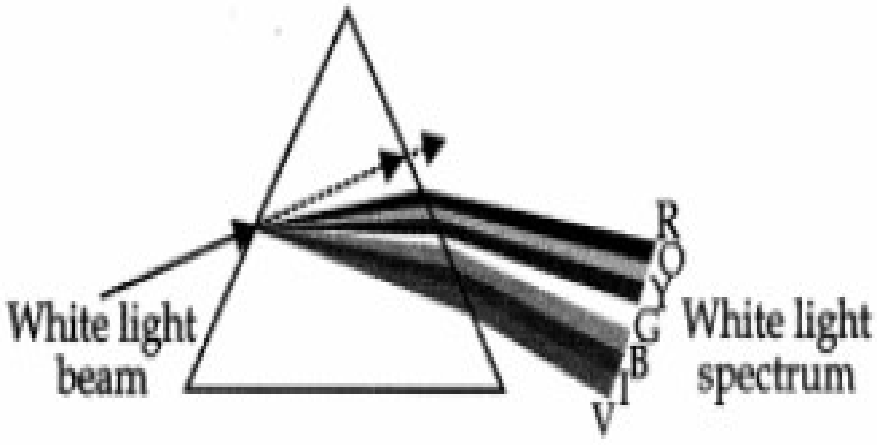
Question 7.

A narrow beam PQ of white light is passing through a glass prism ABC as shown in the diagram.
(i) Write the name and cause of the phenomenon observed.

(ii) Where else in nature is this phenomenon observed?
(iii) Based on this observation, state the conclusion which can be drawn about the constituents of white light.



Answer:
(i) The phenomenon of splitting of white light into seven colours on passing through a glass-prism is called dispersion of light. The dispersion of white light occurs because colours of white light travel at different speeds through the glass prism.
(ii) Formation of rainbow is an example of dispersion of white light in nature.
(iii) The formation of spectrum of seven colours shows that white light is made up of lights of seven different colours mixed together. That is, white light is a mixture of seven colours (or seven coloured lights), i.e., red, orange, yellow, green, blue, indigo and violet.



Question 8. Due to gradual weakening of ciliary muscles and diminishing flexibility of the eye lens a certain defect of vision arises. Write the name of this defect. Name the type of lens required by such persons to improve the vision. Explain the structure and function of such a lens.
Answer:
The defect of this vision is called Presbyopia.

Bifocal lens is used for the correction of this defect. The upper part of this lens is concave and the lower part of the lens is Convex lens. The upper part of the lens is used to see the distant objects clearly and lower part of this lens is used to see the nearby objects clearly.

LONG ANSWER QUESTIONS:

QUESTION 9.

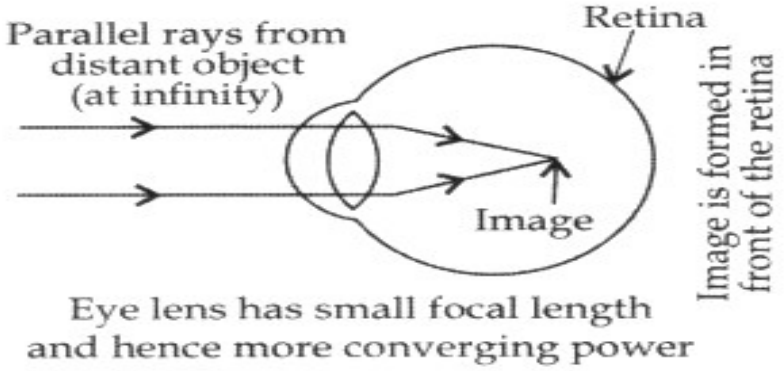
(a) What are the values of (i) near point and (ii) far point of vision of a normal adult person?
(b) A student has difficulty in reading the blackboard while sitting in the last row. What could be his defect of vision? Draw a ray diagram to illustrate this defect of vision.

Answer:

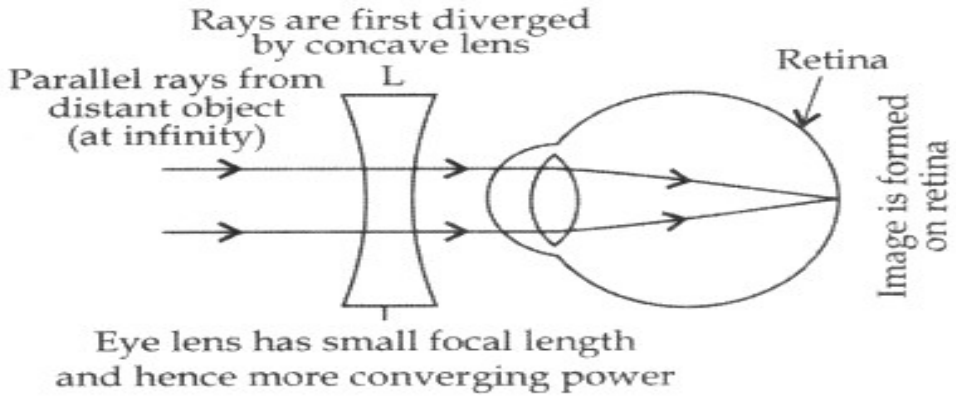
(a) (i) The nearest point up to which the eye can see an object clearly without any strain is called the near point of the eye. The near point of a normal human eye is at a distance of 25 cm from the eye.

(ii) The farthest point from the eye at which an object can be seen clearly is known as the far point of the eye. The far point of a normal human eye is at infinity.

(b) This defect of vision is called myopia.
Ray diagram:
Ray diagram to illustrate this defect



Ray diagram to show the correction of myopia



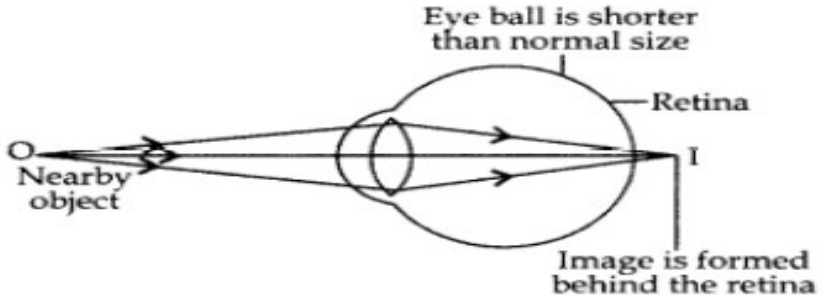
QUESTION 10.

A person cannot read newspaper placed nearer than 50 cm from his eyes. Name the defect of vision he is suffering from. Draw a ray diagram to illustrate this defect. List its two possible causes. Draw a ray diagram to show how this defect may be corrected using a lens of appropriate focal length.

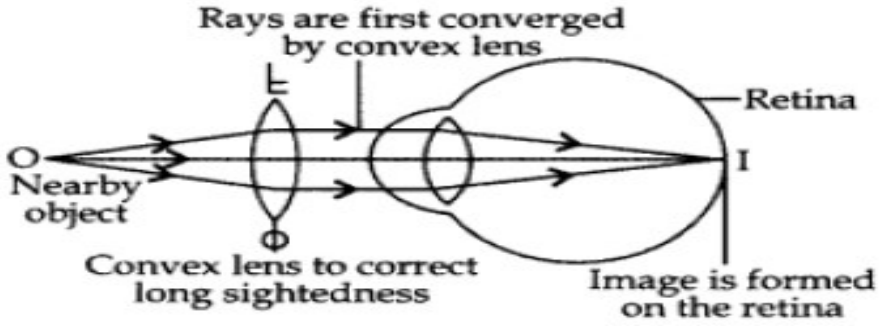
Answer:

If a person cannot read newspaper nearer than 50 cm from his eyes then he is suffering from hypermetropia. It is also called long-sightedness.

Ray diagram, causes and correction of this defect.



An eye suffering from long sightedness, far sightedness or hypermetropia. The image I of a nearby object O is formed behind the retina.



Long sightedness is corrected by using a convex lens

Question 11.

(a) Draw a ray diagram to explain the term angle of deviation. (2017 D)

(b) Why do the component colours of incident white light split into a spectrum while passing through a glass prism, explain.

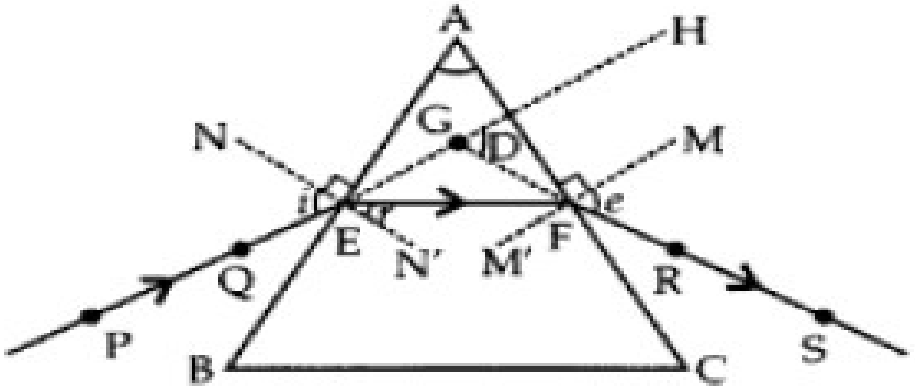
(c) Draw a labelled ray diagram to show the formation of a rainbow.

Answer:

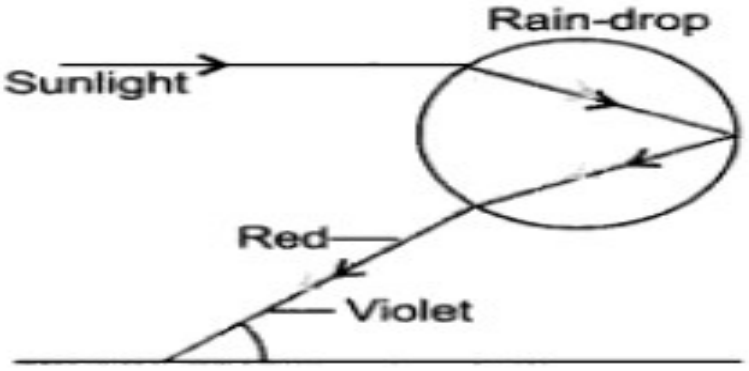
(a) Angle of deviation is the angle between extended incident ray and extended emergent ray through a prism.

PQ = Incident Ray
RS = Emergent Ray
∠D = Angle of Deviation

(b) The incident white light splits into a seven coloured spectrum as speed of different coloured light waves is different when these pass through the prism.



(c)



Rainbow formation

Question 12.

a) Write the function of each of the following parts of human eye: cornea; iris; crystalline lens; ciliary muscles
(b) Millions of people of the developing countries of the world are suffering from corneal blindness. These persons can be cured by replacing the defective cornea with the cornea of a donated eye. A

charitable society of your city has organised a campaign in your neighbourhood in order to create awareness about this fact. If you are asked to participate in this mission how would you contribute in this noble cause?

(i) State the objective of organising such campaigns.
(ii) List two arguments which you would give to motivate the people to donate their eyes after death.

Answer:

(a) Functions of the following parts of human eye:
(i) Cornea. The front part of the eye is called cornea. It is made up of a transparent substance. The light coming from objects enters the eye through cornea.
(ii) Iris. This is a flat, coloured, ring-shaped membrane behind the cornea. Pupil is a hole in the middle of the iris. Iris controls the size of the pupil.
(iii) Crystalline lens. Eye lens is a convex lens which focuses the image of the object on the retina.
(iv) Ciliary muscles. Ciliary muscles hold the eye lens and changes the thickness of eye-lens while focussing the objects placed at different distances from the eye.

(b) (i) Objective of such campaigns. To make people aware of corneal blindness and make them realise their duties towards the society by taking pledge for eye donation.
(ii)

- One pair of eyes can give eyesight to two corneal blind persons (each getting one eye), and make them see this beautiful world.
- Our eyes can live even after our death. People belonging to all age groups, even people with medical conditions like cataract, diabetes, hypertension can donate their eyes.

ASSERTION – REASON QUESTIONS:

Following questions consist of two statements – Assertion (A) and Reason (R). Answer these questions selecting the appropriate option given below:
(a) Both A and R are true and R is the correct explanation of A.
(b) Both A and R are true but R is not the correct explanation of A.
(c) A is true but R is false.
(d) A is false but R is true.

Question 13.

Assertion(A) : White light is dispersed into its seven-colour components by a prism.
Reason (R) : Different colours of light bend through different angles with respect to the incident ray as they pass through a prism.

Answer: (a)

Question 14.

Assertion(A) : The phenomenon of scattering of light by the colloidal particles gives rise to Tyndall effect.
Reason (R): The colour of the scattered light depends on the size of the scattering particles. **Answer: (b)**

Question 15.

Assertion(A): A normal human eye can clearly see all the objects beyond certain minimum distance.
Reason (R) : The human eye has capacity of adjusting the focal length of eye lens.

Answer: (a)

Question 16.

Assertion(A) : A rainbow is sometimes seen in the sky in rainy season only when observer's back is towards the Sun.
Reason (R) : Internal reflection in the water droplets cause dispersion and the final rays are in backward direction.

Answer(a)

Q17. Assertion (A) : Myopia is the defect of the eye in which only nearer objects are seen by the eye.
Reason (R) : The eye ball is elongated.

Answer(a)

Q18. Assertion(A): Hypermetropia is the defect of the eye in which only farther objects are seen.
Reason (R) : Hypermetropia is corrected by using converging lens.

Answer: (b)

Q19. Assertion(A) : Danger signals are made of red colour.
Reason (R) : Velocity of red light in air is maximum, so signals are visible even in dark.

Answer: (c)

Q20. Assertion(A): The sky looks dark and black instead of blue in outer space.
Reason (R) : No atmosphere containing air in the outer space to scatter sunlight.

Answer: (a)

Q21. Assertion (A): The stars twinkle, while the planets do not.
Reason (R) : The stars are much bigger in size than the planets.

Answer: (b)

Q22. Assertion(A): The Sun appears flattened at sunrise and sunset.
Reason (R) : The apparent flattering of the Sun's disc at sunrise and sunset is due to atmospheric refraction.

Answer: (a)

Q23. Assertion (A) : Blue colour of sky appears due to scattering of blue colour.
Reason (R) : Blue light has longer wavelength.

Answer: (c)

CASE STUDY QUESTIONS

Q.24. ***Read the following and answer any four questions from (i) to (v)***

Atmospheric refraction is the phenomenon of bending of light on passing through earth's atmosphere. As we move above the surface of earth, density of air goes on decreasing. Local conditions like temperature etc. also affect the optical density of earth's atmosphere. On account of atmospheric refraction, stars seen appear higher than they actual are; advanced sunrise; delayed sunset, oval appearance of the sun at sunrise and sunset; stars twinkle, planets do not.

(i) Due to atmospheric refraction, apparent length of the day
(a) increases
(b) decreases
(c) remains the same
(d) all of these

Answer: (a) Due to atmospheric refraction, apparent length of the day increases by 4 minutes.

(ii) Apparent position of the star appears raised due to
(a) atmospheric refraction
(b) scattering of light
(c) both (a) and (b)
(d) none of these

Answer: (a) Apparent position of the stars appears raised due to atmospheric refraction.

(iii) The sun appears oval shaped or flattened due to
(a) dispersion
(b) scattering
(c) atmospheric refraction
(d) cannot say

Answer: (c)

(iv) Twinkling of stars and non-twinkling of planets is accounted for by
(a) scattering of light
(b) dispersion of light
(c) atmospheric refraction
(d) none of these

Answer: (c)

(v) In absence of atmosphere, the colour of sky appears
(a) blue
(b) black
(c) red
(d) yellow **Answer: (b) Due to no scattering of light.**

Human Eye and Colourful World

Eye Defects

Presbyopia
Causes
(i) Causes Gradual weakening of ciliary muscles
(ii) Diminishing flexibility of eye lens

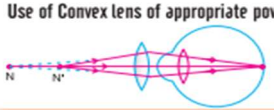
Correction
Use of bifocal lens

Myopia (Near Sightedness)
Causes
(i) Excessive Curvature of eye lens
(ii) Elongation of eyeball

Hypermetropia (Far Sightedness)
Correction
Use of Concave lens of appropriate power

Causes
(i) Focal length of the eye lens becomes too long
(ii) Eye ball becomes too small

Correction
Use of Convex lens of appropriate power



Structure of Eye

Retina
Delicate membrane having enormous number of light sensitive cells

Cornea
Controls and focuses the entry of light into the eye.

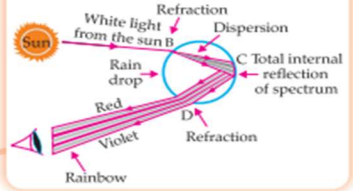
Iris
Control the size of the pupil

Pupil
It regulates and controls the amount of light entering the eye

Lens
Provide the focused real and inverted image of the object on the retina

Formation of Rainbow

Phenomenon associated are dispersion, refraction and total internal reflection.



Dispersion of Light

- Splitting of light into its component colours
- Red colour deviates the least and violet deviates the most.

Shows Tyndall Effect

Scattering of Light

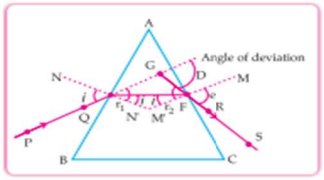
- Reddishness of the sun at sunrise and sunset
- Blue colour of the sky
- Blue colour has shorter wavelength as compared to red so it scatters more.

Atmospheric Refraction

Refraction of light by the earth's atmosphere
- Twinkling of stars
- Planets do not twinkle
- Advanced Sunrise and delayed sunset

Refraction of Light through Prism

- Different colours travel through a glass prism at different speeds.
- The angle between the extended incident ray and the emergent ray is called the angle of deviation.
- The cause of atmospheric refraction is the variation in the density of air in the different layers.
- The refraction of light in case of prism is different than that that of a slab.



Trace the Mind Map
First Level · Second Level · Third Level

UNIT NAME: EFFECTS OF CURRENT

CHAPTER 6

I. ELECTRICITY

Prepared by: - ZEBA WARIS,

KV BARKAKANA

I. ELECTRICITY

ELECTRICITY-

- It is a form of energy that results from the flow of charged particles.
- Electric Charge- The property of sub-atomic particles that causes it to experience a force when placed in an electromagnetic field.

  SI Unit- Coulomb (C)

  1 Coulomb= 6 x 10^{18} electrons

PROPERTIES OF ELECTRIC CHARGE-

- Unlike charges attract each other.
- Like charges repel each other.
- It is conserved i.e. it can neither be created nor be destroyed.
- It is additive i.e. total charge is the algebraic sum of the individual charge.
- It is quantized.

  Q=ne

  Where n= the number of electrons and

  e is the charge on electron = 1.6 x 10^{-19} coulombs.

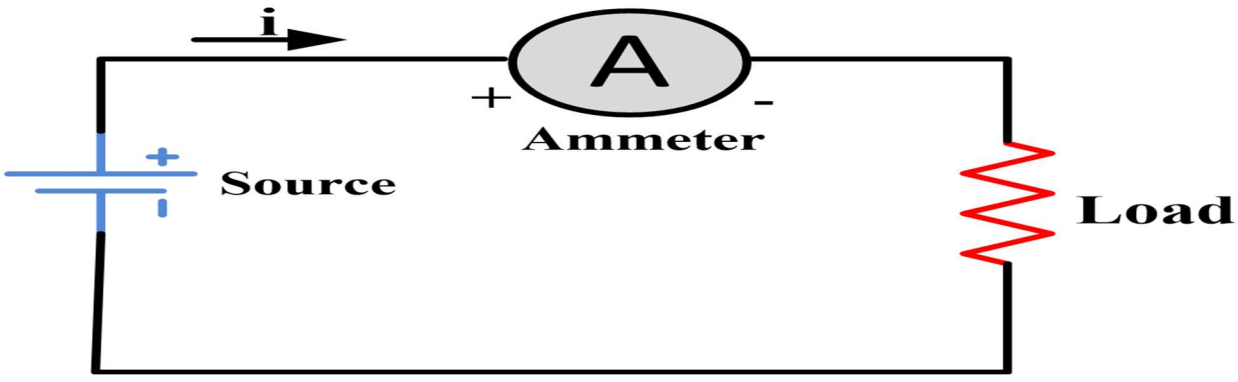
ELECTRIC CURRENT-

- Electric current is expressed by the amount of charge flowing through a particular area in unit time.
- In other words, it is the rate of flow of electric charges.

  I=Q/t

  Q= It

SI Unit- Ampere (A) named after the French scientist, Andre-Marie Ampere (1775–1836).



- One Ampere-When 1 coulomb of charge flows through a conductor in 1 second, the electric charge flowing through it is said to be 1 ampere.
- Smaller unit of current is milliampere (mA) and microampere(μA)

1 mA = 10^{-3}A

1 μA = 10^{-6}A

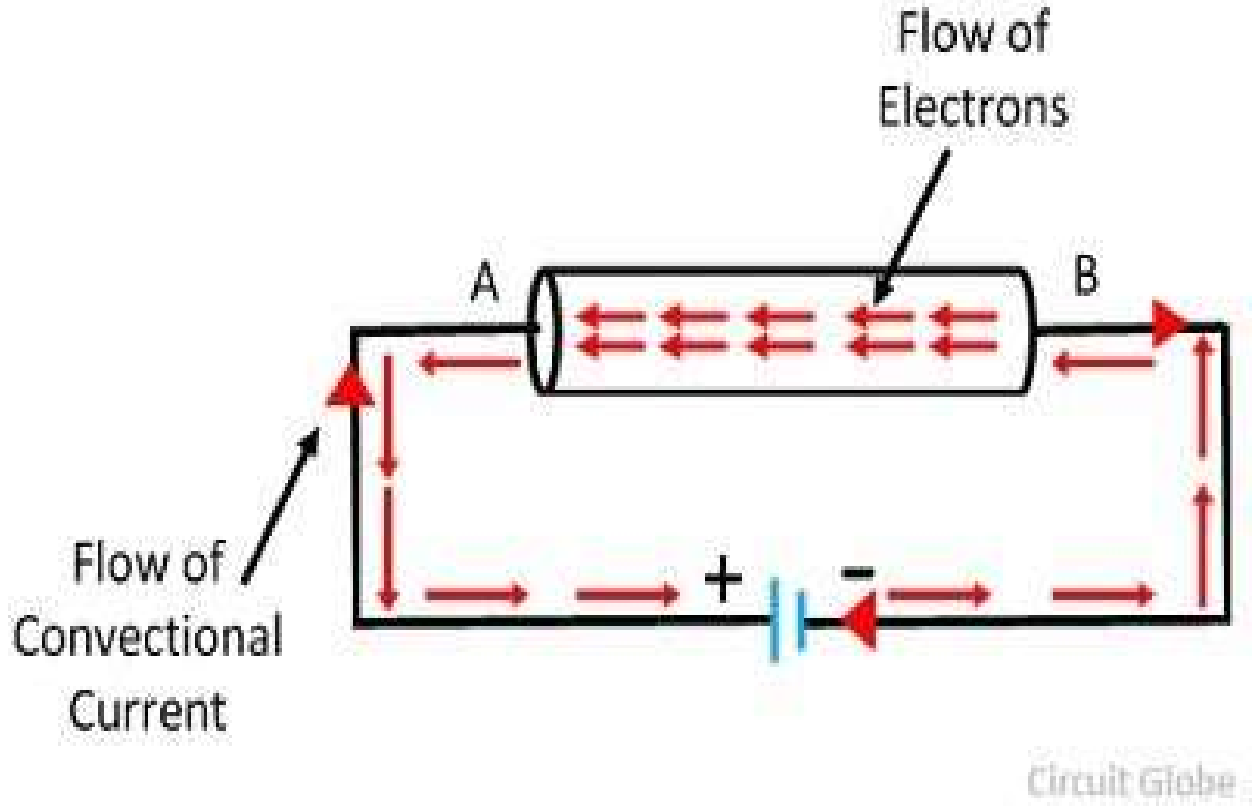
- Ammeter- An instrument used to measure electric current in a circuit. It is always connected in series.
- One Coulomb- The quantity of charge which flows through a circuit when one ampere of current flows through it.

1 coulomb= 1 ampere x 1 second

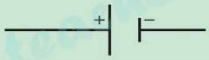
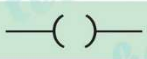
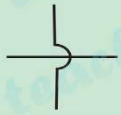
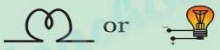
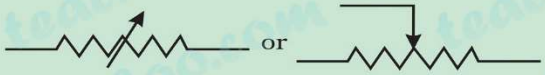
- Electric Circuit- A closed and continuous path of an electric current is called an electric circuit.
- Direction of current- Direction of flow of positive charges

Or

Opposite to the direction of flow of electrons



SYMBOL OF COMPONENTS OF CIRCUIT DIAGRAM-

Sl. No.	Components	Symbols
1	An electric cell	
2	A battery or a combination of cells	
3	Plug key or switch (open)	
4	Plug key or switch (closed)	
5	A wire joint	
6	Wires crossing without joining	
7	Electric bulb	
8	A resistor of resistance *R*	
9	Variable resistance or rheostat	
10	Ammeter	
11	Voltmeter	
12	Galvanometer	

- ELECTRIC POTENTIAL-The amount of work done to bring a unit charge from infinity to a point.

$$V = W/Q = \text{Joule}/\text{Coulomb}$$

SI Unit- volt (V), named after Alesandro Volta 1 volt (V) = 1 JC^{-1}

- POTENTIAL DIFFERENCE-The amount of work done to bring a unit charge from one point to another point.

$$V = W/Q = \text{Joule}/\text{Coulomb}$$

SI Unit- volt (V), 1 volt (V) = 1 JC^{-1}.

It is measured by device Voltmeter. Voltmeter is always connected in parallel across the points between which the potential difference is to be measured

OHM'S LAW- "The potential difference, V, across the ends of a given metallic wire in an electric circuit is directly proportional to the current flowing through it if the temperature remains the same."

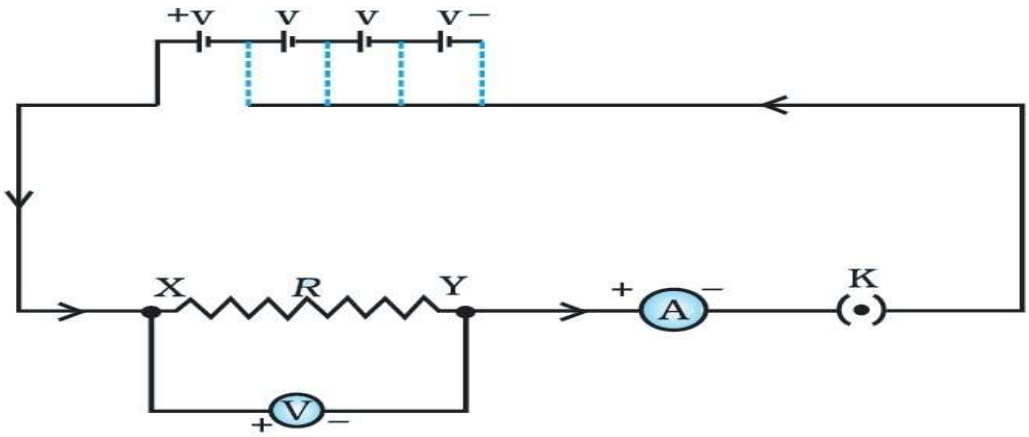
$$V \propto I$$

$$V \propto I$$

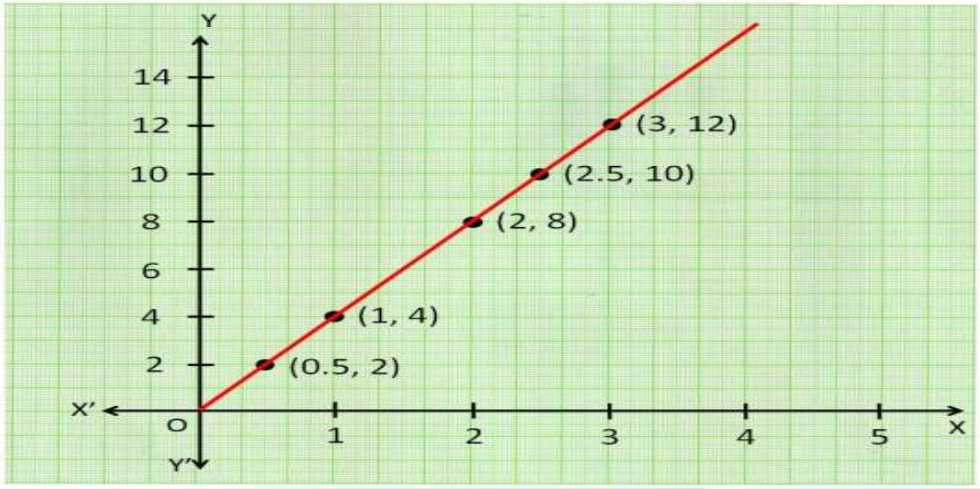
$V = RI$ (R=constant, known as constant of resistance)

$$V/I = R \qquad R = V/I$$

VERIFICATION OF OHM'S LAW-



I (Amperes) (A)	0.5	1	2	2.5	3
V (Volts) (V)	2	4	8	10	12



RESISTANCE- Resistance is a property that resists the flow of electrons in a conductor.

R= V/I

SI Unit- Ohm (Ω)

Variable Resistance- A component used to regulate current without changing the voltage source is called variable resistance.

Rheostat- It is a device used to change the resistance in the circuit.

- 1 Ohm- If the potential difference across the two ends of a conductor is 1 V and current through it is 1 A, then the resistance R of the conductor is 1 Ω.

1 Ω = 1 volt/1 ampere

FACTORS ON WHICH RESISTANCE DEPENDS-

1. Length of the conductor-

$R \propto l$ …. (i)

2. Area of cross-section

$R \propto 1/A$ …..(ii)

$R \propto l / A$

$R = \rho l / A$ …..Where ρ (rho) is a constant of proportionality and is called the electrical resistivity.

$\rho = RA / l$

3. Material of the conductor-

- The metals and alloy have very low resistivity.
- Resistivity of an alloy is higher than its constituent metal.

4. Temperature-with rise in temperature the resistance of the metal increase.

RESISTOR-It is a conductor which offers high resistance to the flow of electric current.

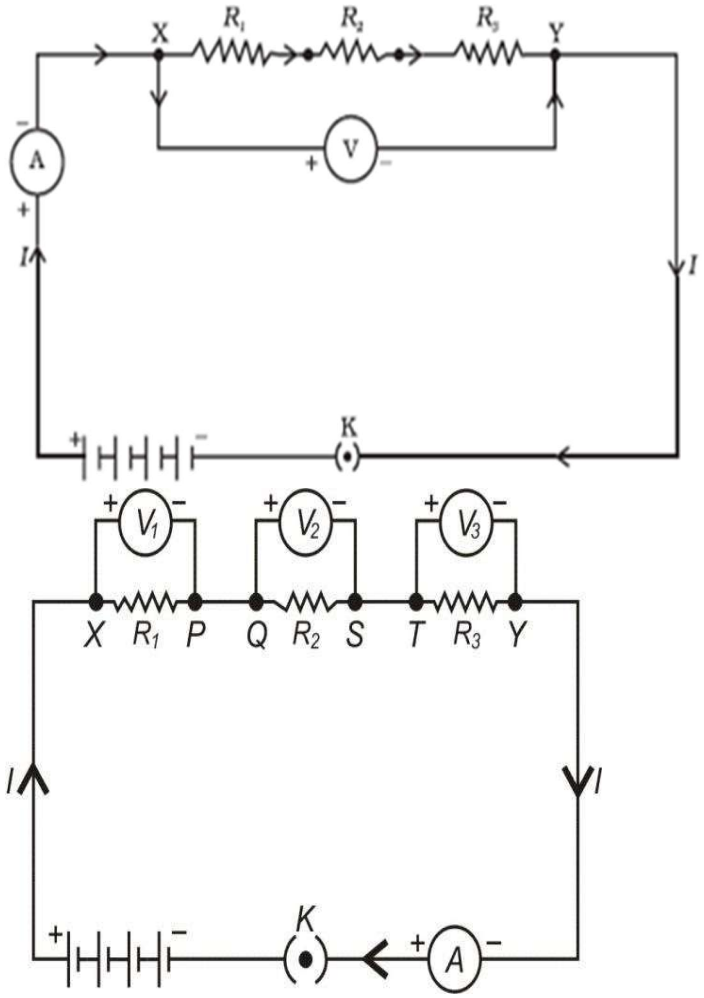
RESISTIVITY- Resistivity of a material is the resistance of a unit length of the material having unit area of cross section.

$\rho = RA / l$ SI Unit- Ωm

RESISTORS IN SERIES-

When two or more than two resistance are joined end to end then the resistor are said to be connected in series.

Activity-1



Observation-

1. The current I is the same in every part of the circuit.
2. The total potential difference is equal to the sum of the individual potential difference.

$V = V_1 + V_2 + V_3$ .....(i) A/c to Ohm's law, $V = IR$

$V_1 = IR_1$, $V_2 = IR_2$ $V_3 = IR_3$

Putting the value of V_1, V_2 and V_3 in equation (i)

$V = V_1 + V_2 + V_3$

$IR = IR_1 + IR_2 + IR_3$

$IR = I (R1 + R_2 + R_3)$

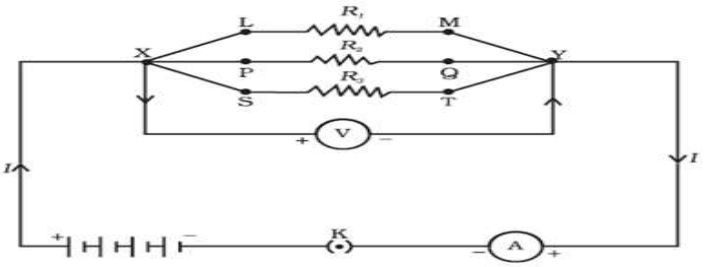
$R = R_1 + R_2 + R_3$

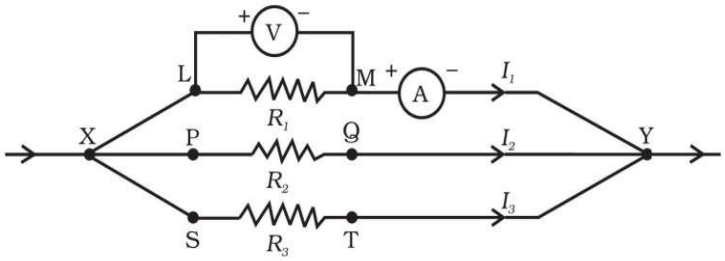
$R_S = R_1 + R_2 + R_3$

Conclusion – When a number of resistances are connected in series, the equivalent resistance is equal to the sum of the individual resistance and is greater than any individual resistance.

RESISTOR IN PARALLEL- A number of resistor are said to be connected in parallel if one end of each resistor is connected to one point and the other end is connected to another point so that the potential difference across each resistor is the same and is equal to the applied potential difference between the two points.

ACTIVITY-





Observation-

The current I divide at the junction of resistor.

The total current is equal to the sum of the individual current.

$$I=I_1 + I_2 + I_3 \quad \text{..... (i)}$$

Applying Ohm's Law

$I_1 = V/ R_1$

$I_2 = V/R_2$

$I_3 = V/ R_3$

If an equivalent R_p is connected in between X and Y so that current I is flown through it then

$I = V/ R_p$

Putting these value in equation (i)

$I=I_1 + I_2 + I_3$

$V/ R_p =V/ R_1 + V/R_2 + V/ R_3$

$V/ R_p =V (1/ R_1 + 1/R_2 + 1/ R_3)$

$1/ R_p =1/ R_1 + 1/R_2 + 1/ R_3$

Conclusion-The reciprocal of the equivalent resistance is equal to the sum of the reciprocals of the individual resistance and is smaller than any individual resistance.

HEATING EFFECT OF ELECTRIC CURRENT

- "The effect of electric current due to which heat is produced in a wire or conductor when current is passed through it is called the heating effect of electric current."
- When electric current flows through the resistance element, the flowing charges suffer resistance. Work has to be done to overcome this resistance which is converted into heat energy.
- If Q amount of charge flows through a potential difference of V then work done,

$$W=VQ, \quad [Q=It \ \& \ V=IR]$$

$$W=IR \times It$$

$$H=I^2Rt$$

It means - $H \propto I^2$

$H \propto R$

$H \propto t$

This effect is also called 'Joule's Heating Effect'.

PRACTICAL APPLICATION OF HEATING EFFECT-

- The heating effect of current is used in electric iron, electric bulb, electric water heater, room heater, electric toaster.
- The heating element is made up of nichrome, maganin etc. because of its high resistivity and high melting point.
- Electric iron: In an iron the upper part is grooved. In this groove a coil is placed. Mica as an insulator is placed between the metal part and the coil, so that there is no electrical connection between them. Mica is a bad conductor of electricity but it is a good conductor of heat. Due to the flow of current through the coil it gets heated and the heat transferred to the metal part through mica. Finally, the metal part gets heated.
- Electric bulb: we see a thick metallic wire in the bulb. It is made of tungsten metal. In a glass vessel or bulb the tungsten wire is kept sealed. The glass bulb is filled with neutral gas or vacuum. The tungsten wire is known as filament when the current flows through the tungsten wire or filament it becomes heated and emits light. Due to the flow of current heating effect of an electric current is used as the source of light.
- Electric heater: In an electric heater coil is used. A high resistance material like nichrome is used as coil. The coil is wound in grooves on ceramic

format or china clay. When electric current flows through the coil and it gets heated. Due to high resistance the coil becomes red hot.

- Electric fuse: It protects circuits and appliances by stopping the flow of any unduly high electric current. The fuse is placed in series with the device. It consists of a piece of wire made of a metal or an alloy of appropriate melting point, for example aluminum, copper, iron, lead etc. If a current larger than the specified value flows through the circuit, the temperature of the fuse wire increases. This melts the fuse wire and breaks the circuit.

The fuse wire is usually encased in a cartridge of porcelain or similar material with metal ends. The fuses used for domestic purposes are rated as 1 A, 2 A, 3 A, 5 A, 10 A, etc. For an electric iron which consumes 1 kW electric power when operated at 220 V, a current of (1000/220) A, that is, 4.54 A will flow in the circuit. In this case, a 5 A fuse must be used.

ELECTRIC POWER-

- The electric energy dissipated or consumed in an electric circuit is termed as electric power.

$$P = W/t$$

$$= V \times Q/t \qquad [Q/t=I]$$

$$= VI = IR \times I = I^2R$$

$$= V \times V/R = V^2/R$$

SI Unit- Watt

1 Watt- 1 Watt is the power consumed by a device that carries 1 A of current when operated at a potential difference of 1 V.

$$1W = 1 \text{ Volt} \times 1 \text{ Ampere}$$

$$= 1 \text{ V} \times \text{A}$$

1 W h- It is the energy consumed when 1 watt of power is used for 1 hour.

KWh- -It is the commercial unit of electric energy. It is commonly known as 'unit'.

$$1 \text{ kW h} = 3.6 \times 10^6 \text{ J}$$

MCQ

1. How do we connect an ammeter in a circuit?

i) series ii) parallel iii) both iv) none of them

2. When a 4V battery is connected across an unknown resistor there is a current of 100 Ma in the circuit. The value of the resistance of the resister is:

i) 4 Ω ii) 40 Ω iii) 400 Ω iv) 0.4 Ω

3. Unit of electric power may also be expressed as:

i) volt-ampere ii) kilowatt-hour iii) watt-second iv) Joule-second

4. Nichrome is the mixture of-

(i) Cu + Ni (ii) Cu +Mn + Ni (iii) Ni + Cr +Mn + Fe (iv) Ni + Cr

5. Name the physical quantity whose unit is JC^{-1}.

i) current ii) potential difference iii) resistance iv) power

6. Power of a lamp is 60 W. The energy consumed by it in 1 s.

i) 40 J ii) 60 J iii) 80 J iv) 15 J

7. Which material would you advise to use in electrical heating device?

i) Copper ii) silver iii) aluminium iv) Nichrome

8. Which of the following does not represent electrical power in a circuit?

(i) I^2 R (ii) IR^2 (iii) VI (iv) V^2 /R

9. If two resistors of 25 Ω and 15 Ω are joined together in series and then placed in parallel with a 40 Ω resistor, the effective resistance of the combination is:

(i) 0.1 Ω (ii) 10 Ω (iii) 20 Ω (iv) 40 Ω

10. When the area of cross-section of a conductor is doubled, its resistance becomes:

(i) double (ii) half (iii) four times (iv) one-fourth

ASSERTION –REASON

1. Assertion: A fuse wire is always connected in parallel with the mainline.

Reason: If a current larger than the specified value flows through the circuit, fuse wire melts.

2. Assertion (A) : Tungsten metal is used for making filaments of incandescent lamps.
Reason (R) : The melting point of tungsten is very low.

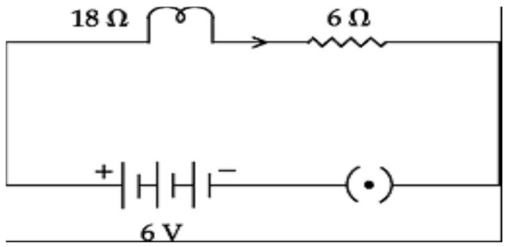
3. Assertion (A) : Longer wires have greater resistance and the smaller wires have lesser resistance.
Reason (R) : Resistance is inversely proportional to the length of the wire.

4. Assertion (A) : Alloys are commonly used in electrical heating devices, like electrical iron, toasters etc.
Reason (R) : Alloys do not oxidise (burn) readily at high temperatures.

5. Assertion (A) : The resistivity of a substance does not depend on the nature of the substance and temperature.
Reason (R) : The resistivity of a substance is a characteristic property of the material.

VERY SHORT ANSWER QUESTIONS (2)

1.



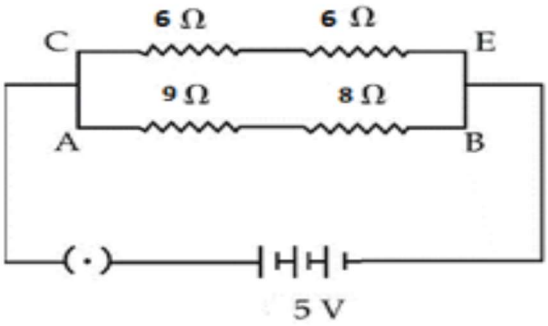
In the given circuit, calculate

(a) Total resistance of the circuit

(b) Current flowing through the circuit

2. Two resistors each of 10 Ω are connected in i) series ii) and then in parallel to a battery of 6 V. Calculate the ratio of power consumed in the combination of resistor in two case.

3. Study the circuit and find the



(i) Total resistance in arm CE

(ii) Current in arm AB

4. Draw a schematic labelled diagram of a closed circuit which connects all the given components in series and connected across a 12-V battery:

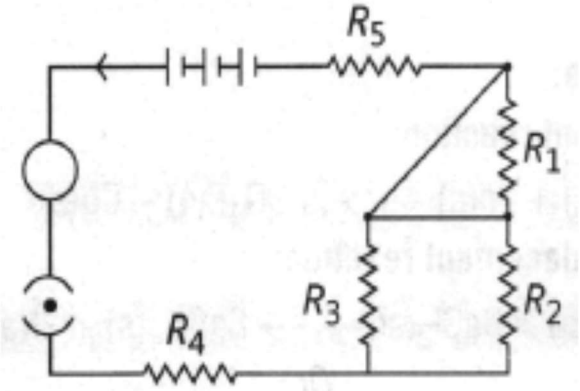
(i) 20 W lamp

(ii) An ammeter

(iii) A switch

(iv) 10 Ω resistor

5.



Consider the following electric circuit:

(i) Which two resistors are connected in series?

(ii) Which two resistors are connected in parallel?

6. What do you mean when we say that the electric appliance is earthed? What is its importance?

7. Some work is done to move a charge Q from infinity to a point A in space. The potential of the point A is given as V. What is the work done to move this charge from infinity in terms of Q and V?

8. State the commercial unit of electric energy and find its relation with its SI unit.

9. Name an instrument that measures electric current in a circuit. Define the unit of electric current.

10. Draw an electric circuit consisting of a 0.5 m long nichrome wire XY , an ammeter, a voltmeter, four cells of 1.5 V each and a plug key.

SHORT ANSWER TYPE QUESTION (3)

1. Draw a circuit diagram to show how 3 bulbs can be lit from a battery so that 2 bulbs are controlled by the same switch while the third bulb has its own switch.

2. An electric appliance of 1.5 kW power rating operates on a 220V main supply and has a current rating of 5 A. Is this fuse suitable for this electrical appliance? Explain.

3. If three resistors of 6 Ω, 7 Ω and 10 Ω are connected in series. Calculate the equivalent resistance in the circuit.

(i) What is the potential difference across the three resistorsR1, R2 and R3 in a series combination if the potential across the circuit is V?

(ii) What is the current along each of the resistors in a series combination if the current flowing in the circuit is I?

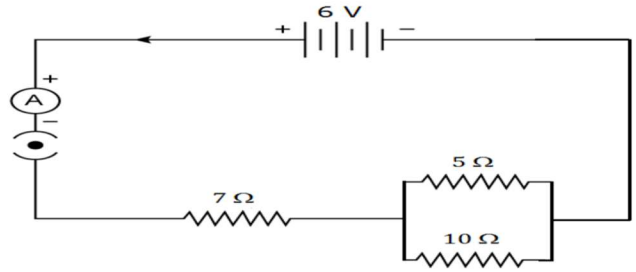
4. An electric heater of resistance 10 Ω and resistance wire of 8 Ω are connected in series with a 6V battery. Find

(i) Current through the circuit

(ii) Potential difference across the electric heater

(iii) Potential difference across electric wire

5. Consider the following electric circuit:



Calculate:

(i) Resultant resistance

(ii) Total current

(iii) Voltage across 7 Ω resistor

6. A heater connected to a 230V power source draws 5.5 A current. Calculate

(i) Electric power of the heater

(ii) Resistance of the heater

(iii) Cost of operating this heater for 20 hours if commercial electricity unit cost is Rs. 4.

7. One billion electrons pass from a point A towards another point B in 10^{-4} s. What is the current in amperes? What is its direction?

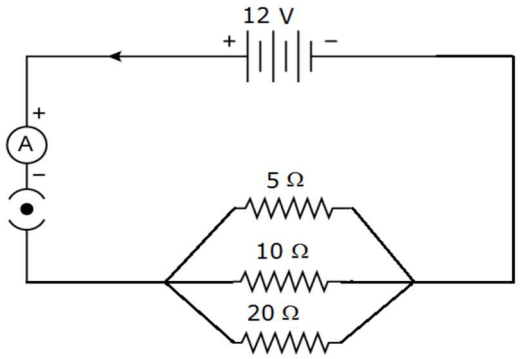
8. A 4 kW heater is connected to a 220-V power source. Calculate

i. Electric current passing through the heater

ii. Resistance of the heater

iii. Electric energy consumed in a 2-hour use of the heater

9. In the circuit given below, three resistors of 5 Ω , 10 Ω and 20 Ω, respectively, are connected across a battery of 12 V.



Calculate:

(a) Current through each resistor

(b) Total current in the circuit

(c) Total resistance of the circuit

10. An electrical appliance is rated 200 V□100 W. What is the resistance of the appliance? Five such appliances run simultaneously for 4 hours. What is the energy consumed?Calculate the cost of running these appliances if the per unit cost is Rs 4.60.

LONG ANSWER QUESTIONS

1. Suppose your parents have constructed a two-room house and you want that in the living room there should be a provision of one electric bulb, one electric fan, a refrigerator and a plug point for appliances of power up to 2 kilowatt. Draw a circuit diagram showing electric fuse and earthing as safety devices.

2. (i) Consider a conductor of resistance 'R', length 'L', thickness 'd' and resistivity 'ρ'. Now this conductor is cut into four equal parts. What will be the new resistivity of each of these parts? Why?

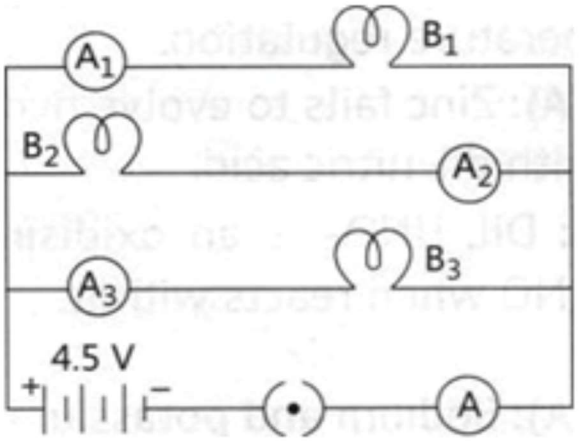
(ii) Find the resistance if all of these parts are connected in:

(a) Parallel

(b) Series

(iii) Out of the combinations of resistors mentioned above in the previous part, for a given voltage which combination will consume more power and why?

3. (i) B1, B2 and B3 are three identical bulbs connected as shown in figure. When all the three bulbs glows, a current of 3 A is recorded by the ammeter A.

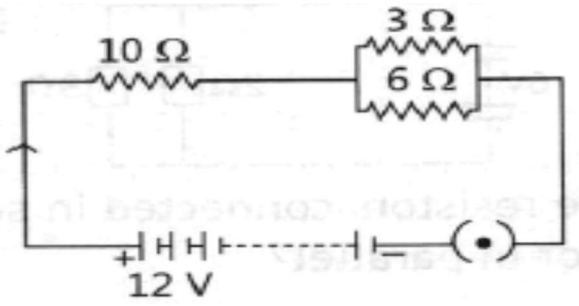


What happens to the glow of the other two bulbs when the bulb B1 gets fused?

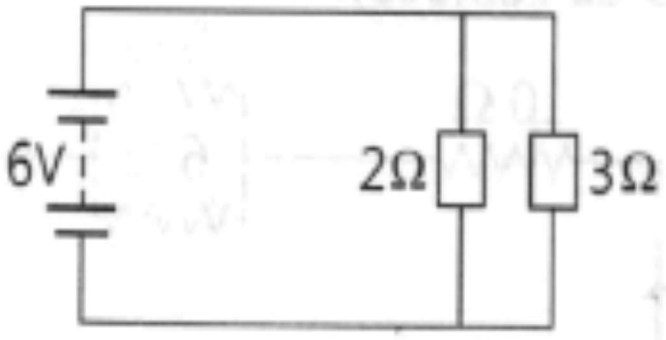
ii) Consider the circuit shown in the diagram.

a) Find the current in 3 Ω resistor.

b) Find the total resistance of the circuit.



4. The figure given below shows an electric circuit in which current flows from a 6 V battery through two resistors.



(i) Are the resistors connected in series with each other or in parallel? 1

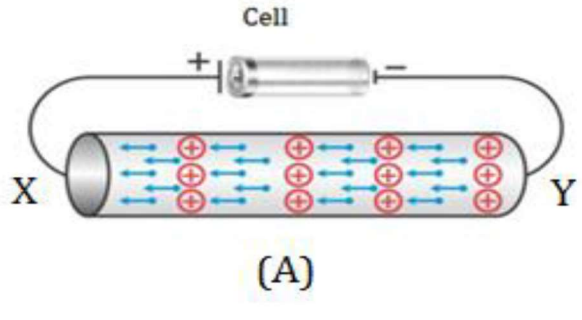
(ii) For each resistor state the potential difference across it. 2

(iii) The current flowing from the battery is shared between the two resistors. Which resistor will have bigger share of the current? 2

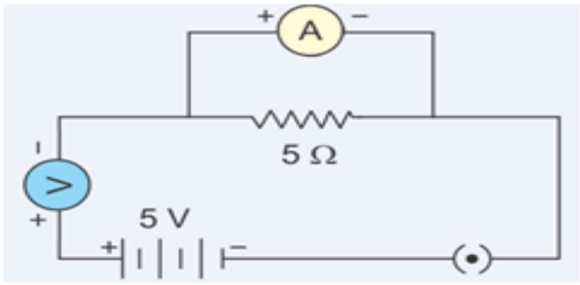
5. Obtain an expression for the heat produced in a conductor when a voltage V is applied across it. Heating effect of electric current is desirable as well as undesirable. Explain this statement.

CASE BASED

1. Observe the diagrams (A) and (B) and answer the questions from (a) to (c) on the basis of related studied concepts.



(A)



(B)

a) State the direction of current in metal wire XY. (1)

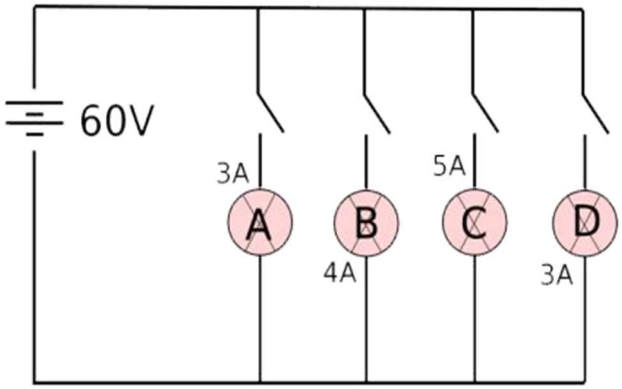
b) What happens when the cell across the metal wire XY is removed? (1)

c) Which devices are connected incorrectly in circuit diagram (B)? Why? (2)

OR

Draw the correct circuit diagram for replacing the incorrect circuit connections.

2. In the given circuit, A, B, C and D are four lamps connected with a battery of 60V.



Analyse the circuit to answer the following questions.

(i) What kind of combination are the lamps arranged in (series or parallel)?

(ii) Explain with reference to your above answer, what are the advantages (any two) of this combination of lamps?

(iii) Explain with proper calculations which lamp glows the brightest?

(iv) Find out the total resistance of the circuit.

3. Vinay was preparing for his science exam. Suddenly light of his room went off. His cousin brother Vasu quickly with mobile phone torch found that fuse has blown. He checked and put a fuse wire. The light comes to life again. Vinay thanked Vasu and continued his study.

(a) What were the values displayed by Vasu and Vinay?

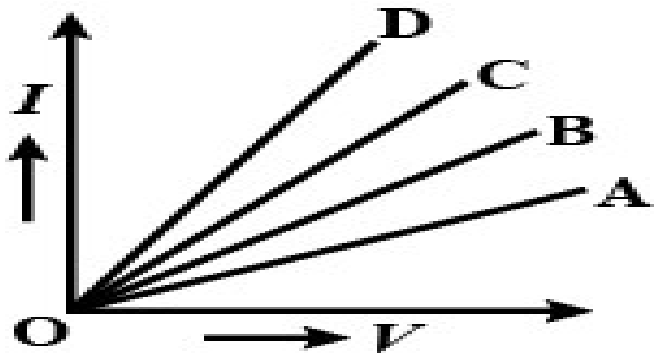
(b) What is electric fuse?

(c) What characteristics you would prefer for a fuse wire?

(d) What is the advantage of using fused wire?

4. Ohms law gives a relationship between current and potential difference. According to this Law, at constant temperature, the current flowing through a conductor is directly proportional to the potential difference across its ends. The ratio of potential difference applied between the ends of a conductor and the current flowing through it is a constant quantity called resistance.

The following graph is obtained by a researcher while doing an experiment to study Ohm s law. The *I* – *V* graph for four conductors *A*,*B*,*C* and *D* having resistance *RA*,*RB*,*RC* and *RD* respectively are shown in the graph.



(i) If all the conductors are of same length and same material, which is the thickest?

(ii) If all the conductors are of same thickness and of same material, which is the longest?

(iii) Which one of the following relations is true for these conductors?

(a) RA > RB > RC > RD (b) RA = RB < RC < RD (c) RA < RB < RC < RD (d) RA = RB = RC = RD

(iv) If conductors *A* and *B* are connected in series and *I* – *V* graph is plotted for the combination, its slope would be:

(a) more than that of A (b) between A and B (c) more than that of D (d) less than that of A

……

II. MAGNETIC EFFECT OF 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.

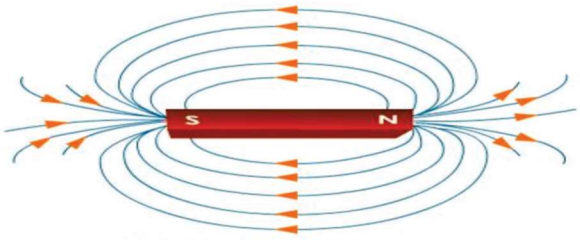
(iv) Field lines never intersect each other as for two lines to intersect, there must be

two north directions at a point, which is not possible.

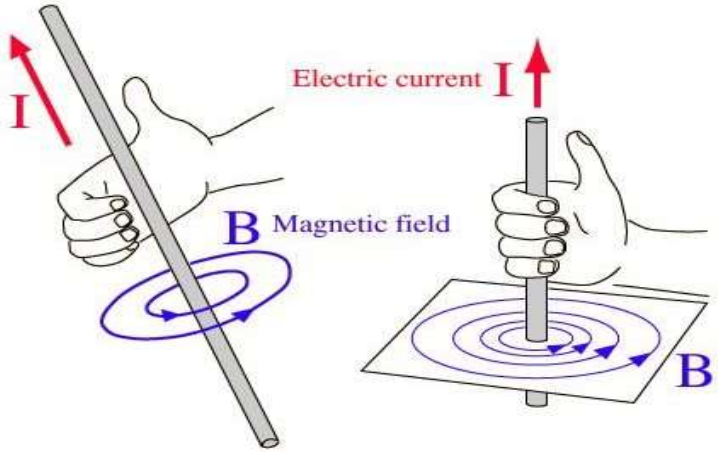
(v) Direction of field lines inside a magnet is from South to North.

(vi) The relative strength of magnetic field is shown by degree of closeness of field lines.

Magnetic Field of a Bar Magnet

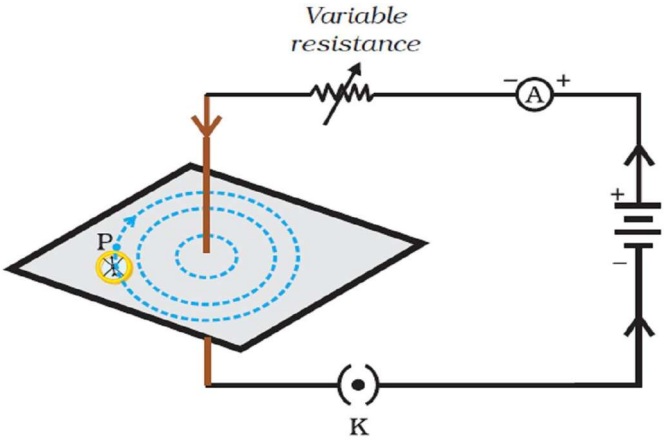


• H. C. Oersted was the first person to state that electric current has magnetic field. Right Hand Thumb Rule



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 ∝ Strength of current

$$\text{Magnetic field} \propto \frac{1}{\text{Distance from conductor}}$$

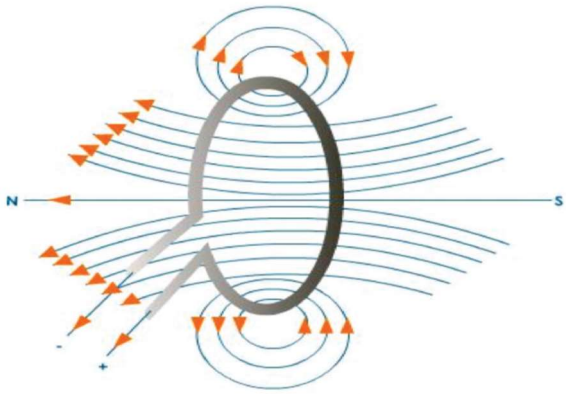
Magnetic Field Due to Current Through a Circular Loop

• 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

$$\text{Magnetic field} \propto \frac{1}{\text{Distance from conductor}}$$

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.

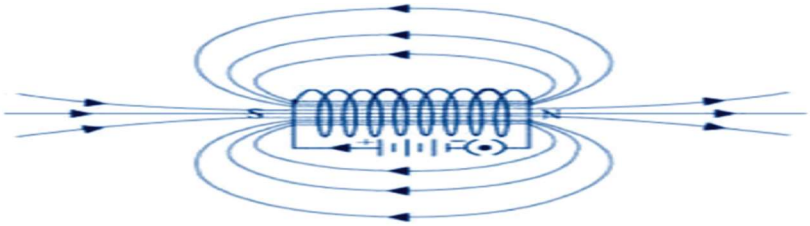
• Magnetic field is uniform inside the solenoid and represented by parallel field lines.

• Direction of magnetic field

(i) Outside the solenoid: North to South

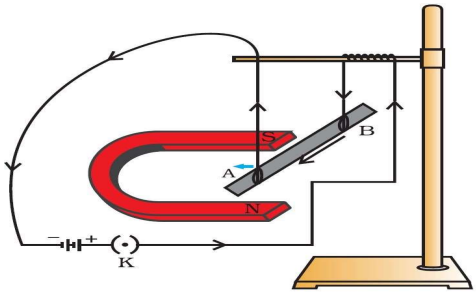
(ii) Inside the solenoid: South to North

• Solenoid can be used to magnetise a magnetic material like soft iron.



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.



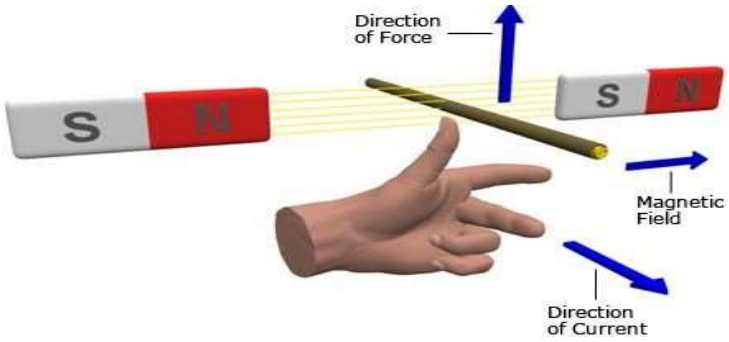
The displacement in the conductor is the maximum when the direction of current is at right angle to the direction of magnetic field.

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.

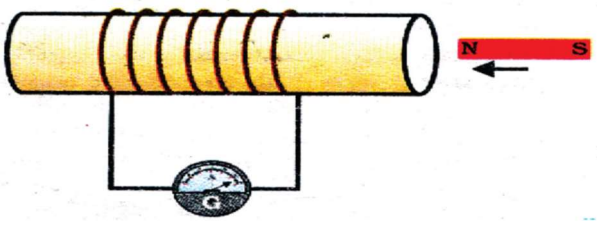


Galvanometer: Instrument that can detect the presence of current in a circuit. It also detects the direction of current.

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

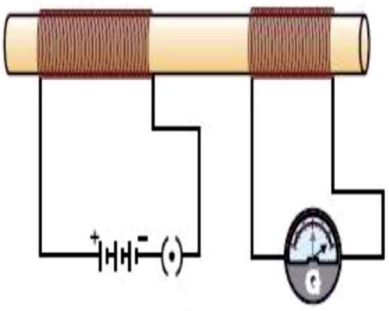


(i) Magnet moved into the coil: Momentary deflection in G indicating presence of current.

(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



(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.

Alternate Current (A. C.) : The current which reverses its direction periodically.

- In India, A. C. reverses its direction in every 1/100 second.

Time period = 1/100 +1/100= 1/50

Frequency =1/Time Period

= 1/1/50

= 50 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:

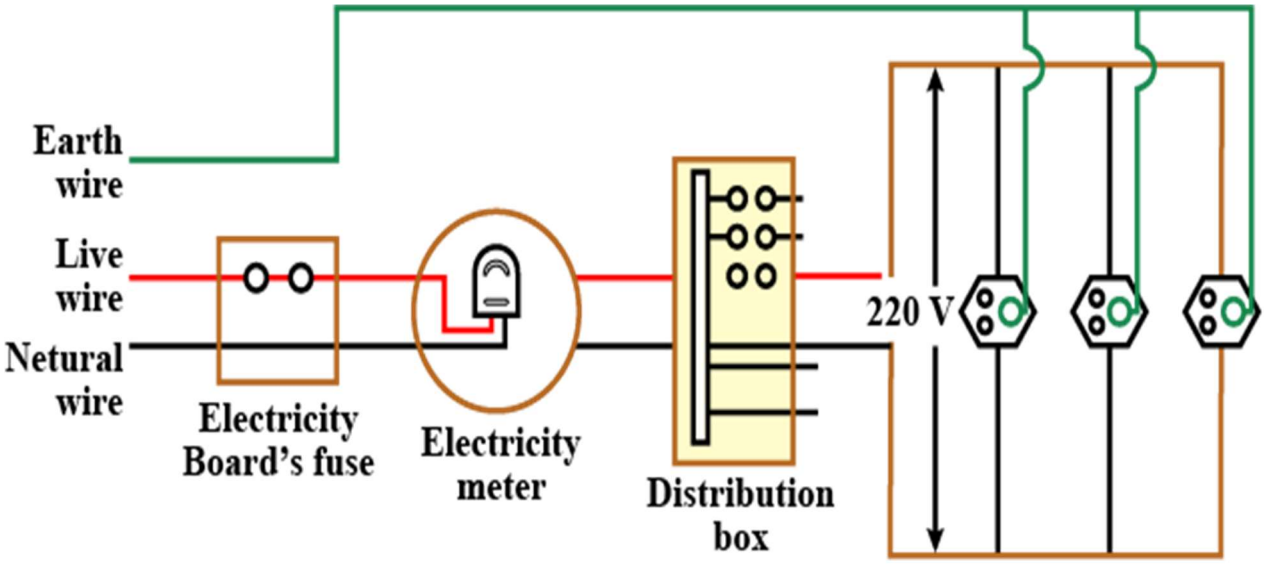
(i) Live wire (positive) with red insulation cover.

(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:

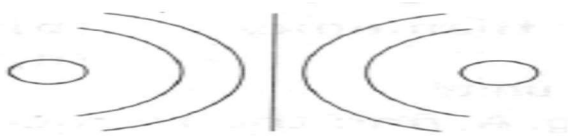
(i) Electric fuse

(ii) Earth wire

(iii) MCB (Miniature Circuit Breaker.

MCQ

1. The diagram given below represents magnetic field caused by a current-carrying conductor which is:



(a) a solenoid (b) a long straight wire (c) a circular coil (d) a short straight wire

2. The strength of magnetic field due to a straight conductor depends on the:

(a) nature of conductor (b) current passing through the wire

(c) direction of current (d) all of above

3. The strength of magnetic field inside a long current carrying straight solenoid is:

(a) same at all points

(b) minimum in the middle

(c) found to increase from one end to the other

(d) more at the ends than at the centre.

4. For a current in a long straight solenoid N and S-poles are created at the two ends. Among the following statements, the incorrect statement is:

(a) The field lines inside the solenoid are in the form of straight lines which indicates that the magnetic field is the same at all points inside the solenoid

(b) The strong magnetic field produced inside the solenoid can be used to magnetise a piece of magnetic material like soft iron, when placed inside the coil

(c) The pattern of the magnetic field associated with the solenoid is different from the pattern of the magnetic field around a bar magnet

(d) The N-and S-poles exchange position when the direction of current through the solenoid is reversed

5. If the direction of current in the coil at one end of an electromagnet is clockwise.This end of the electromagnet will be:

(a) West pole b) north pole (c) South Pole (d) east pole

6. A soft iron bar is inserted inside a current-carrying solenoid. The magnetic field inside the solenoid:

(a) will decrease (b) will become zero (c) will remain the same (d) will increase

7. The magnetic field lines in the middle of the current-carrying solenoid are:

(a) parallel to the axis of the tube (b) perpendicular to the axis of the tube

(c) spirals (d) circles

8. The strength of magnetic field due to a solenoid depends on the:

(a) number of turns in the solenoid

(b) strength of current in the solenoid

(c) nature of core material

(d) all of the above

9. SI unit of magnetic field is

(a) webre (b) tesla (c) newton (d) henry

10. Magnetic field lines can be used to determine-

(a) only the direction of magnetic field

(b) only the relative strength of the magnetic field

(c) both the direction and relative strength of the magnetic field

(d) the shape of the magnetic field

ASSERTION REASON

1. Assertion : The magnetic field produced by a current carrying solenoid I is independent of its length and cross sectional area.

Reason : The magnetic field inside the solenoid is uniform.

2. Assertion : No net force acts on a rectangular coil carrying a steady current when suspended freely in a uniform magnetic field.

Reason : Forces acting on each pair of the opposite sides of the coil are equal and opposite.

3. Assertion : The direction of force is given by Fleming's left hand rule.

Reason : A magnetic field exert a force on a moving charge in the same direction as the direction of field itself.

4. Assertion : For a point on the axis of a circular coil carrying current, magnetic field is maximum at the centre of the coil.

Reason : Magnetic field is proportional to the distance of point from the circular coil.

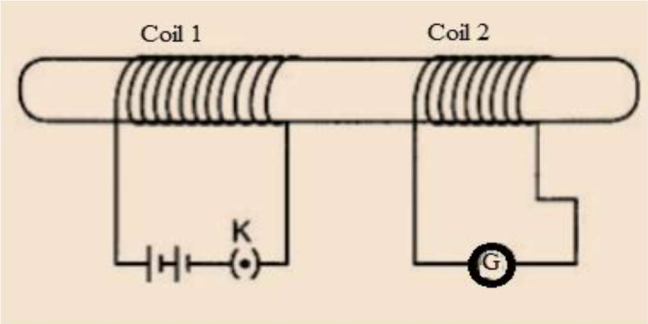
5. Assertion(A) : Alternating Current is used in household supply.
Reason (R) : AC electric power can be transmitted over long distances without much loss of energy.

VERY SHORT ANSWER QUESTIONS (2)

1. In the arrangement shown in figure there are two coils wound on a non-conducting cylindrical rod.

a) Initially the key is not inserted in the circuit.

b) Later the key is inserted and then removed shortly after.



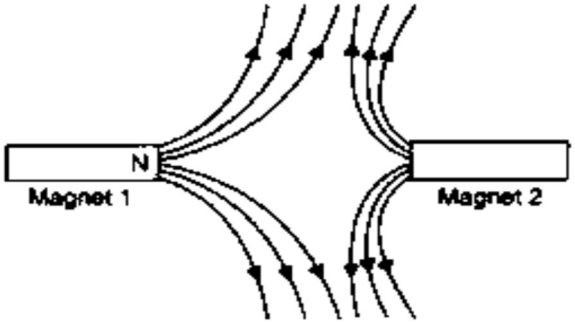
What are the two observations that can be noted from the galvanometer reading?

2. Draw the magnetic field lines around a straight current carrying conductor.

3. When a magnetic needle is brought near a current carrying conductor, it deflects. Why?

4. What does the closeness of field lines in a magnetic field signify?

5. The figure given below shows the magnetic field between two magnets:



(i) Copy the diagram and label the other poles of the magnets.

(ii)Which is the weaker magnet?

6. Name some source of direct current

7. Why does a compass needle get deflected when brought near a bar magnet?

8. What kind of magnetic field is produced by a current carrying circular loop?

9. List the factors affecting the strength of an electromagnet.

10. How does AC differ from DC? What are the advantages and disadvantages of AC over DC?

SHORT ANSWER QUESTIONS (3)

1. (a) What are the patterns formed by the circular loop carrying current?

(b) Which rule is used to find the direction of the magnetic field produced due to the electric current in a circular loop?

(c) On which factors does the strength of a magnetic field depend?

2. (a) Distinguish between a bar magnet and an electromagnet. (Any 2 points)

(b) State Fleming's left-hand rule.

3. What is usual colour code followed for connecting live, neutral and earth wires? Why is it so important?

4. Two circular coils 'X' and 'Y' are placed close to each other. If the current in the coil 'X' is changed, will some current be induced in the coil 'Y '? Give reason.

5. (a) What are the patterns formed by the circular loop carrying current?

(b) Which rule is used to find the direction of the magnetic field produced due to the electric current in a circular loop?

(c) On which factors does the strength of a magnetic field depend?

6. (a) Distinguish between a bar magnet and an electromagnet. (Any 2 points)

(b) State Fleming's left-hand rule.

7. State how the magnetic field produced by a straight current carrying conductor at a point depends on (a) current through the conductor (b) distance of point from conductor.

8. What is the function of an earth wire? Why is it necessary to earth metallic appliances?

9. Explain different ways to induce current in a coil.

10. Which rule is employed to find the direction of force on a current carrying conductor when kept in a magnetic field? State the rule and explain it by a diagram.

LONG ANSWER QUESTIONS

1. (i) Consider a conductor of resistance '*R*',length '*L*', thickness '*d* ' and resistivity '*ρ* '. Now this conductor is cut into four equal parts. What will be the new resistivity of each of these parts?

(ii) Find the resistance if all of these parts are connected in

(a) parallel (b) series

(iii) Out of the combinations of resistors mentioned above in the previous part, for a given voltage which combination will consume more power and why?

2. (i) With the help of a labelled diagram, explain the distribution of magnetic field due to a current through a circular loop. Why is it that if a current carrying coil

has n turns, the field produced at any point is n times as large as that produced by a single turn?

(ii) Draw a pattern of magnetic field formed around a current carrying solenoid. What happens to the magnetic field when the current through the solenoid is reversed?

3. (a) State Right Hand Thumb rule to find the direction of the magnetic field around a current carrying straight conductor.

(b) How will the magnetic field be affected on:

(i) increasing the current through the conductor

(ii) reversing the direction of flow of current in the conductor?

4. (a) A coil of insulated copper wire is connected to a galvanometer. With the help of a labelled diagram state what would be seen if a bar magnet with its south pole towards one face of this coil is

(i) moved quickly towards it,

(ii) moved quickly away from it,

(iii) placed near its one face?

(b) Name the phenomena involved in the above cases.

(c) State Fleming's left-hand rule.

5. How does a solenoid behave like a magnet? Can you determine the north and south poles of a current–carrying solenoid with the help of a bar magnet? Explain.

CASE BASED

1. The magnetic field at any point is the combined effect of the magnetic field due to the current in the wire and the magnetic field of the Earth. Iron filings when placed near the wire carrying current are arranged in circles due to the magnetic field produced by the current flowing through the wire. However, at the point far away from the wire, the magnetic field due to the earth is predominant as compared to the magnetic field due to current due to which the iron filings are arranged in straight lines. The point where the two fields are equal and opposite is called the neutral point. At the neutral point, the net magnetic field is zero and the compass needle at this point rests in any direction.

(a) How are the magnetic field lines at the point near the straight current-carrying conductor? [1]

(b) To what parameter is the magnitude of the magnetic field produced by the straight conductor directly proportional? [1]

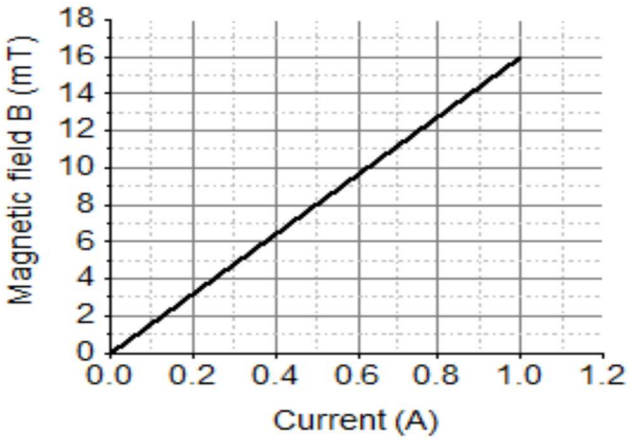
(c) Which rule is used to find the direction of the magnetic field produced by the straight current-carrying conductor? [2]

OR

What according to the rule will be the direction of the current when lines of the magnetic field are in the anti-clockwise direction?

2 A solenoid is a long helical coil of wire through which a current is run in order to create a magnetic field. The magnetic field of the solenoid is the superposition of the fields due to the current through each coil. It is nearly uniform inside the solenoid and close to zero outside and is similar to the field of a bar magnet having a north pole at one end and a south pole at the other depending upon the direction of current flow. The magnetic field produced in the solenoid is dependent on a few factors such as, the current in the coil, number of turns per unit length etc.

The following graph is obtained by a researcher while doing an experiment to see the variation of the magnetic field with respect to the current in the solenoid. The unit of magnetic field as given in the graph attached is in milli-Tesla (mT) and the current is given in Ampere



i. What type of energy conversion is observed in a linear solenoid?

a. Mechanical to Magnetic

b. Electrical to Magnetic

c. Electrical to Mechanical

d. Magnetic to Mechanical

ii. After analysing the graph a student writes the following statements.

I. The magnetic field produced by the solenoid is inversely proportional to the current.

II. The magnetic field produced by the solenoid is directly proportional to the current.

III. The magnetic field produced by the solenoid is directly proportional to square of the current.

IV. The magnetic field produced by the solenoid is independent of the current.

Choose from the following which of the following would be the correct statement(s).

a. Only IV b. I and III and IV c. I and II d. Only II

iii. From the graph deduce which of the following statements is correct.

a. For a current of 0.8A the magnetic field is 13 mT

b. For larger currents, the magnetic field increases non-linearly.

c. For a current of 0.8A the magnetic field is 1.3 mT

d. There is not enough information to find the magnetic field corresponding to 0.8A current.

iv. What will happen if a soft iron bar is placed inside the solenoid?

a. The bar will be electrocuted resulting in short-circuit.

b. The bar will be magnetised as long as there is current in the circuit.

c. The bar will be magnetised permanently.

d. The bar will not be affected by any means.

3. In 19th century, Hans Christian Oersted, one of the leading scientists played a crucial role in understanding electromagnetism. In 1820, he accidentally discovered that a compass needle got deflected when an electric current passed through a metallic wire. An electromagnet is a temporary magnet of soft iron which retains magnetism only when the current passes around it. Electromagnets are used in electric bell, telephone, electric motor, etc. Oersted showed that electricity and magnetism were related phenomena. His research later created technologies such as the radio, television and fibre optics.

i) Which of the following is not a part of an electromagnet?

(a) Iron (b) Toothpick (c) Power source (d) Wire

ii) How can Magnetism of a magnet be destroyed?

iii) How can strength of an electromagnet be increased?

iv) Which coil produces the strongest electromagnet for a given flow of current?

(a) A 5 cm coil with 200 turns

(b) A 10 cm coil with 200 turns

(c) A 20 cm coil with 200 turns

(d) A 10 cm coil with 100 turns

UNIT NAME: NATURAL RESOURCES

CHAPTER 7

I. OUR ENVIRONMENT

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KV BOKARO NO 01

CHAPTER: OUR ENVIRONMENT

ENVIRONMENT: It is defined as the surrounding conditions and elements with which a living thing interacts with.

Or

Environment can be defined as a sum of all the living and non-living elements and their effects that influence human life.

Living or biotic elements are animals, plants, forests, fisheries, and birds.

Non-living or abiotic elements are water, land, sunlight, air, and rocks.

Types of waste added by us to the environment

We generate mostly two types of waste by our different activities to our environment. They are

1. biodegradable waste and

2. non-biodegradable waste

Biodegradable waste: substances that are broken down by biological processes are said to be biodegradable.

Example: kitchen waste like spoilt food, vegetables peels, used tea leaves, waste paper etc.

Non-biodegradable waste: substances that are not broken down by biological process are said to be non-biodegradable.

Example: milk packets, empty medicine bottles/strips/bubble packs, plastic footwear, plastic carry bags etc.

These substances may be inert and simply persist in the environment for a long time or may harm the various members of the eco-system.

Harmful effects of biodegradable and bon biodegradable waste

1. The waste destroys the natural beauty and our surroundings become dirty.

2. Decomposition of these wastes results in the production of foul smell, which spreads to the surrounding areas.

3. These wastes may also block the drains creating pools of waste, which becomes the breeding sites of mosquitoes. The latter is carriers of diseases like malaria and dengue

ECOSYSTEM

All the interacting organisms in an area together with the non-living constituents of the environment form an ecosystem.

COMPONENTS OF ECOSYSTEM: Ecosystem consists of two components.

1.Biotic component: Biotic components comprising living organisms such as plants, animals, microorganisms, and human beings.

2. Abiotic components: Abiotic components comprising physical factors like temperature, rainfall, wind, soil, and minerals.

TYPES OF ORGANISMS ON THE BASIS OF OBTAINING THEIR SUBSTANCE FROM THE ENVIRONMENT

1. PRODUCERS: They are green plants, blue green algae some bacteria and minute free floating autotrophic organisms called phytoplankton. All of them possess chlorophyll. With the help of chlorophyll, they can absorb radiant energy of sun and use the same in building organic compounds from inorganic raw materials. The process is called photosynthesis. It releases oxygen. Organic compounds constitute the food not only for autotrophs but also for heterotrophs. Food consists of both body building and energy releasing chemicals. The energy contained in food is chemical energy.

Functions in Ecosystem:

i. Producers trap solar energy and change the same into chemical energy.

ii. They manufacture food from inorganic raw materials for body building and energy liberation.

iii. Producers provide food and its contained energy to the other biotic components.

iv. They initiate food chains.

v. Producers pick up CO_2 and release O_2. They therefore, maintain the concentration of the two gases.

2. Consumer: They are organisms which feed on other organisms. Consumers are of four types: -

i. Herbivores: They are organisms which directly feed on plants. e.g.-deer, rabbit, goat, zooplanktons, etc.

ii. Carnivores: They are organisms which prey upon other animals and feed on their flesh. e.g.- frog, lion, tiger, shark, etc.

iii. Omnivores: They are organisms which eat both plant and animals. e.g.- cockroach, humans, crow, etc.

iv. Parasites: They are organisms which rely on other organisms (host) for their nutrition. e.g.- cuscuta, tapeworm, lice, leech etc.

Functions in Ecosystem:

i. They provide biological control over the population of producers and different levels of consumers.

ii. Many consumers help producers in pollination and fruit dispersal.

3. Decomposers: They are saprophytes which obtain their nourishment from organic remains. e.g.- many bacteria, many fungi.

Functions in Ecosystem:

i. Decomposers are natural scavengers as they cleanse the earth of organic remains.

ii. They create space for newer generations of organisms.

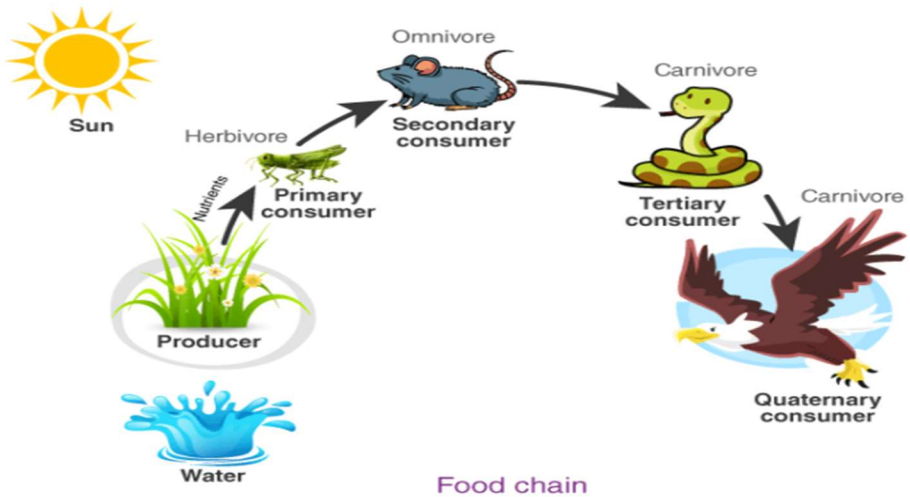
iii. Decomposers release minerals and other raw materials trapped in organic matter. A continued replenishment of these raw materials is essential for growth of plants and hence maintenance of ecosystem.

FOOD CHAIN AND WEBS

Food Chain: Food chain is a sequence of organisms in a biotic community through which food passes with members of a step becoming food of the next step of the sequence.

e.g.- i. Grass→ grasshopper→ frog → eagle

ii. Phytoplankton → zooplanktons → small fishes → big fishes



Food chain

Each step or division in food chain which is characterised by a particular method of obtaining field is called trophic level. A food chain contains 3-4 trophic level:

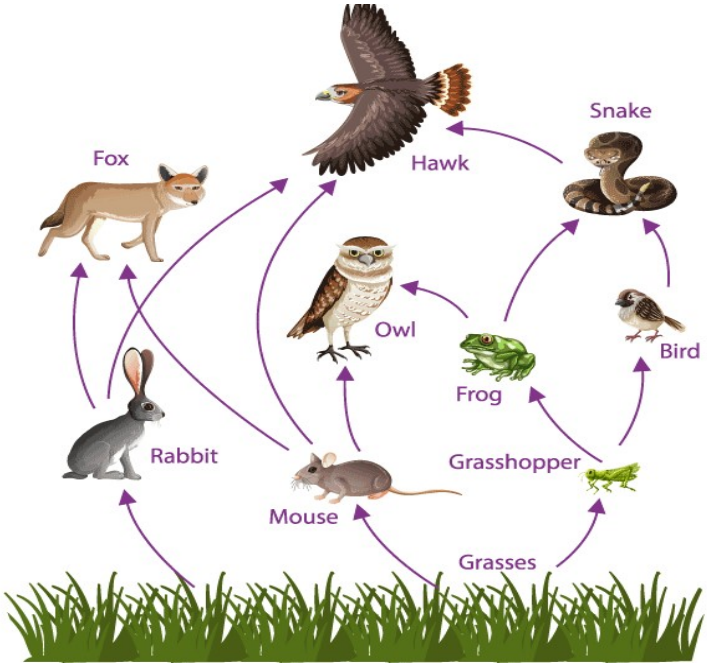
i. Producers

ii. Herbivores or Primary consumers)

iii. First order (Primary) Carnivores or Secondary Consumers

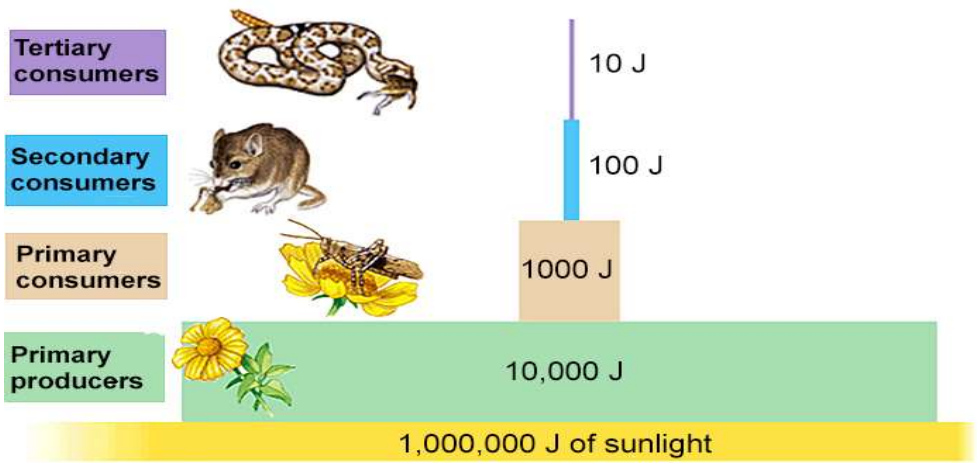
iv. Second Order (Secondary) Carnivores or Tertiary Consumers.

Food Web: Food web is a network of food chins operating in an ecosystem which get connected at various trophic levels to form a few feeding connections amongst different organisms of the biotic community.



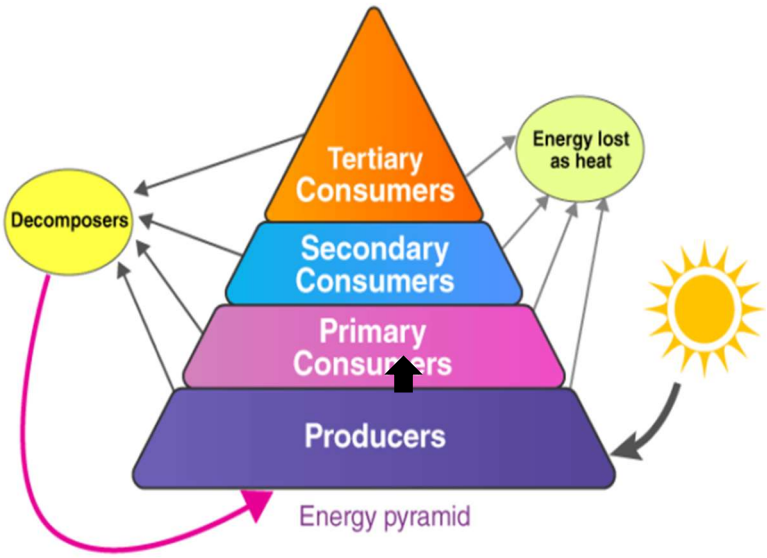
ENERGY FLOW

- The green plants in a terrestrial ecosystem capture about 1% of the energy of sunlight that falls on their leaves and convert it into food.
- When green plants are eaten by primary consumer, a great deal of energy is lost as heat to the environment, some amount goes into the digestion and in doing work and the rest goes towards growth and reproduction. An average of 10% of the food eaten is turned into its own body and made available for the next level of consumers.
- Therefore, 10% is the amount of organic matter that is present at each step and reaches the next level of consumers.



- Since so little energy is available for the next level of consumers, food chains generally consist of only three to four steps. The loss of energy at each step is so great that very little usable energy remains after fourth trophic level.

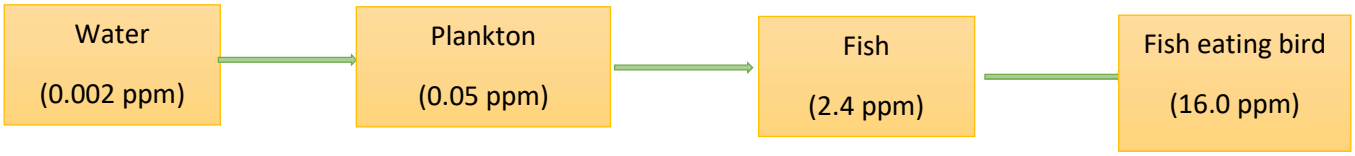
Pyramid of Energy: It is a graphical representation of the amount of energy contained sequence-wise in different trophic levels of food chain with producers forming the base and top carnivores the tip.



BIOLOGICAL MAGNIFICATION OF HARMFUL CHEMICALS

The increase in concentration of chemical per unit weight of the organisms with the successive rise in trophic level is called biological magnification.

For example, when we use pesticides and other chemicals (e.g., DDT) to protect our crop, these chemicals are either washed down into the soil or into the water bodies. From the soil these gets absorbed by the plants with water and minerals, and from the water bodies these are taken up by the aquatic plants and animals. As, these chemicals are non-biodegradable these gets accumulated progressively at each trophic level. As human beings occupy top level of each food chain, the maximum concentration of these chemicals get accumulated in our bodies.



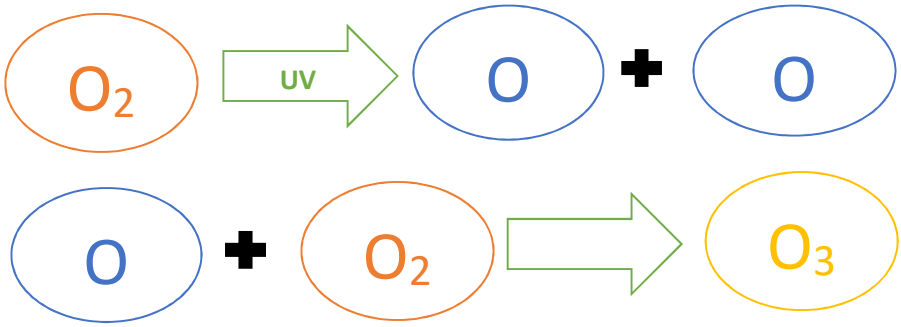
OZONE LAYER

- Ozone is a triatomic molecule of oxygen.
- Most of the ozone is found in the stratosphere whereas very little amount is also found in the troposphere of the atmosphere.

- Ozone is a deadly poison.
- It shields the surface of earth from ultraviolet (UV) radiations from the Sun, which is highly damaging to organisms, for example, it causes skin cancer in human being.

Formation:

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



Depletion:

- The amount of ozone in the atmosphere began to drop sharply in 1980s.
- A spring time ozone hole was discovered over Antarctica in 1985.
- Chemicals like chlorofluorocarbons (CFCs) which are used as refrigerants and in the fire, extinguishers are the main cause of depletion.
- In 1987, the United Nations Environment Programme (UNEP) succeeded in forging an agreement to freeze CFC production at 1986 levels.

Effects of Depletion:

i. Cancers- The incidence of skin cancer will increase.

ii. Eye sight- There will be dimming of eye sight, photo burning and higher incidence of cataract. A large no. of land animal will become blind.

iii. Mutation- More mutation will occur, and most of them will be harmful.

iv. Photosynthesis- 10-25% decline in photosynthesis would occur.

v. Global Warming- Reduced photosynthesis will increase CO_2 concentration causing global warming.

GARBAGE MANAGEMENT

Garbage: Garbage is refused of food, vegetables, and food articles along with other domestic wastes.

Garbage Management: It is the non-pollutant disposal of the waste. It consists of three steps:

i. Collection of garbage.

ii. Transport of garbage from collection sites to disposal sites.

iii. Disposals of garbage. Prior to disposal, components of garbage are separated into decomposable, recyclable, combustible, and non-combustible components.

- Recyclable components are generally taken away by rag pickers.
- A quantity of decomposable waste is eaten by pigs and cattle.
- The remaining decomposable waste is composted. Combustible component is disposed of through burning, incineration, and pyrolysis.
- The non-combustible waste is used in landfills.

Green and Blue Coloured Bins: All residential and commercial establishments are required to keep two types of bins segregation of wastes at initial stage-

- Green coloured bin for biodegradable article.
- Blue coloured bins for non-biodegradable wastes.

SUMMARY

Ecosystem: It consists of biotic components and abiotic components.

COMPONENT OF ECOSYSTEM

BIOTIC COMPONENT	ABIOTIC COMPONENT
Living Organisms	Temperature Wind Rainfall Soil Minerals

TYPES OF ECOSYSTEM

ARTIFICIAL ECOSYSTEM	NATURAL ECOSYSTEM
Aquarium Agricultural field Zoos	Ocean Forest Grassland

TYPES OF LIVING ORGANISMS

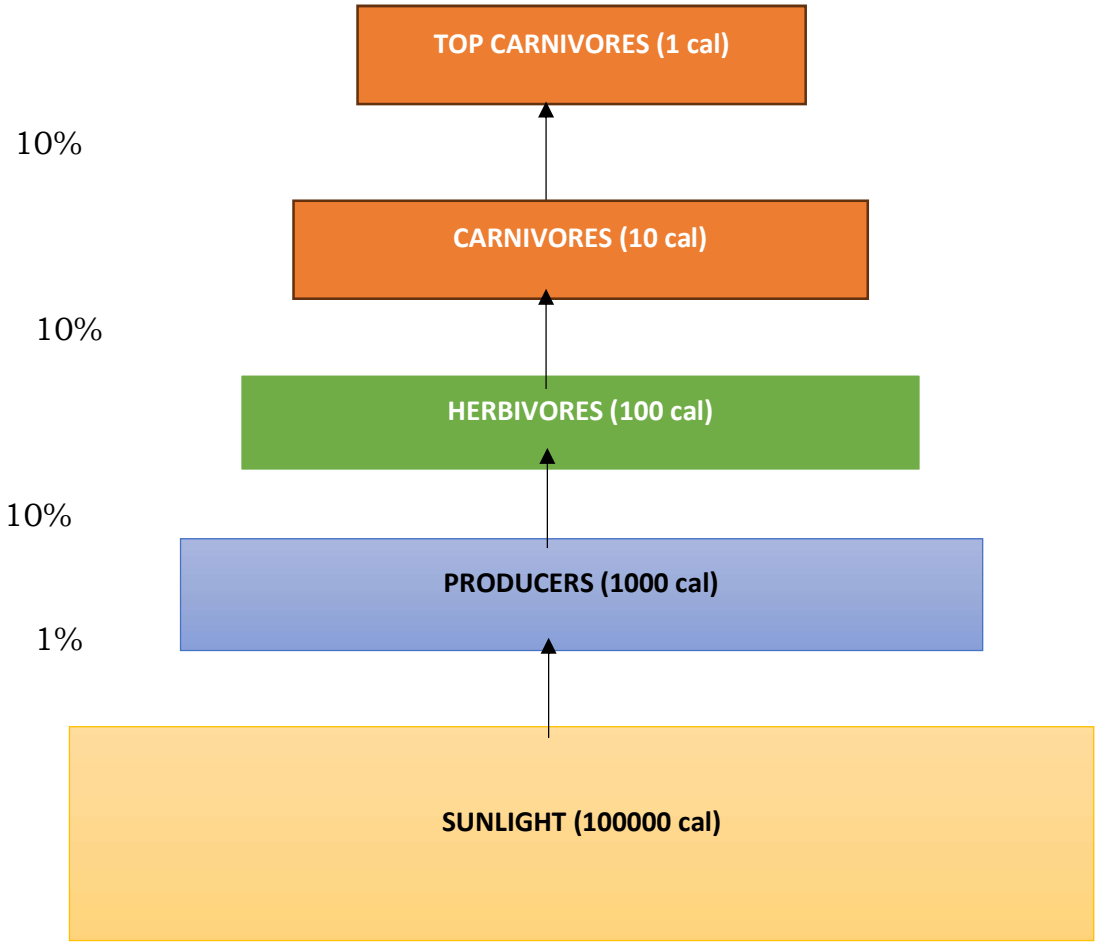
PRODUCERS	CONSUMERS			DECOMPOSERS
	HERBIVORES	CARNIVORES	OMNIVORES	
Which makes their own food	Which directly depend on plant for their food.	Which eat flesh of other animals.	Which eat both plant and animal product	They depend on dead decaying organic matter for nutrition.
e.g., green plants, algae, certain bacteria	e.g., goat, sheep.	e.g., tiger, lion.	e.g., human, dog.	e.g., some bacteria and fungi.

FOOD CHAIN AND FOOD WEB

	FOOD CHAIN	FOOD WEB
Units	It consists of single unit of food relation.	It is complex formed by several units of food relations.
Sequence	It is a straight sequence of organisms.	It is a network of many linkages among the connected food chains.

Population	It has maximum of 4-6 populations of different species.	It consists of numerous populations of different species.
Food	Only one type of organism is used as food by a particular type of organism.	An organism can use two to several types of organisms as food.
Disturbance	A disturbance in food chain is difficult to overcome.	A disturbance is overcome after some time.
Endangered Sp.	It does not help in restoring population of endangered sp. Rather it may decline further.	It helps in increasing population of endangered species.

ENERGY FLOW



TYPES OF WASTE

	BIODEGRADABLE WASTE	NON-BIODEGRADABLE WASTE
Origin	They are biological in origin.	They are commonly man-made
Degradability	The wastes are degraded by microorganism.	They are not degraded by microorganism
Accumulation	They do not accumulate in nature.	They pile up and accumulate in nature.
Biomagnification	They do not show biomagnification.	The soluble nondegradable wastes enter food chains and undergo biomagnification.
Resources	The waste can be converted into resources.	Some waste can be recycled.
Example	Garbage, livestock waste, sewage.	Plastic, glass, nickel, several pesticides.

WASTE MANAGEMENT

GREEN BIN	BLUE BIN
Use for wet waste	Use for dry waste
Kitchen and other plant and animal waste	Recyclable Waste
Ex- vegetable and fruit peels	Ex- newspaper, bottles, food tin

DISPOSABLE CUPS

PROS	CONS
They were hygienic	They are non-biodegradable
They reduced the chances of contamination.	They can't be burnt down as they release toxic gases.
	Their dumping place became sites of infection

ALTERNATIVES

KULHADS	PAPER CUPS
They are ecofriendly but making lakhs of khulhads daily resulted in idling of fertile land and taking out its top soil.	They are biodegradable and can also be recycled as well as burnt down.

OZONE FORMATION

$O_2 \xrightarrow{UV} [O] + [O]$

$O_2 + [O] \longrightarrow O_3$

CAUSES OF OZONE DEPLETION

(i) Use of ozone depleting substances like chlorofluorocarbons.

(ii) Unregulated rocket launches

(iii) Nitrogenous compounds as NO_2, NO, N_2O

EFFECTS OF OZONE DEPLETION

(i) Cancer

(ii) Harmful Mutations

(iii) Death of young ones

(iv) Blinding of animals

(v) Global Warming

STEPS TAKEN TO CONTROL OZONE DEPLETION

(i) Montreal Protocol (1987): UNEP succeeded in forging an agreement to freeze CFCs production at 1986 levels.

(ii) Helsinki Declaration (1989): Most nations pledge to phase out CFCs and halons by 2000

MULTIPLE CHOICE QUESTIONS (MCQs)

1. **Which one of the following in an artificial ecosystem?**

(a) Pond

(b) Crop field

(c) Lake

(d) Forest

2. **In a food chain, the third trophic level is always occupied by**

(a) Carnivores

(b) Herbivores

(c) Decomposers

(d) Producers

3. An ecosystem includes

(a) All Living organisms

(b) Non-living objects

(c) Both living organism and non-living objects

(d) Sometimes living organisms and sometimes non-living objects

4. In the given food chain, suppose the amount of energy at fourth trophic level is 5kJ, what will be the energy available at product level?

Grass → Grasshopper → Frog → Snake → Hawk

(a) 5 kJ

(b) 50 kJ

(c) 500 kJ

(d) 5000 kJ

5. Accumulation of non-biodegradable pesticides in the food chain in increasing amount at each higher trophic level is known as

(a) Eutrophication

(b) Pollution

(c) Biomagnification

(d) Accumulation

6. Depletion of ozone is mainly due to

(a) Chloroflurocarbon compounds

(b) Carbon monoxide

(c) Methane

(d) Pesticides

7. Organisms which synthesise carbohydrates from inorganic compounds using radiant energy are called

(a) Decomposers

(b) Producers

(c) Herbivores

(d) Carnivores

8. In an ecosystem, the 10% of energy available for transfer from one trophic level to the next is in the form of

(a) Heat energy

(b) Light energy

(c) Chemical energy

(d) Mechanical energy

9. Organisms of a higher trophic level which feed on several types of organisms belonging to a lower trophic level constitute the

(a) Food web

(b) Ecological pyramid

(c) Ecosystem

(d) Food chain

10. Flow of energy in the ecosystem is always

(a) Unidirectional

(b) Bidirectional

(c) Multi directional

(d) No specific direction

11. At which trophic level is maximum energy available?

(a) T4

(b) T2

(c) T1

(d) T3

12. What will happen if deer is missing in the food chain

Grass → Deer → Tiger

(a) The population of deer increases

(b) The population of grass decreases

(c) Tiger will start eating grass

(d) The population of tiger decreases and population of grass increases

13. **Soil fertility is determined by its ability to**

(a) Decay organic matter (b)Hold organic matter

(b) Hold up water (c) Support life

14. **Food Web is constituted by**

(a) Relationship between the organisms and the environment

(b) Relationship between plants and animals

(c) Various interlinked food chains in the ecosystem

(d) Relationship between animal and environment

15. **How much of the net primary productivity of a terrestrial ecosystem is eaten and digested by herbivores?**

(a) 100%

(b) 10%

(c) 1%

(d) 0.1%

ANSWERS

1. B
2. A
3. C
4. D
5. C
6. A
7. B
8. C
9. A
10. A
11. C
12. D
13. D
14. C
15. B

ASSERTION AND REASON TYPE QUESTIONS

For questions below, two statements are given-

One labelled Assertion (A) and the other labelled Reason (R). Select the correct answer (a), (b), (c) and (d) as given below:

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

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

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

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

1. (A) : Used tea leaves are non-biodegradable

   (R) : They can be disposed off by decomposers.

2. (A) : Zooplanktons feed on phyto-plankton.

   (R) : Phyto-plankton are the major producers of aquatic ecosystems.

3. (A) : Herbivores are consumers of first order.

   (R) : They feed on other herbivores.

4. (A) : Decomposition of organic remains is essential for continued life on earth.

   (R) : There is low mineralisation.

5. (A) : Number of top carnivore is very large.

   (R) : They are not preyed upon the other.

6. (A) : Green coloured bins are meant for dumping of biodegradable wastes.

   (R) : The bins are fitted with decomposer kits.

7. (A) : Concentration of carbon dioxide in the atmosphere is rising.

   (R) : Oceans are emitting a lot of carbon dioxide into the atmosphere.

8. (A) : Decomposers are macroconsumers.

   (R) : They feed on organic matter and release mineral for circulation.

9. (A) : Food chain is a straight chain of trophic level.

   (R) : A network of several food chains constitute a food web.

10. (A) : Producers constitute the first trophic level.

    (R) : Frog is a herbivore.

ANSWERS

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

CASE STUDY BASED QUESTIONS

1. **Food web is a network of food chains operating in an ecosystem which are connected to one another at various trophic levels. It provides stability to ecosystem, recovery from depletion, checking overpopulation and preventing starvation in case there is decrease in no. of lower trophic level. In food web each organism has a choice of eating two to many kinds of organisms while it can also be eaten by no. of predators. Rabbit is prey for fox, jackals, hawk, and other carnivores. Deer is a prey for jackals, wolfs, and tigers. A wolf can feed on fox, jackals, wild cat, and deer. If the population of species decreases, the predator shall start eating other animals. Meanwhile the threatened species recovers and the ecological balance restores.**

(a) Several sources of food are provided in a

(i) Food chain

(ii) Food web

(iii) Trophic level

(iv) Detritus

(b) Wolf preys upon

(i) Fox and jackal

(ii) Goat and deer

(iii) Wild cat and rabbit

(iv) All of the above

(c) What is the defect in an unaccounted food chain?

(i) There is a single choice of prey

(ii) It is unstable

(iii) It is prone to dislocation

(iv) No defect, it is superior to food web.

(d) A prey population gets depleted. What is its effect on ecosystem?

(i) Temporary depletion followed by recovery

(ii) Not much effect on predator

(iii) Little disturbance in ecosystem

(iv) All the above

2. India today is facing the problem of overuse of resources, contamination of soil and water and lack of methods of processing the waste. The time has come for the world to say goodbye to "Single use plastics." Steps must be undertaken to develop environment-friendly substitutes, effective waste collection and methods of its disposal. Indore treated 15 lakhs metric tonnes of waste in just 3 years, through biomining and bioremediation techniques. Bioremediation involves introducing microbes into a landfill to naturally break it down and biomining involves using trommel machine to sift through the waste to separate the soil and the waste component. The city managed to chip away 15 lakh metric tonnes of waste at a cost around <10 crores. A similar experiment was successfully carried out in Ahmedabad also.

(a) State two methods of effective plastic waste collection in your school.

(b) Name any two uses of "single use plastic" in daily life.

(c) If we discontinue the use of plastic, how can an environment friendly substitute be provided?

(d) Do you think microbes will work similarly in landfill sites as they work in laboratory? Justify your answer.

3. In nature a system operates that keeps the population of different species under check. This is even though animals of lower trophic level are prolific breeders. For example, a rabbit pair can give up to 30 offspring in a year while a mice pair can produce up to 60 of them. The number of offspring born per year decreases with the rise in trophic level. A tigress will bear 2-3 cubs after interval of two years.

(a) Which one produce more offspring?

(i) Herbivores

(ii) Primary carnivores

(iii) Secondary carnivores

(iv) Tertiary carnivores

(b) Plants protect themselves from herbivores by

(i) Bristles, spines, and thorns

(ii) Poisonous glucosides

(iii) Bitter alkaloids

(iv) All the above

(c) Biocontrol of population is maintained by

(i) Number of offspring/fecundities

(ii) Predation

(iii) Availability of food

(iv) Recycling of nutrients

(d) A tigress gives birth to only 2-3 cubs once two years. A female rabbit gives birth to 30 offspring in a year. The reason is:

(i) Increase availability of food to rabbit and reduced food to tigress

(ii) Rabbits constitute preys for a number of carnivores

(iii) Biomass decreases with rise in trophic level

(iv) Flow of energy is unidirectional

ANSWERS

1. (a) – (ii), (b) – (iv), (c) – (i), (d) – (iv)
2. (a) (i) Separation of biodegradable and non- biodegradable waste

   (ii) Use of separate bins for plastic

   (b) (i) Packing water, milk, food, biscuits.

   (ii) disposable bowls, tumblers, plates, spoons etc.

   (c) (i) Use of paper article like cups

   (ii) earthen pots and utensils

   (iii) cloth and jute

   (d)Yes. Whether in laboratory or in landfill, microbes will work similarly.
3. (a) – (i), (b) – (iv), (c) – (ii), (d) – (ii)

SHORT ANSWER QUESTIONS (SAQs)

1. **Construct an aquatic food chain showing four trophic level.**

A) Phytoplankton → Zooplankton → Small carnivorous fish → Large carnivorous fish

2. **Explain biological magnification with the help of an example.**

A) **Biological magnification is the increase in the concentration of a chemical per unit weight of the organisms with the successive rise in trophic level. For example, concentration of harmful chemical like DDT will increase 80,000 times the concentration present in water**.

Water	→	Plankton	→	Fish → Fish eating birds
(0.02 m)		(0.05ppm)		(2.4ppm) (16.0ppm)

3. **Mention the basis of classifying substances as biodegradable and non-biodegradable. Give two examples each**.

A) Substances are classified into biodegradable and non-biodegradable on the basis of their disposability or non-disposability by saprophytic organisms.

Biodegradable: Used tea leaves, waste paper.

Non-biodegradable: DDT, silver/aluminium foil.

4. **List two reasons to show that the existence of decomposers is essential in an ecosystem?**

A) (i) They function as saprophytes and cleanse the earth of organic matter.

(ii) Decomposers release minerals tied up in organic remains. Thus, they help in recycling of biogeochemicals.

5. **Recycling is considered as a welcome practice to deal with the environmental problems. Justify the statements with two arguments.**

A) Recycling is considered as a welcome practice to deal with the environmental problems due to the following reasons:

(i) Process of recycling reduces the use of landfills.

(ii) Recycling reduces the extra energy consumption.

(iii) Recycling reduces the spreading and ill-effects of pollution

(iv) Recycling is cheaper and significantly cost savings.

6. **It is said that there is need to put a complete ban on the products containing aerosols. What are aerosols? Why is there a demand to put a ban on them?**

A) Aerosols are the mist producing propellants used in sprays like deodorant, perfumes, after shaves etc. They are commonly made of chlorofluorocarbons which are the strongest ozone depleting substances. Therefore, there is a demand of putting a ban on them.

7. (a) Complete the following table

	Oxygen	Ozone
Formula	(i)	(ii)
Benefits to biotic components	(ii)	(iv)

(b) How is Ozone formed at higher level of atmosphere?

A) (a) (i) O_2 (ii) O_3

(iii) Respiration

(iv)Protection

(b) Ozone is formed at higher levels of atmosphere through action of UV radiations on oxygen.

$$O2 \xrightarrow{UV} [O] + [O]$$

$$O_2 + [O] \longrightarrow O_3$$

8. Food web is shown as the series of branching lines of food chains. Explain and justify the statements.

A) Food web is a network of food chains occurring in an ecosystem which gets connected at different trophic levels so as to form feeding connections or alternatives amongst different organisms of the community. Because the food chains are connected at different trophic levels, connectives appear as branching lines of food chains.

9. (a) Construct a terrestrial food chain comprising four trophic levels.

(b) What will happen if we kill all the organisms in one trophic level?

(c) Calculate the amount of energy available to the organisms at the fourth trophic level if the energy is available at the second trophic level is 2000J.

A) (a) Grass $\longrightarrow$ Grasshopper $\longrightarrow$ Frog $\longrightarrow$ Snake

(b) Organisms of higher trophic level will die due to starvation while those of the lower trophic level will increase in number beyond the carrying capacity of the ecosystem.

(c) $T_2 \longrightarrow T_3 \longrightarrow T_4$

2000J 200J 20J

10. (a) Write two harmful effects of using plastic bags on the environment. Suggest alternatives to the usage of plastic bags.

(b) List any two practices that can be followed to dispose off the wastes produced in our homes.

A) (a) Harmful effects of using plastic bags:

(i) Being non-biodegradable the used plastic bags accumulate, contaminate land and water.

(ii) They block drainage system.

(iii) Burning for recycling produces toxic fumes. Alternatives to plastic bags:

(i) Use of cloth/jute/paper bags

(ii) Use of metallic and glass container

(b) (i) Separation of biodegradable and non-biodegradable wastes.

(ii) Use of biodegradable wastes for composting.

LONG ANSWER QUESTIONS

1. **We often observe domestic waste decomposing in the bylanes of residential colonies. Suggest ways to make people realize that the improper disposal of waste is harmful to the environment.**

A) Domestic waste is often thrown outside the living quarters or some common place near the homes for municipal staff to pick up and dispose the same. The waste is however, spread by stray cattle, pigs and dogs and is left to decompose. It is an improper method of waste disposal being harmful to environment as well as to all of us. It produces stink and becomes a source of several disease. The scattered decomposing waste attracts flies, mosquitoes, and rats.

Therefore, a proper waste disposal method involving biodegradable in covered green bins and non-biodegradable in covered blue bins be adopted. The municipal staff can take the wastes from the bins

2. **"Damage to the ozone layer is a cause of concern." Justify the statement. Suggest any two steps to limit the damage**.

A) Cause of concern: Ozone layer present in the stratosphere has thinned out by about 8% over the equator and more so over the antarctica where a big ozone hole appears every year. This has increased the level of UV radiations reaching the earth by 15-20%. These radiations are causing increased number of skin cancers, cataracts and reduced immunity in human beings. There is increased number of blinding of animals, death of young

ones, reduced photosynthesis, higher number of mutations and damage to articles. Steps to limit the damage:

(i) Ban on productions and use of halons

(ii) Ban on production and use of chlorofluorocarbons.

3. Students in a school listened to the news 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 a 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 arrive at two main points- one is self-management of the garbage we produce and second is generate less garbage at individual level.

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

(b) As an individual what can be done to generate the least garbage? Give two points.

(c) List two values the teacher instilled in his student in this episode.

A) (a) Managing the garbage:

(i) Separation of garbage into biodegradable and non-biodegradable, recyclable and non-recyclable parts.

(ii) Handing over the recyclable waste to ragpickers and the rest are given to waste collectors for compost formation, incineration and land filling.

(b) Generate least garbage:

(i) Use of cloth bags for shopping instead of polythene or plastic bags.

(ii) Reuse of glass and metallic containers instead of disposing them.

(C) The values instilled by the teacher in the students are:

(i) Proper disposal of garbage

(ii) Generate less garbage.

(iii)Keep the environment clean for healthier living.

4. What are decomposers? What will be the consequences of their absence in an ecosystem?

A) Definition: Decomposers are saprophytes which obtain their nourishment from organic remains by secreting digestive enzymes over the latter and absorbing the solubilized substances.

Absence of decomposers:

(i) Organic remains will pile up leaving no space for new living beings.

(ii) Biochemical cycling will stop so that raw materials will not be available to plants for manufacture of more food.

(iii) In the absence of food, all living beings will die of starvation.

5. How will you create an artificial aquatic ecosystem which is self-sustainable?

A) The requirements of creating an artificial aquatic ecosystem are a large jar filled initially with pond water, aquatic plants, aquatic animals such as fishes, food for animals, light and oxygen. Pond water contains decomposers so that the need for regular cleanliness is not required. Aquatic plants perform photosynthesis and remove CO_2 release by animals in their respiration. They also release oxygen. Aquatic animals can feed on vegetation as well as food provided in the jar. The organic matter released as waste by plants and animals is removed by decomposers.

VERY LONG ANSWER QUESTIONS

1. (a) What are trophic levels in a food chain?

(b) Explain the flow of energy through food chain.

(c) Write a four trophic level food chain and represented in the form of an ecological pyramid.

A) (a) Trophic level: They are steps or divisions of food chain which are characterised by particular methods of obtaining food, e.g., producers (T_1), herbivores (T_2), primary carnivores (T_3) etc.

(b) Flow of energy through food chain: Energy enters in the food chain through producers. Producers or green plants trap solar energy and convert it into chemical energy of food during photosynthesis. From producers' energy passes into herbivores. A lot of energy dissipates during transfer and utilization of food energy by herbivores (10% law). From herbivores the food energy passes into primary carnivore, again with a lot of dissipation. Only about 10% of herbivore energy is passed into body mass of primary carnivores. From primary carnivores, nearly 10% energy passes into secondary carnivores and so on. It is ultimately lost as heat.

Sun $\xrightarrow{1\%}$ Producers $\xrightarrow{10\%}$ Herbivores $\xrightarrow{10\%}$ Pri. Carnivores $\xrightarrow{10\%}$ Sec. Carnivores

100000 cal 1000 cal 100 cal 10 cal 1 cal

(c)Aquatic four trophic Level food chain:

Phytoplanlton → Zooplankton → Small Carnivorous fish → Large carnivorous fish.

2. Name the wastes which are generated in your house daily. What measures would you take for their disposal?

A) Waste:

(i) Vegetables and fruit peels and rind, stale food, food leftovers, used tea leaves.

(ii) Milk pouches, polythene bags, empty cartons.

(iii) Waste paper (newspaper, bags, envelope), packing paper, empty bottles, torn cloth pieces, etc.

(iv) Dust and other sweepings.

Disposals:

(i) Separation into biodegradable and non-biodegradable, recyclable and non-recyclable waste.

(ii) Recyclable waste (waste paper, cloth, polythene, cartons, bottles, cans etc) can be given to rag pickers for recycling.

(iii) Preparation of compost or vermicompost from kitchen wastes for home garden (kitchen garden).

(iv) In the absence of kitchen garden, the household garbage and other wastes can be given to waste collectors for disposal.

3. Explain some harmful effects of agricultural practices on the environment.

A) (i) Soil: Fertilizer added to soil not only changes the chemistry of the soil but also kills many useful microbes.

(ii)Ground water: A part of fertilizer always leaches down into the soil and reaches ground water. It raises the salt content of ground water.

(iii)Eutrophication: Run-off from fields sprayed with fertilizer reaches waterbodies. It results in their eutrophication.

(iv) Pesticides: Pesticides sprayed over crops reach water bodies killing the biota. Persistent pesticides undergo biomagnification and prove highly harmful to higher organisms.

(v) Ground Water: Continued use of ground water in agriculture has resulted in lowering of water table at most of the places.

(vi) Irrigation: It causes water-logging and salination of soils.

(vii) Damage to Nature: Natural ecosystems and habitats have been damaged during clearing land for agriculture.

CHAPTER 8

CONTROL AND CO-ORDINATION IN ANIMALS AND PLANTS

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CHAPTER-CONTROL AND COORDINATION

Living organisms show response to various stimuli like heat, light, cold, touch, pressure etc

Stimulus: -The change in the environment to which an organism responds and reacts is called stimulus. Control & coordination in animals takes place by Nervous system and Endocrine system

Response: The reaction of our body to a stimulus. E.g. withdrawal of our hand on touching hot object

Coordination- The working together of various organs of the body of an organism in a proper manner to produce appropriate reaction to a stimulus is called coordination.

Receptors: Are specialized tips of some nerve cells that detect the information from the environment

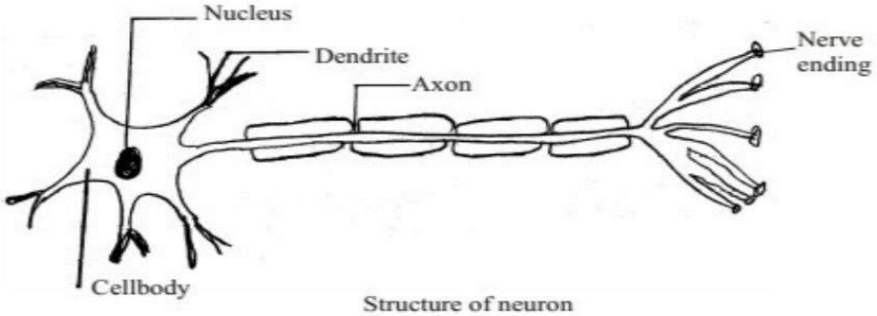
Nervous system consists of: -a) Brain b) Spinal cord c) Nerves

It receives information from environment and various body parts and acts accordingly through muscles and glands

Neuron: -Is the structural and functional unit of Nervous system. It is an electrically excitable cell in the nervous system that functions to process and transmit information.

The different parts of Neuron: - a) Dendrites, b) cell body c) Axon

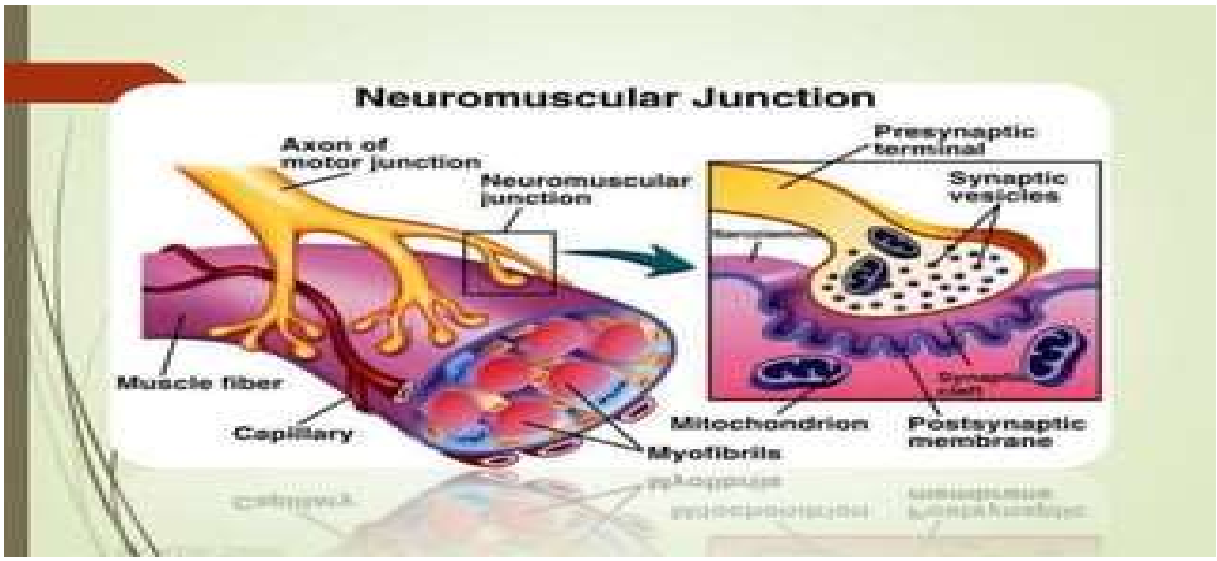
Synapse: - Junction between two adjacent nerves the axon (nerve fibre) transmits electrical signals from the cell body. The dendrites are branching fibres that receive electrical signals from other neurons. The shape of a neuron is determined by the job it does.



Structure of neuron

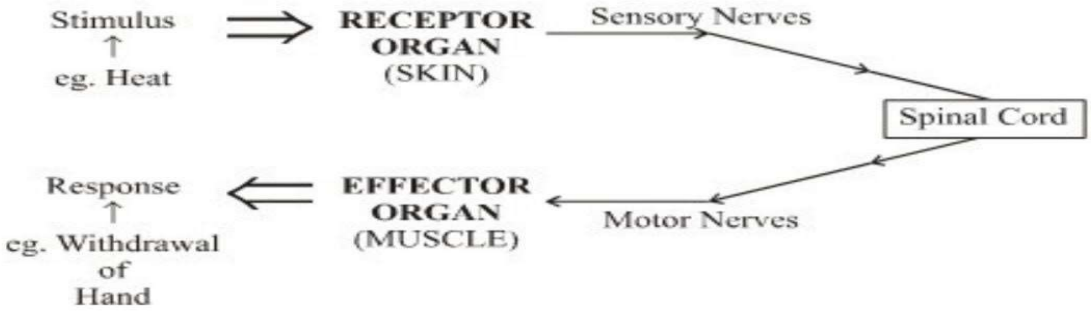
Synapse: The point of contact between the terminal branches of axon of one neuron with the dendrite of another neuron is called synapse

Neuromuscular junction (NMJ): A synaptic connection between the terminal end of a motor nerve and a muscle (skeletal/ smooth/ cardiac). It is the site for the transmission of action potential from nerve to the muscle.



Reflex Action- Spontaneous, involuntary and automatic response to stimulus to protect us from harmful situations. E.g. On touching a hot object unknowingly, we instantly withdraw our hand

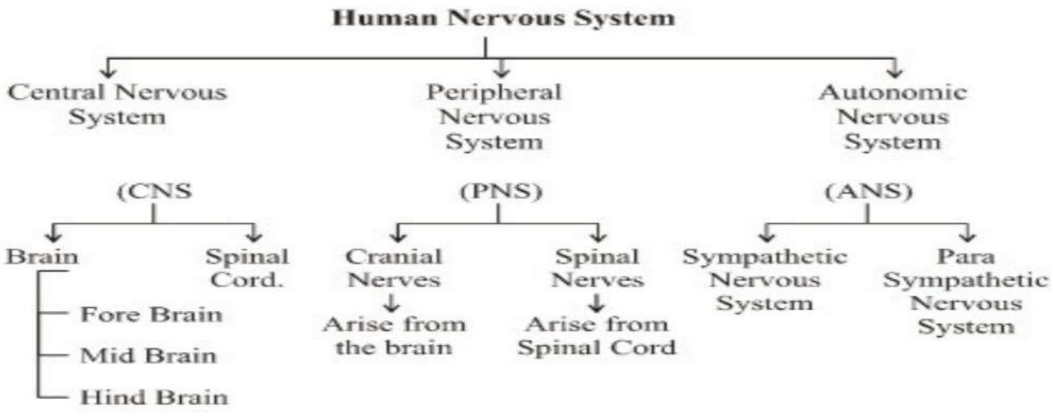
Reflex arc: The pathway taken by nerve impulses in a reflex action is called reflex arc. Voluntary means it is under the control of a person (e.g. writing) Involuntary means it is not under the control of a person. (e.g. Heartbeat)



NERVOUS SYSTEM Consists of

(1) Central Nervous System (CNS)

(2) Peripheral Nervous System (PNS)is further divided into (i) Autonomic Nervous System (ii) Voluntary Nervous System.



CENTRAL NERVOUS SYSTEM

Human Brain is enclosed in cranium (brain box) and is protected by cerebrospinal fluid which acts as a shock absorber. Human brain has three major parts or regions: (a) Fore-brain (b) Midbrain (c) Hindbrain The functions of brain are

(ii) Centre of coordination of all activities (ii) Thinking processes (iii) Complex process

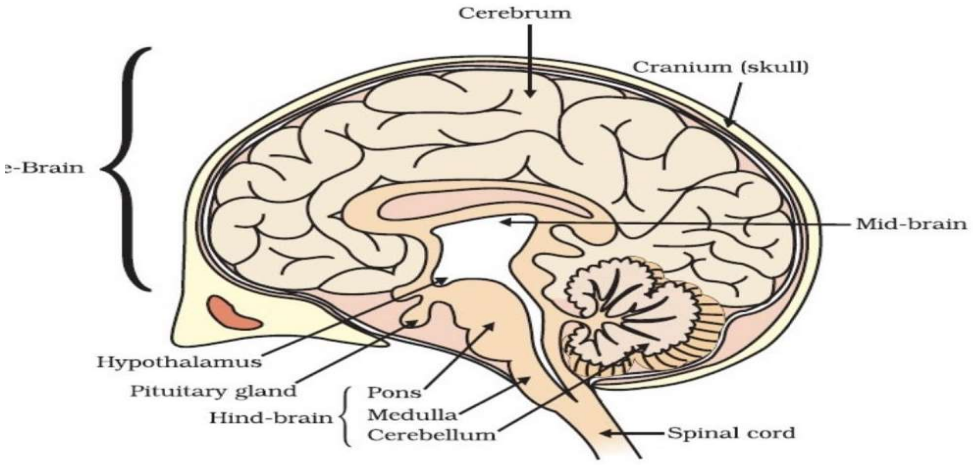


Figure 7.3 *Human brain*

Forebrain or Cerebrum-

Main thinking and largest part of the brain which controls voluntary actions, stores information, receives sensory impulses from various body parts and integrates it.

It has 3 main areas.

a. Sensory area- to receive impulses from sense organs via Receptors

b. Motor area- control voluntary movements

c. Association areas- Reasoning, learning & intelligence.

Thalamus- It relays sensory information to the cerebrum.

Hypothalamus- It forms the link between Nervous system & Endocrine system

Mid brain- It connects the forebrain and hindbrain. It is the portion of the central nervous system associated with vision, hearing, motor control, sleep/wake, arousal (alertness), and temperature regulation.

Hindbrain-connect the forebrain and hindbrain

Cerebellum- controls & coordinates muscular movements, maintaining body posture and equilibrium.

Pons- acts as a bridge between brain and spinal cord

Medulla Oblongata- Controls involuntary actions like blood pressure, salivation, vomiting etc.

Spinal cord: -cylindrical or tubular structure is extending downward from the medulla oblongata. Spinal Cord is enclosed in Vertebral column

Protection of the brain & the spinal cord-

(i) Bony outer covering: Skull or Cranium for the brain and Vertebral column for the spinal cord. (ii) Cerebrospinal fluid is present in between the three membranes and acts as shock absorber.

Endocrine glands and hormones

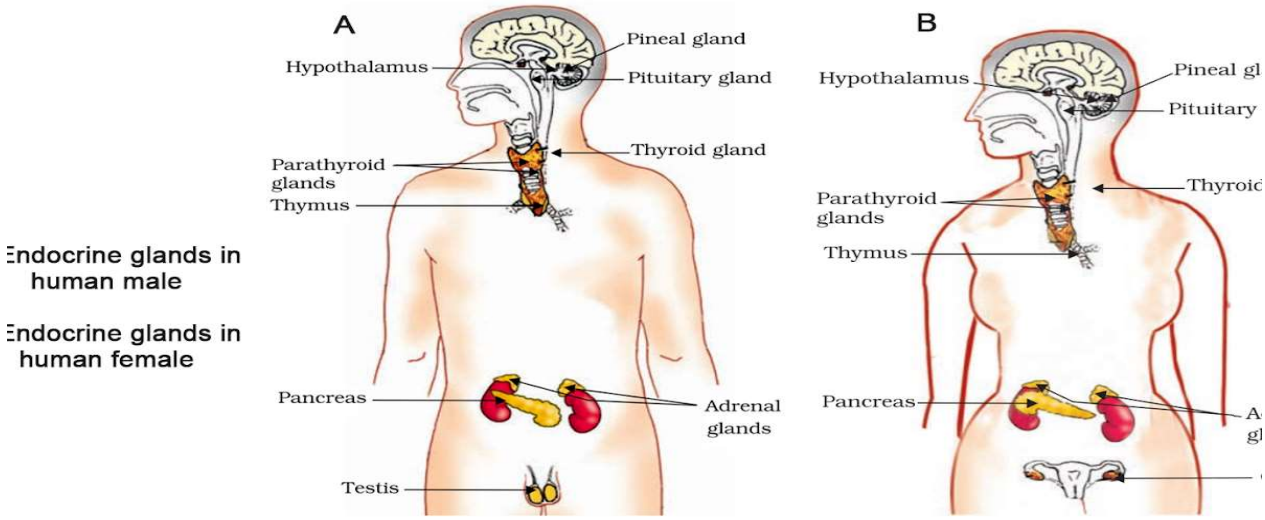
Hormones are chemical compounds which help to coordinate growth, development and responses to the environment. Their characteristics are -

(i) They are secreted by endocrine glands

(ii) Are secreted in small amounts & may act in nearby places or distant places.

(iii) Do not take part in the reaction & are destroyed immediately.

Location of different endocrine glands in human body



Endocrine glands in human male

Endocrine glands in human female

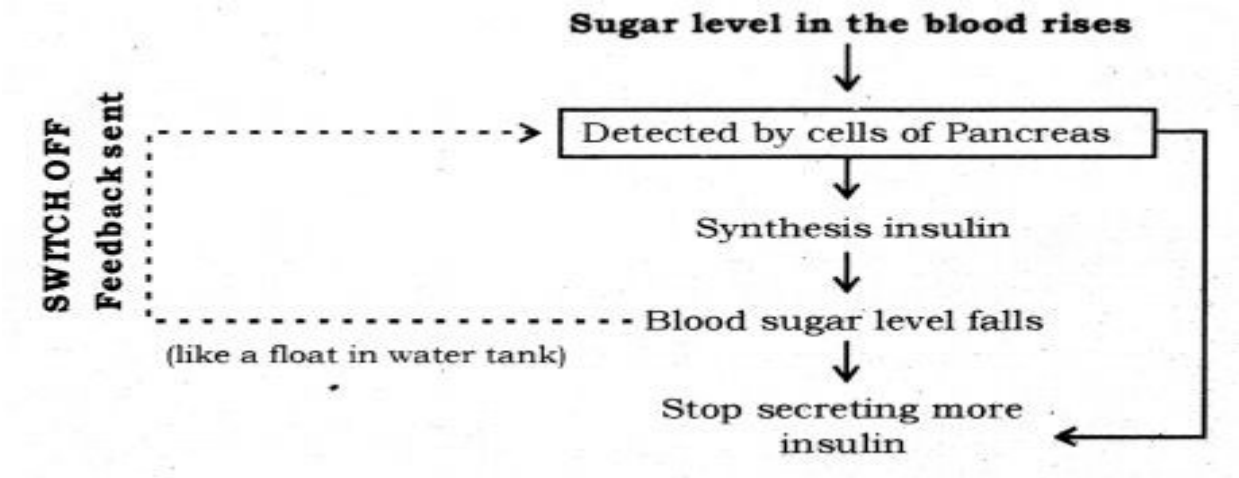
Important Endocrine glands, the hormone they secrete & their functions

Table 7.1 : Some important hormones and their functions

S.No.	Hormone	Endocrine Gland	Functions
1.	Growth hormone	Pituitary gland	Stimulates growth in all organs
2.	**Thyroxin**	Thyroid gland	Regulates metabolism for body growth
3.	Insulin	**Pancreas**	Regulates blood sugar level
4.	Testosterone	Testes	**Development of male sex organs.**
5.	**Oestrogen** **Progesterone**	Ovaries	Development of female sex organs, regulates menstrual cycle, etc.
6.	Adrenaline	Adrenal gland	**Response to stress, emergency**
7.	Releasing hormones	**Hypothalamus**	Stimulates pituitary gland to release hormones

Iodized Salt is necessary because the thyroid gland needs iodine to make thyroxine which helps in regulating the metabolism of carbohydrates, fats and proteins. Deficiency of iodine causes a disease called goiter.

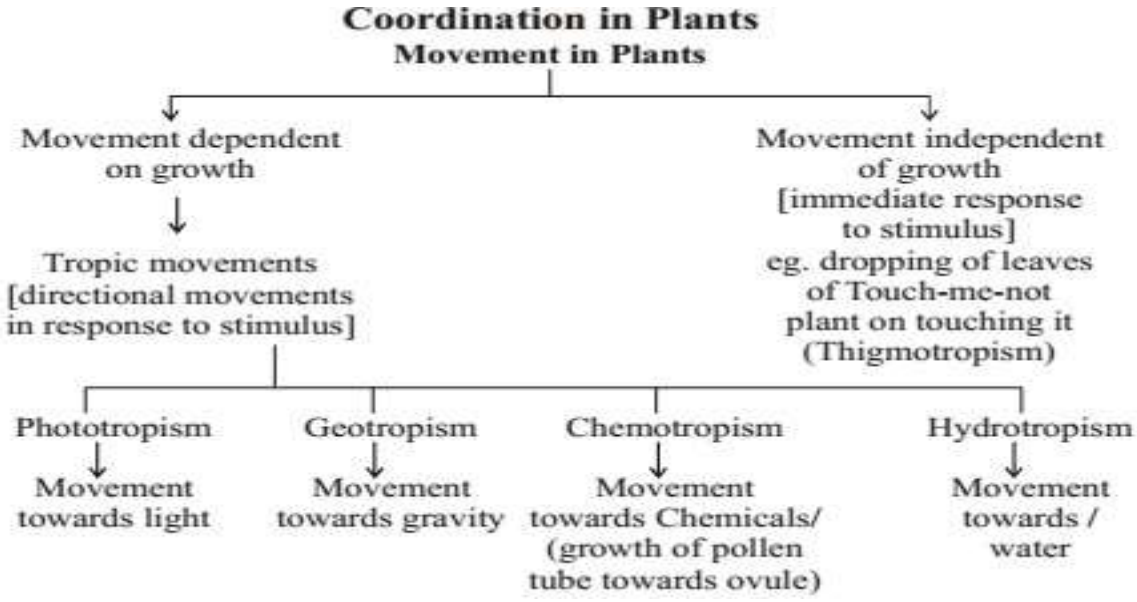
Diabetes: It is due to deficiency of Insulin hormone secreted by pancreas that is responsible to lower/control the blood sugar levels.



Treatment: Common diabetes can be controlled by medicine but in severe cases. Injections of insulin hormone are given to the patients.

Feedback Mechanism The excess or deficiency of hormones has a harmful effect on our body. Feedback mechanism makes sure that hormones are secreted in precise quantities and at the right time.

Coordination In Plants- Only chemical coordination is present in plants



Tropic movements- The movements of plants dependent on growth in the direction of stimulus (positive) or away from it (negative) are called tropic movements. E.g. Phototropism, Geotropism, Chemotropism.

Nastic movements: The movements of plants independent of growth and non-directional is nastic movements

PHYTOHORMONES: The four types of plant hormones responsible for control and coordination in plants are: 1) Auxins 2) Gibberellins 3) Cytokinin 4) Abscisic acid (ABA) While auxins, gibberellins and cytokinins promote the growth of a plant, abscisic acid prevents or hampers the growth of a plant.

Auxins: Auxins hormone controls a plant response to light and gravity. It is made by the cells present at the tip of a stem and roots. This hormone moves the plant away from light and towards gravity. It speeds up the growth of stem and slows down the growth of roots. Auxins promote cell enlargement, cell differentiation and fruit growth

Gibberellins: Gibberellins hormone works in the presence of auxin hormone and promotes cell enlargement and cell differentiation. It also promotes fruit growth, elongation of shoots and in breaking the dormancy in seeds and buds.

Cytokinin: This hormone promotes cell division in plants and breaks dormancy in seeds and buds. They also delay aging in leaves and promote the opening of stomata.

Abscisic acid: This hormone inhibits the growth of a plant. Therefore, Abscisic acid promotes dormancy in seeds and buds. It promotes closing of stomata, wilting and falling of leaves and detachment of fruit and flower from the plant.

LONG ANSWER QUESTIONS (5 Mark)

1. What constitutes the central and peripheral nervous system? How are the components of the central nervous system protected?

2. Name the plant growth hormone which is synthesized at the shoot tip. Explain briefly why a plant bends towards light during its growth.

3. Draw the diagram of the human brain and label the parts. Write the function of cerebellum and pons

4. (i) Define reflex action and state its significance? (ii) How do plants respond to external stimuli?

5. (i) Name the hormone secreted by pancreas, write its function. (ii) How does our body respond when adrenaline is secreted into the blood?

(iii) Cite an example to explain the feedback mechanism for regulation of hormonal secretion?

6. With the help of a flow chart, explain the various types of plant movements with suitable examples?

7. Give technical terms for the following events

(i) Movement of plant parts in response to water

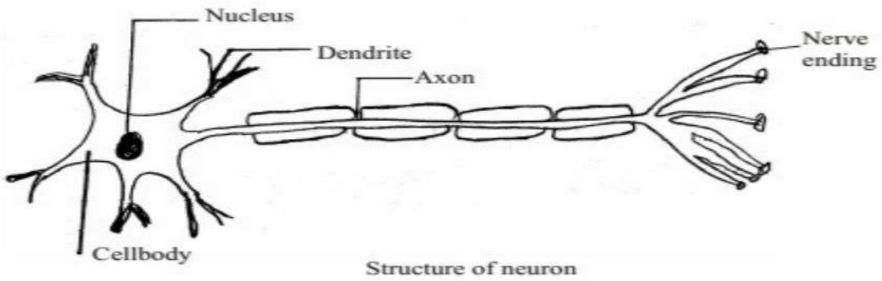
(ii) Movement of plant parts in the direction of light

(iii) Movement of plant parts towards chemical substances

(iv) Downward movement of roots in response to gravitational force

(v) Movement of plant parts in response to touch

8. Answer the following questions based on the given figure



Structure of neuron

(i) Name the part of neuron where passing of information takes place-

(a) By electric impulse (b) In the form of chemicals

(ii) Which part of neuron acquires information and which part conducts it away

(iii)In what form does this information travel?

9. (a)Define hormones. Write four characteristics of hormones in humans.

(b) Name the disorder caused by the following situations:

(i)Under secretion of growth hormone

(ii) Over secretion of growth hormone

(iii) Under secretion of insulin

(iv) Deficiency of iodine

10. (a) Name the hormone which is released into the blood when its sugar level rises. Explain the need of Chemical communication in multicellular organisms, the organ which produces this hormone and its effect on blood sugar level. Also mention the digestive enzymes

secreted by this organ with one function of each.

(b) Explain the need of Chemical communication in multicellular organisms.

SHORT ANSWER TYPE QUESTIONS (2 MARK)

1. Name the hormones in animals which are: a) Necessary for growth b) Necessary for changes associated with puberty

2. Write the name and functions of any two parts of the human hind-brain?

3. How does our body maintain blood sugar level?

4. How does auxin promote phototropism?

5. What are nastic and tropic movements? Give one example of each?

6. What is cerebrospinal fluid and what is its function?

7. Identify the phytohormones used by plants while performing the following functions:

(i) Cell division in shoot tip

(ii) Inhibiting growth during unfavourable conditions

8. What is a Reflex arc and what are its components?

9. When a person is excited or angry, name the hormone which is directly secreted into the blood. Mention the gland which secretes this hormone.

10. What causes a tendril to encircle or coil around the object in contact with it? Explain the process involved

SHORT ANSWER QUESTIONS (3 MARK)

1. (a) Draw the structure of neuron and label cell body and axon

(b) Name the part of neuron:

(i) where the information is acquired

(ii)Through which information travels as an electrical impulse

2. Define receptors and state their location in our body? Mention any two receptors present in our forebrain and their functions?

3. A compound of iodine is compulsorily added to common salt in small quantities.

(a) Why is it important for us to have iodized salt in our diet?

(b) Name the disease caused by its deficiency.

(c)Write the symptoms of the disease.

4. Which hormone is known as an emergency hormone in our body and how it helps in coping during an emergency?

5. (a)Name the part of the brain which controls: (i)voluntary action (ii)involuntary action

(b) What is the significance of the peripheral nervous system? Name the components of this nervous system and distinguish between the origins of the two?

6. Which plant hormone is present in greater concentrations in the areas of rapid cell division? Name one plant growth promoter and one plant growth inhibitor?

7. How are the two vital organs Brain and Spinal cord protected in our body?

8. What is chemotropism? Give one example. Name any two plant hormones and mention their functions.

9. What are the functions carried out by the nervous system in human beings?

VERY SHORT ANSWER TYPE QUESTIONS (1 mark)

1. Name the largest cell present in human body?

2. What is synapse?

3. State the main function of Cytokinin?

4. What is the significance of reflex action?

5. Mention one example of chemotropism?

6. How is the spinal cord protected in the human body?

7. Mention the function of the hind-brain in humans?

8. Name the hormone which helps in regulating sugar level in our blood? Name the gland which secretes this hormone?

9. A young green plant receives sunlight from one direction only. What will happen to its shoots?

10. State the function of gustatory receptors and olfactory receptors?

11. Why are Endocrine glands called ductless glands?

12. Name the part of the brain concerned with muscular coordination in the body?

13. Which part of the human body contains the largest number of neurons?

14. Which hormones are responsible for changes during puberty?

15. In which part of neuron conversion of electrical signals to chemical signals take place?

16. Sunflowers move in accordance with the path of the sun due to.....

17. Posture and balance of the body is controlled by.....

18. Brain is protected by a bony covering called .....

19. Iodine is essential for the synthesis of .....hormone

20. The gland in man which is exocrine and endocrine is.....

MULTIPLE CHOICE QUESTIONS

1. Which of the following organs is not controlled by autonomic nervous system?

a). Heart b). Uterus c). Glands d). Eyes

2. Junction of two neurons is called.

a) Synapse b) Synapsis c) Joint d) Junction

3. Which of the following is a plant hormone?

a) Insulin b) Thyroxine c) Oestrogen d) Cytokinin

4. Which one of the endocrine glands is known as the master gland?

a) Pituitary b) Adrenal c) Thyroid d) Parathyroid

5. The seat of intelligence and voluntary action in the brain is:

(a) Diencephalon (b) Cerebrum (c) Cerebellum (d) Medulla Oblongata

6. Electrical impulse travels in neuron from:

a. Dendrite→axon→axon end→cell body

b. Cell body→Dendrite→axon→axon end

c. Dendrite→cell body→axon→axon end

d. Axon end→axon→cell body→Dendrite

7. Which of the following acts as both endocrine and exocrine glands?

a) Pituitary b) Adrenal c) pancreas d) ovaries

8. The growth of tendrils in pea plants is due to

a) Effect of light

b) Effect of gravity

c) Rapid cell division in tendrillar cells in contact with the support

d) Rapid cell divisions in tendrillar cells that are away from the support.

9. The substance that triggers the fall of mature leaves and fruits from plants is :

a. Auxin b. Gibberellins c. Abscisic acid d. Cytokinin

10.Which of the following protects the brain from external shocks?

(a) Pericardium (b) Pleura (c) Cerebrospinal fluid (d) Duramater

11. Artificial ripening of fruits is carried out by

a) Ethylene (b) Auxin (c) Gibberellins (d) Abscisic acid

12. Name the hormone which controls the basal metabolic rate in animals

(a) Oxytocin (b) Aldosterone (c) Adrenal (d) Thyroxine

13. Name the longest cell in the human body

(a) Liver cell (b) Nerve cell (c) Muscle cell (d) Reproductive cell

14. The part of brain which controls respiration, heartbeat and peristalsis is

(a) Cerebrum (b) Cerebellum (c) Medulla oblongata (d) Pons

15. The center for regulating body temperature is

(a) Pons (b) Hypothalamus (c) Cerebellum (d) Thalamus

16. Posture and balance of the body is controlled by

(a) Cerebellum (b) Cerebrum (c) Pons (d) Medulla oblongata

17. Which of the following in not a plant hormone

(a) Auxin (b) Gibberellins (c) Insulin (d) Cytokinin

18. The functional gap between two neurons is

(a) Impulse (b) Dendrite (c) Axon (d) Synapse

19. Which plant hormone promotes dormancy in seeds and buds?

(a) Auxin (b) Gibberellins (c) Cytokinin (d) Abscisic acid

20. Roots of plants are:

(a) positively geotropic (b) negatively geotropic

(c) positively phototropic (d) None of these

21. Which plant hormone promotes cell division?

(a) Auxin (b) Gibberellin (c) Cytokinin (d) Abscisic acid

22. Which nerves transmit impulses from the central nervous system towards muscle cells?

(a) Sensory nerves (b) Motor nerves

(c) Relay nerves (d) Cranial nerves

23. Which part of nervous system controls the reflex activities of the body?

(a) Brain (b) Spinal cord (c) Cerebrum (d) Cerebellum

24. Which of the following acts as both endocrine and exocrine gland?

(a) Pancreas (b) Thyroid (c) Adrenal (d) Liver

25. The leaves of Mimosa are sensitive to

(a) light (b) smell (c) touch (d) heat

26. A student accidentally places her hand on a flame of candle and quickly pulls her hand away. The flame represents

(a) a response (b) a stimulus (c) an impulse (d) an effector

27. Which of the following statements is correct about receptors?

(a) Gustatory receptors detect taste while olfactory receptors detect smell

(b) Both gustatory and olfactory receptors detect smell

(c) Auditory receptors detect smell and olfactory receptors detect taste

(d) Olfactory receptors detect taste and gustatory receptors smell

28. Which of the following acts as both endocrine and exocrine glands?

(a) Adrenal (b) Pituitary (c) Thyroid (d) Pancreas

29. Fall of mature leaves and fruits from plants is triggered by which of the following substances?

(a) Auxin (b) Cytokinin (c) Gibberellin (d) Abscisic acid

COMPETENCY LEVEL QUESTIONS (HOTS)

1) You go for a visit to your grandmother's house. you see that she keeps her house beautiful and green with lots of plants. She has many potted plants inside and outside of the house. However, she complains that the plants kept in the drawing room are not keeping straight, all the plants are bending towards one direction.

(A) Why are the plants bending in one direction only?

(B) The hormone involved in this phenomenon is

(a)Auxin (b) Cytokinin (c) Ethylene (d) Abscisic acid

(C)Grandma's plants are showing

(a) Positive hydrotropism (b) positive phototropism

(c) Negative geotropism (d) chemotropism

2) Many children in a remote mountain village complain of swollen necks, the number of children with swollen necks keeps increasing every month ,a villager Tukaram who is superstitious, thinks that the village is cursed by a devil .Mukesh, another villager who thinks it as a disease, suggests consultation with a doctor .

(A)Do you agree with Tukaram or Mukesh and why?

(B) What is the reason behind the swollen necks of the young children in the village?

(a) malnutrition (b) lack of iodine in diet (c) lack of protein in diet (d) lack of fat in diet

(C) Does the location of their villages have anything to do with the reason for the disease?

(D)Swollen necks are the symptom of which disease

(a) Diabetes (b) Obesity (c) Goiter (d) Hypertension

3). (a) Name the hormone secreted by thyroid. What is the function?

(b) Why is the iodized salt advisable?

4). How does pancreas controls blood glucose level

5). How do auxins promote the growth of a tendril around a support? Describe in brief.

6). On touching a hot plate, you suddenly withdraw your hand. Which category of neuron becomes activated first and which one next?

7). Write one example of plant part (a) which is positively hydrotropic as well as positively geotropic? (b) Which part is positively phototropic as well as negatively geotropic?

8). Why is abscisic acid known as a stress hormone?

9). The neck of a person appears to be swollen.

(a) Name the disease the person suffering from

(b) Name the mineral whose deficiency causes this disease

10). Give a reason to explain why

(i) Adrenalin helps in dealing emergency situations

(ii) Secretions of growth hormones should be specific to human body

11). Why do the endocrine glands directly release their secretions into the blood?

12). Name the plant hormone which

(i) inhibits growth and causes wilting of leaves

(ii) promotes cell division

13) On entering into the kitchen Anjali smells something burning and sees smoke, immediately she turns and runs out. Was her reaction voluntary or involuntary? Why?

14).Ram and Shyam visit a park where they find many mimosa plants, Ram touches them with his feet and the leaflets close up, after some time they open up and again close when Shyam

touches them. Why do the leaflets close when touched? How do all the leaflets sense stimuli though all are not touched?

15) Aarushi's mother kept bananas in a polybag and found that they got spoiled fast, Aarushi asked her mother not to keep bananas in the polybag. Why should the bananas not be kept in a polybag? Which is the only gaseous phytohormone?

CHAPTER 9

REPRODUCTION

Prepared by: - PURNIMA KUMARI,

KV KHUNTI

NOTES

Reproduction: producing young ones of their own kind.

If an organism does not reproduce, will it die? Then why is it important? (Significance of reproduction):

- In order to create organisms those are similar to them.
- To ensure their species' existence.
- To carry their genetic information to the next generation.
- Reproduction gives rise to Variation which lead to origin of new species.

Basic events of reproduction:

- DNA replication (copying of DNA)

Significance of DNA copying:

- Provides cellular apparatus to daughter cell.
- DNA copy will retain the character.

Information source of making protein:

- Cellular DNA
- DNA is responsible for transfer of character from parents to offspring.

BLUE PRINT: a code of characteristics which carried from parents to offspring's.

NUCLEUS

CHROMOSOME

DNA

GENE

VARIATION: Differences in traits/characteristics among the individuals of the same species.

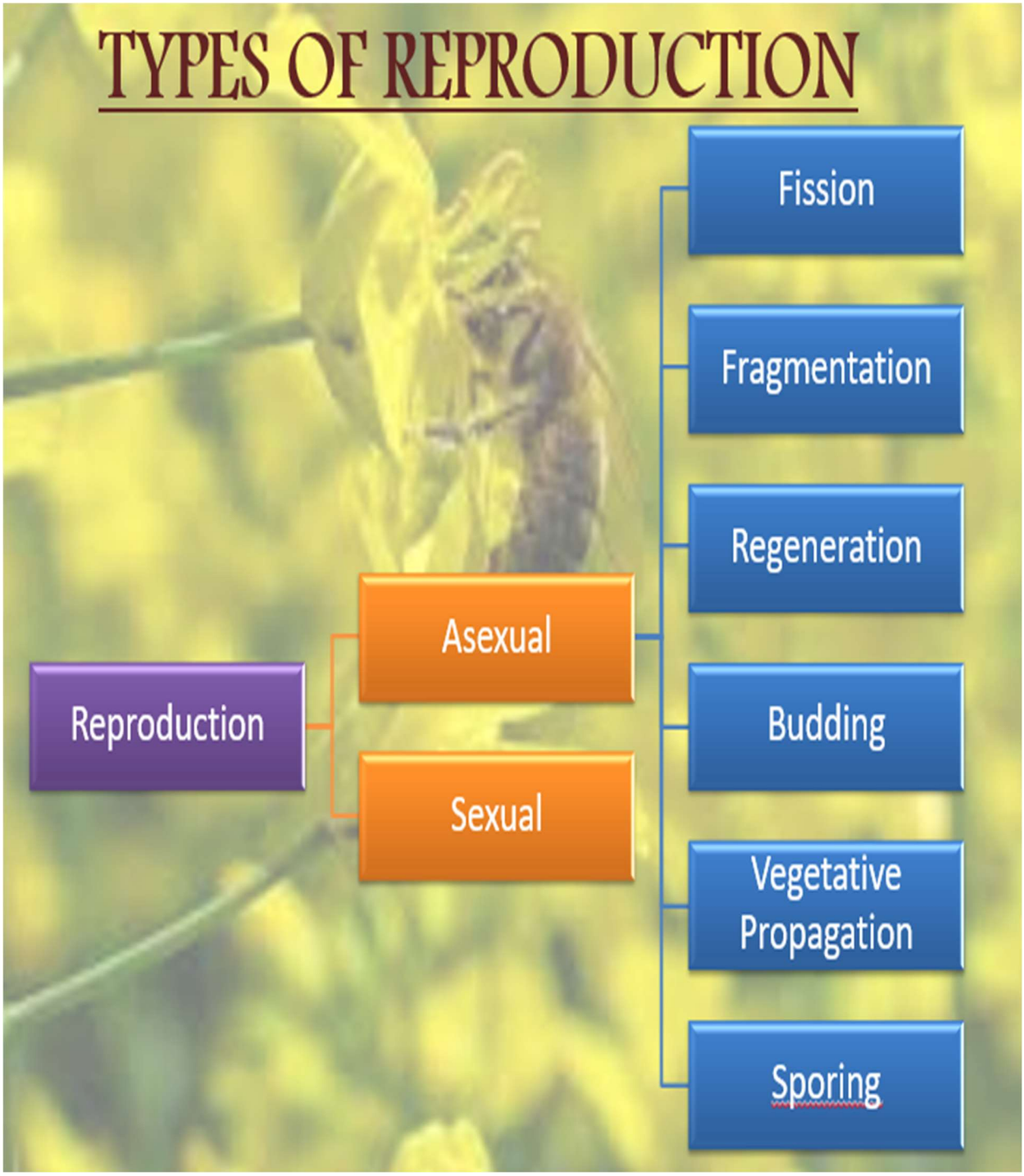
Causes/ reasons of variations:

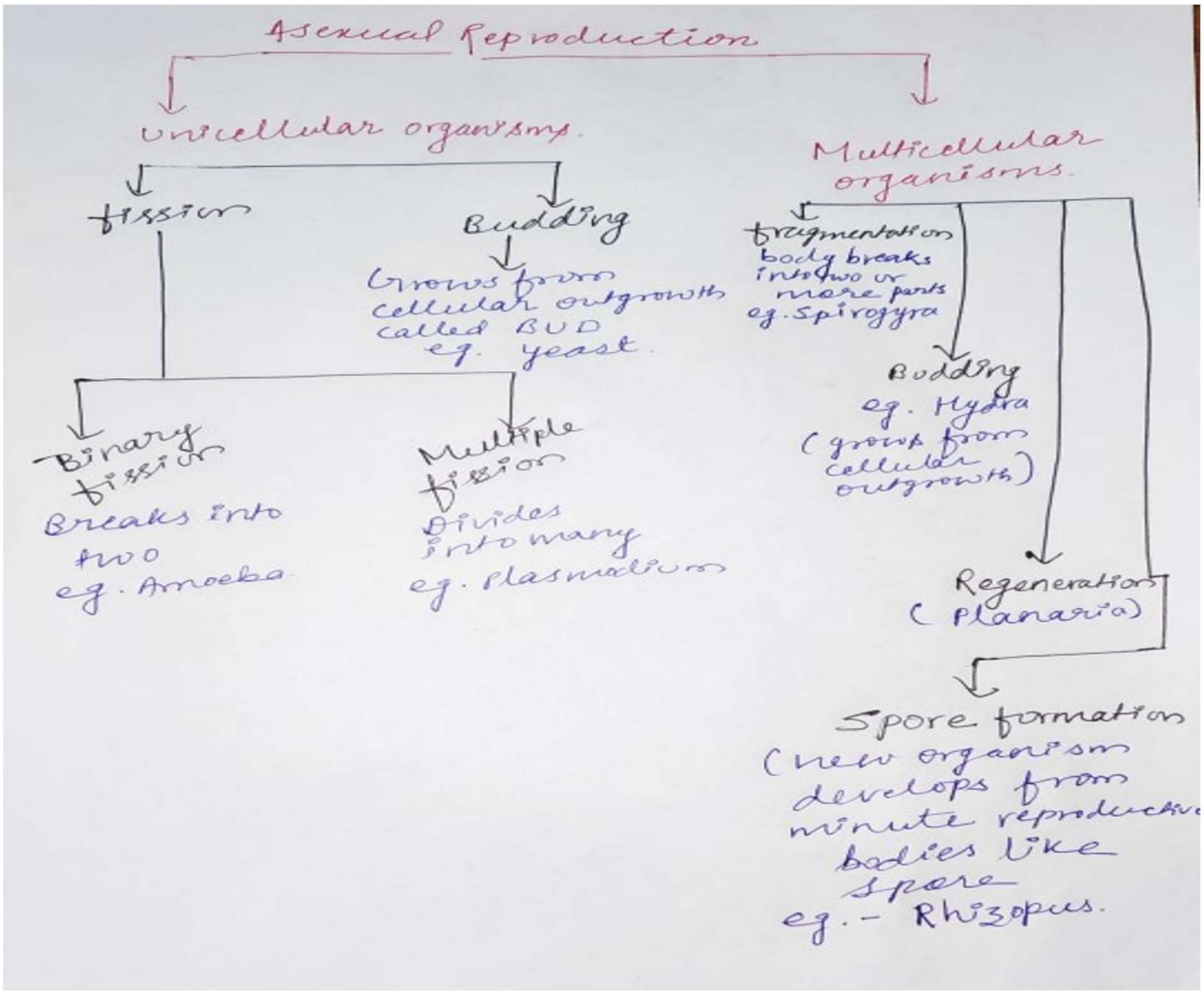
- **Faulty DNA replication.**
- **Crossing over**
- **Sexual reproduction.**

Importance of variation:

- Pre adaption: if environmental changes result in change in niche, some individuals adapt and survive due to variation.
- Improved varieties.
- Evolution.

Mind map:





BINARY FISSION:

Binary= 2

Fission= division

Division of parents into two daughter cells.

Ex – amoeba

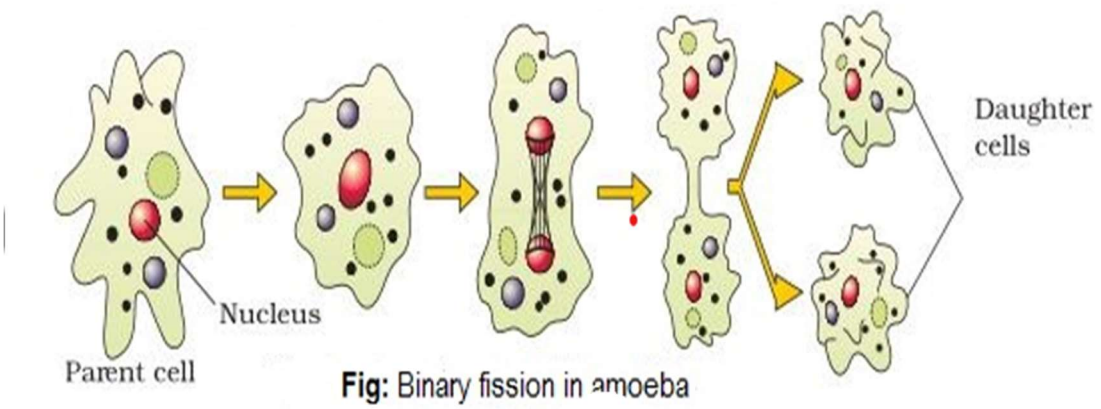


Fig: Binary fission in amoeba

- Here amoeba divides from any plane, there is no specified orientation of division.
- Specified orientation: ex- Leishmania which cause kala-azar), paramecium, there is division orientation specified, as they divide longitudinally.

MULTIPLE FISSION: division of parent cell into two or more cells. Ex- plasmodium.

BUDDING: Formation of an outgrowth from an organism which separates to produce a new individual.

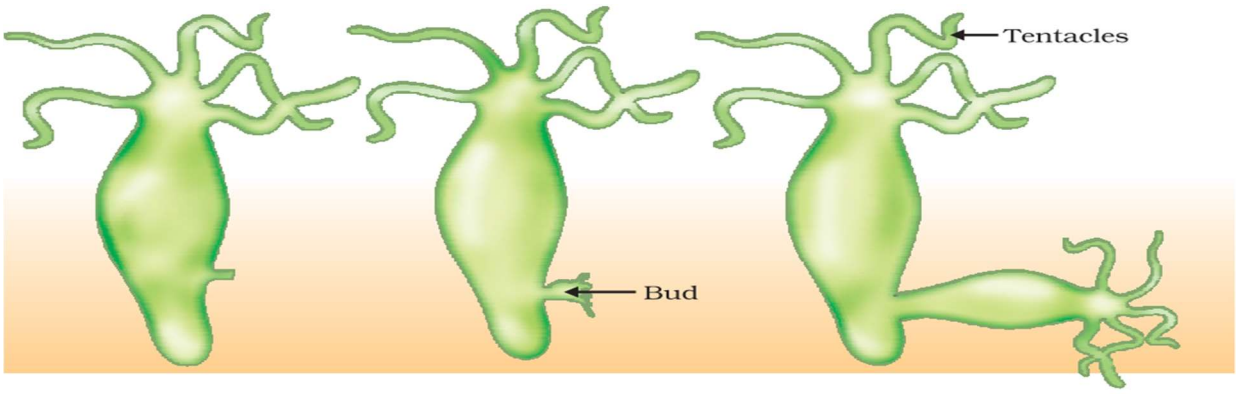


Figure 8.4 *Budding in Hydra*

In hydra it is also called a regeneration as it grows out of body.

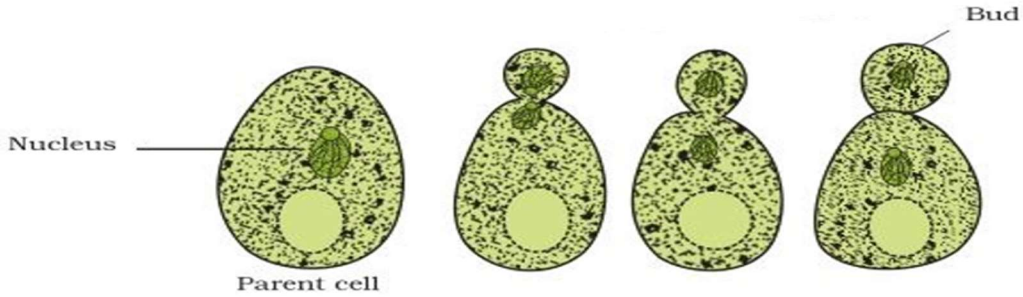


Fig: Budding in yeast

LET'S DIFFERENTIATE

BINARY FISSION	MULTIPLE FISSION
The parent organism divides into two nearly equal sized daughter cells.	The parent organism divides into multiple numbers of daughter cells.
The nucleus of the parent divides once to produce two daughter nuclei.	The nucleus of the parent divides multiple times to form multiple daughter nuclei.
Exhibited by Amoeba	Found in malarial protozoa- *Plasmodium*

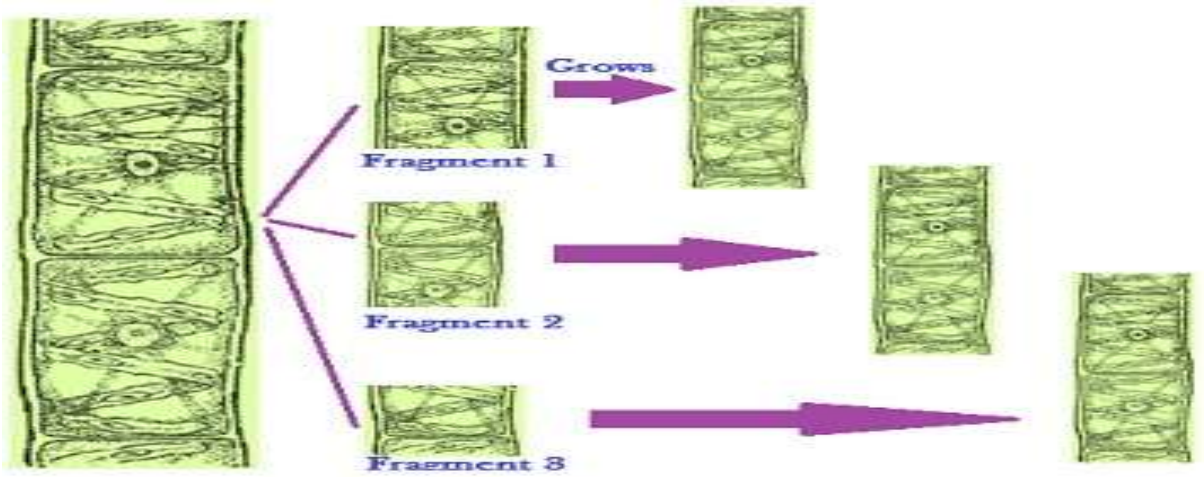
FISSION	BUDDING
The parent individual loses its identity once it produces the daughter cells.	The parent individual persist after the daughter individual has budded off.
Rapid and instantaneous process	Slow and gradual process
Exhibited by only unicellular organisms eg. Amoeba	Found in unicellular/ multicellular organisms eg. Yeast, Hydra etc.
No specialised cells required in fission	In case of multicellular organisms, budding takes place by certain rgenerative cells.

FRAGMENTATION: frag mare=break.

Breaking up of the body of organisms into two or more parts called fragments.

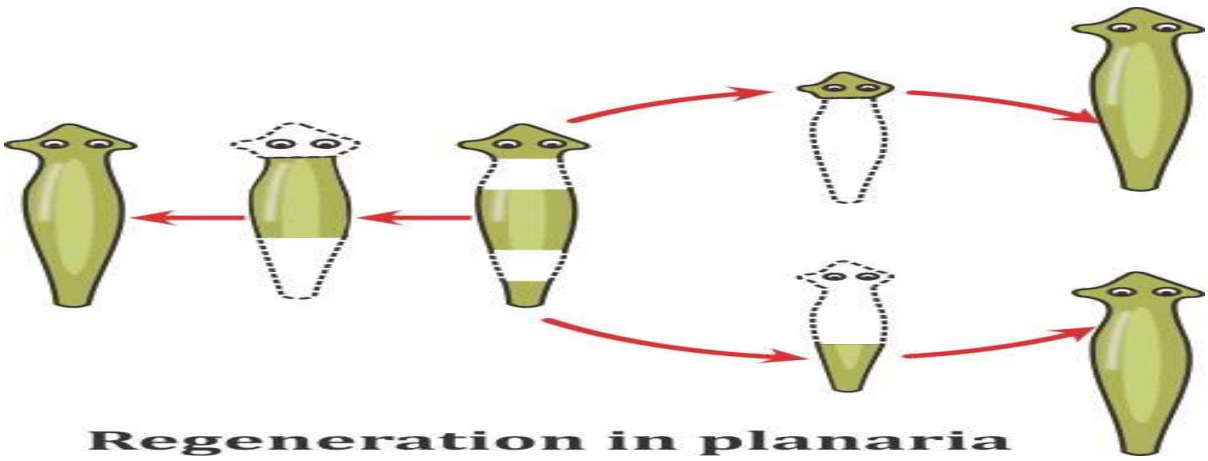
Each fragment grows into new individuals

Ex spirogyra



REGENERATION:

- Planaria if broken into pieces, each piece grows the missing parts and forms the complete individual.
- This is due to presence of specialised cells.



FRAGMENTATION	REGENERATION
Occurs in invertebrates	Occurs in vertebrates as well as invertebrates
It's a method of asexual reproduction	It can be considered as a method of asexual reproduction or formation of lost body parts.
It occurs in organisms with simple body organisation	It also occurs in organisms with complex body structure.
No specific cells are involved	Specialised regenerative cells are involved.

SPORE FORMATION:

- Minute unicellular reproductive bodies which gets dispersed and forms new individuals on germination.

Spores: minute unicellular reproductive bodies.

Ex- Rhizopus

- Advantage of spore formation- spores are covered by thick walls that protect them from unfavourable conditions (high temp., water, lack of food etc.) until they find a favourable condition (temp and moisture)to grow.

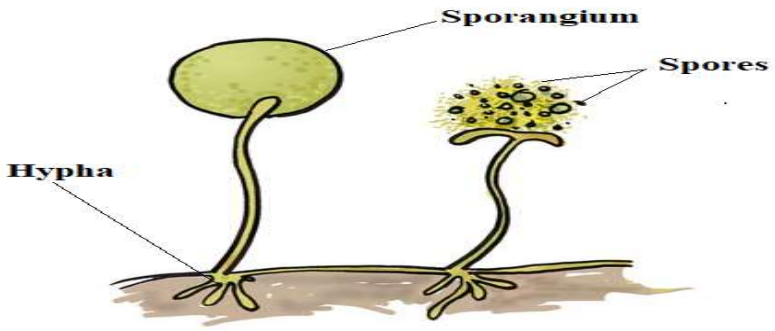


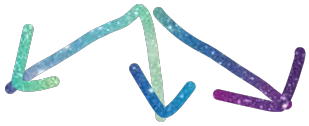
Fig-Spore formation in Rhizopus.

VEGETATIVE PROPAGATION:

- Formation of new plants from vegetative parts of plants life roots stems leaves etc

TYPES OF VEGETATIVE PROPAGATION

Natural method



Leaves Stem Roots

Artificial method

Cutting Grafting Layering

Natural method:

Roots	Stems	Leaves
Roots of some plants develop buds which grow to form new plants. Example dahlia sweet potato	Steam of some plants grow into a new plant . Example potato Ginger, onion turmeric and banana	Marginal notches of leaves bear birds. Example Bryophyllum

Advantages of vegetative propagation:

- Seedless plants can be grown
- Quicker method
- Requires less attention and care
- Good quality can be maintained

- Survival rate is high
- Uniform yield.

❖ **Tissue culture:** Method of raising new plants from plant tissue over a culture.

WHY DID SEXUAL REPRODUCTION GAIN IMPORTANCE?

Advantages of sexual reproduction:

- Variation - which is essential for recognition
- Evolution
- Better adaptability
- Chance of survival increases.

Disadvantages of vegetative propagation:

- Overcrowding
- Vegetative propagules cannot be stored for long
- If plant is diseased it will spread to all daughters
- Absence of variation Undesirable characteristics cannot be eliminated.

Disadvantage of sexual reproduction:

- Two parents required Cannot be done in unfavourable conditions
- Uniformity is not maintained in offspring

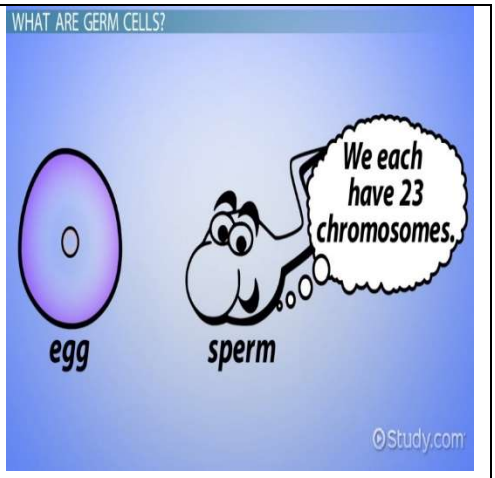
Disadvantage of Asexual reproduction

- No variations
- No evolution
- Survival value decreases.

HOW DNA GETS COPIED FROM TWO PARENTS?

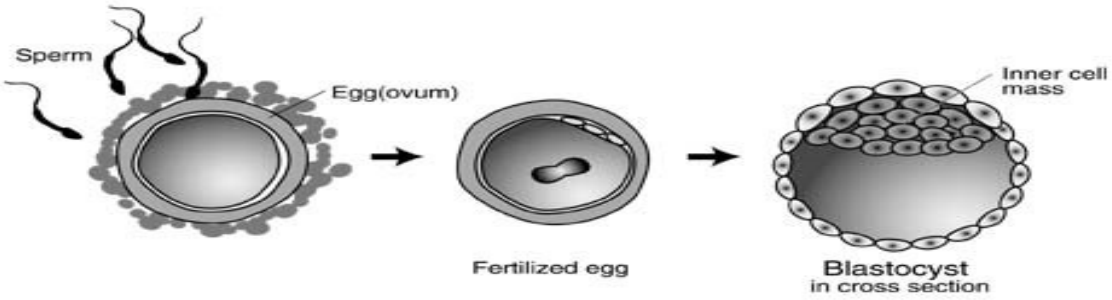
- In sexual reproduction, two parent individuals are involved.
- Every species has a definite number of chromosomes (eg. 46 in case of humans)
- Each of the parent contributes a copy of his/her DNA to their offspring.
- Does that mean the child will have double DNA?
- Sexual reproduction is carried out by means of specialised cells in complex organisms which carries only half of the DNA content/ half number of chromosome (haploid) of the organism (eg. 23 chromosomes in humans) unlike the somatic cells. Such cells are called germ cells or gametes or sex cells.

- When these germ-cells from two individuals combine during sexual reproduction to form a new individual, it results in re-establishment of the number of chromosomes and the DNA content in the new generation.



FERTILISATION

- The process of fusion of two gametes from two different individuals during sexual reproduction is known as Fertilisation.
- The process of fertilisation results in the formation of a diploid (having all chromosomes e.g. 46 in humans) structure called Zygote.
- Zygote further grows and develops into a new organism.



POST FERTILISATION

Where does the Zygote get energy from?

- In simple organisms, gametes are not much different from each other. Often, they are found to produce similar gametes (Isogametes).
- But in the case of complex organisms, gametes are dissimilar quite specialised in their functions.
- One germ-cell is large and stores food (this is where the zygote gets its energy) while the other is smaller and likely to be motile.
- Conventionally, the motile germ cell is called the male gamete and the germ-cell containing the stored food is called the female gamete.

SEXUAL REPRODUCTION IN FLOWERING PLANTS

REPRODUCTIVE STRUCTURES-

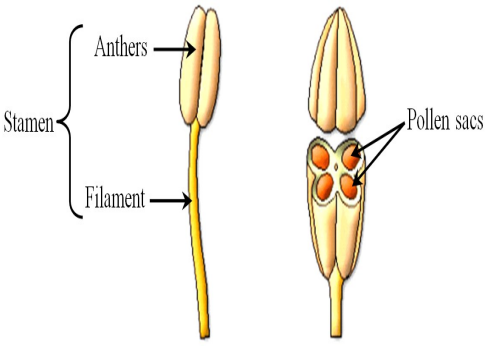
- The reproductive structures of angiosperms are located inside the flower.
- The flower contains four basic structures (Petals, Sepals, Stamen & Pistil/ Carpel) out of which Stamen and Pistil are the male & female reproductive structures respectively.

TYPES OF FLOWER: A flower can be of two types depending on the presence of one or both reproductive structures-

Unisexual flowers	Bisexual flowers
Either stamen or pistil or present in a flower. Eg. Papaya, Watermelon, Cucumber, Maize etc. 	Flowers have both stamen and Pistol Eg. Mustard, Hibiscus, Tomato, Rose etc. 

STAMEN & PISTIL

- The stamen is the male reproductive part of a plant which has the following structures-
  - ❖ Anther- A sac like structure that produces the Pollen grains. Within the pollen grain male germ cells are formed.
  - ❖ Filament- A long slender tube that holds the anther above.
- The pistil is the female reproductive part of a plant which has the following distinct structures-
  - ❖ Ovary- The swollen base of the pistil that contain ovules. Each ovule produces an egg cell.
  - ❖ Style- The elongated middle part of the Pistil that connects the ovary and the stigma.
  - ❖ Stigma- The terminal sticky part of Pistil.



Structure of stamen

structure of Carpel/pistil

Non-reproductive parts of flower:

- Petals or Corolla-helps in pollination and protection.
- Sepals or calyx-protects the flower when it is Bud.
- Thalamus-gifts base to the flower.
- Pedicel/receptacles-joins flower to the stem.

POLLINATION & ITS TYPES

Pollination: transfer of pollen grain from anther to stigma.

Agents of pollination

biotic agent abiotic agent

Biotic agents-insects, birds and bats.

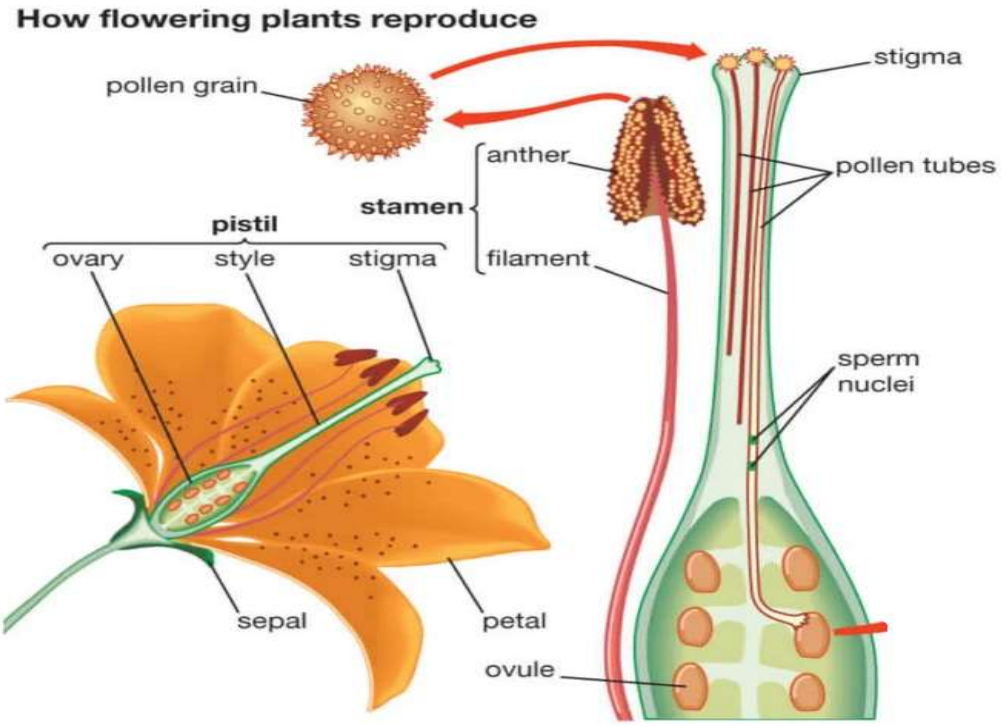
Abiotic agents- wind and water

TYPES OF POLLINATION

	Self-Pollination	**Cross pollination**
Definition	Transfer of pollen grains to stigma of same flower	Transfer of pollen grains to stigma of another flower of plant or another plant (same species)
Agents	Not Required	Required
Variation	No	Lot of
Occurrence	Bisexual	Bisexual as well as unisexual flowers

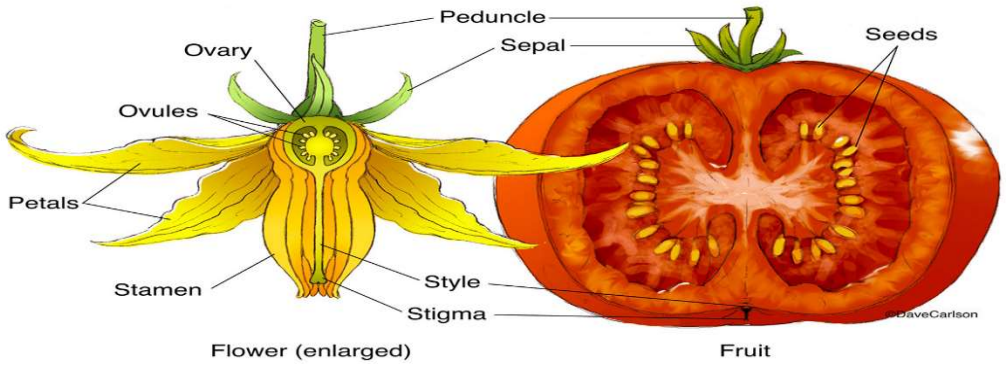
FERTILISATION IN PLANTS

Once the pollen lands on a stigma, it has to reach the egg-cell (female gamete) which are in the ovary. For this, a tube called pollen tube grows out of the pollen grain and travels through the style to reach the ovary where the male germ cells are released and thus, fertilization takes place



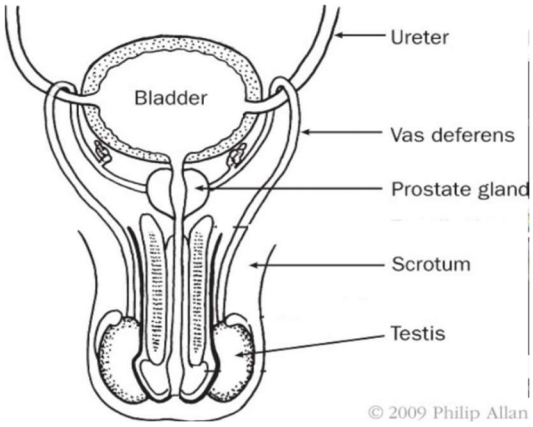
POST-FERTILISATION CHANGES IN PLANTS

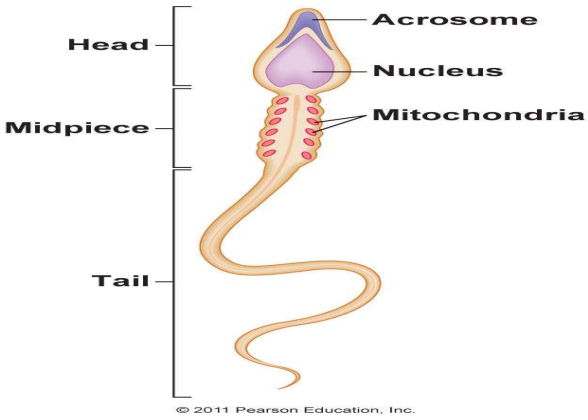
- After fertilisation, the zygote divides several times to form an embryo within the ovule.
- ovule develops a tough coat and is gradually converted into a seed.
- The ovary grows and ripens to form a fruit.
- The petals, sepals, stamens, style and stigma shrink and fall off.
- The seed contains the future plant or embryo which develops into a seedling under favourable conditions. This process is known as germination.



SEXUAL REPRODUCTION IN HUMAN BEINGS

- MALE REPRODUCTIVE SYSTEM- It consists of all the structures that produces the male germ cell/ gametes, keeps it alive and delivers it to the female reproductive tract.
    - Testes- These are glands present outside the abdominal cavity inside the scrotum. Because sperm formation requires a lower temperature than the normal body temperature.
        - Function- The main function of testes is to produce male gametes or sperms and also to secrete an essential hormone in males called testosterone.
    - Vas Deferens- The sperms formed are delivered through the vas deferens which unites with a tube coming from the urinary bladder. The urethra thus forms a common passage for both the sperms and nitrogenous wastes.
    - Associated glands- Prostate and the Seminal vesicles are some associated glands found in the path of vas deferens that add their secretions so that the sperms are now in a fluid which makes their transport easier and this fluid also provides nutrition.
    - Male gamete- The male gamete is called the sperm which are microscopic tiny bodies having a head containing the genetic material and a long tail that helps it to move.

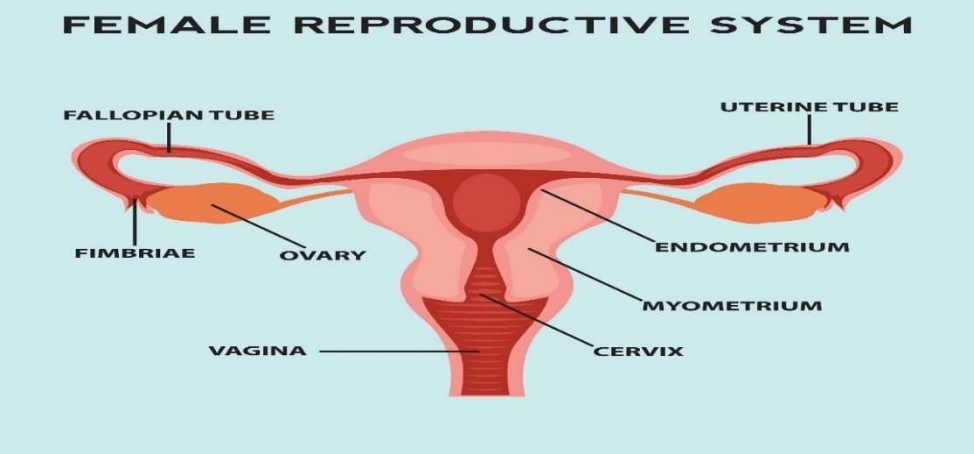




SEXUAL REPRODUCTION IN HUMAN BEINGS

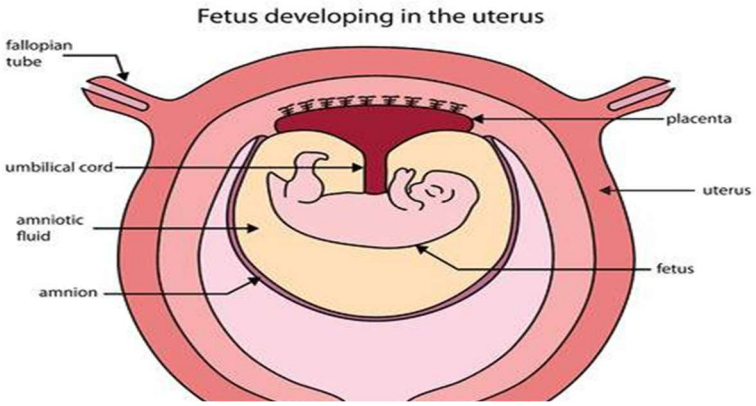
- **FEMALE REPRODUCTIVE SYSTEM-** It consists of all the structures that produces the female gamete, site of fertilisation and nourishment of a growing embryo.
    - Ovary- A pair of glands present in the abdominal cavity in females whose main function is to produce female gamete i.e. ovum/egg and secretion of essential hormones like estrogen.

- Oviduct/ Fallopian tube - A pair of thin tubular structure that transfers the female gamete from the ovary to the uterus. Oviduct is the site of fertilisation.
- Uterus- A chamber like structure where the embryo grows also known as womb. The fertilised egg (zygote) gets implanted in the wall of the uterus and starts dividing. The wall of the uterus is lined with blood vessels and nutritive tissues which nourishes the growing embryo.



SPECIAL TISSUE FOR NOURISHMENT

- The special tissue associated with the female reproductive system to provide nutrition to the growing embryo is called the Placenta. This is a disc which is embedded in the uterine wall. It contains villi on the embryo's side of the tissue.
- The function of placenta is to provide oxygen and other nutritional elements from the mother's blood to the baby and to remove carbon dioxide and excretory products from the embryo to the mother's blood
- On the mother's side are blood spaces, which surround the villi. This provides a large surface area for glucose and oxygen to pass from the mother to the embryo and similarly nitrogenous wastes are also removed.

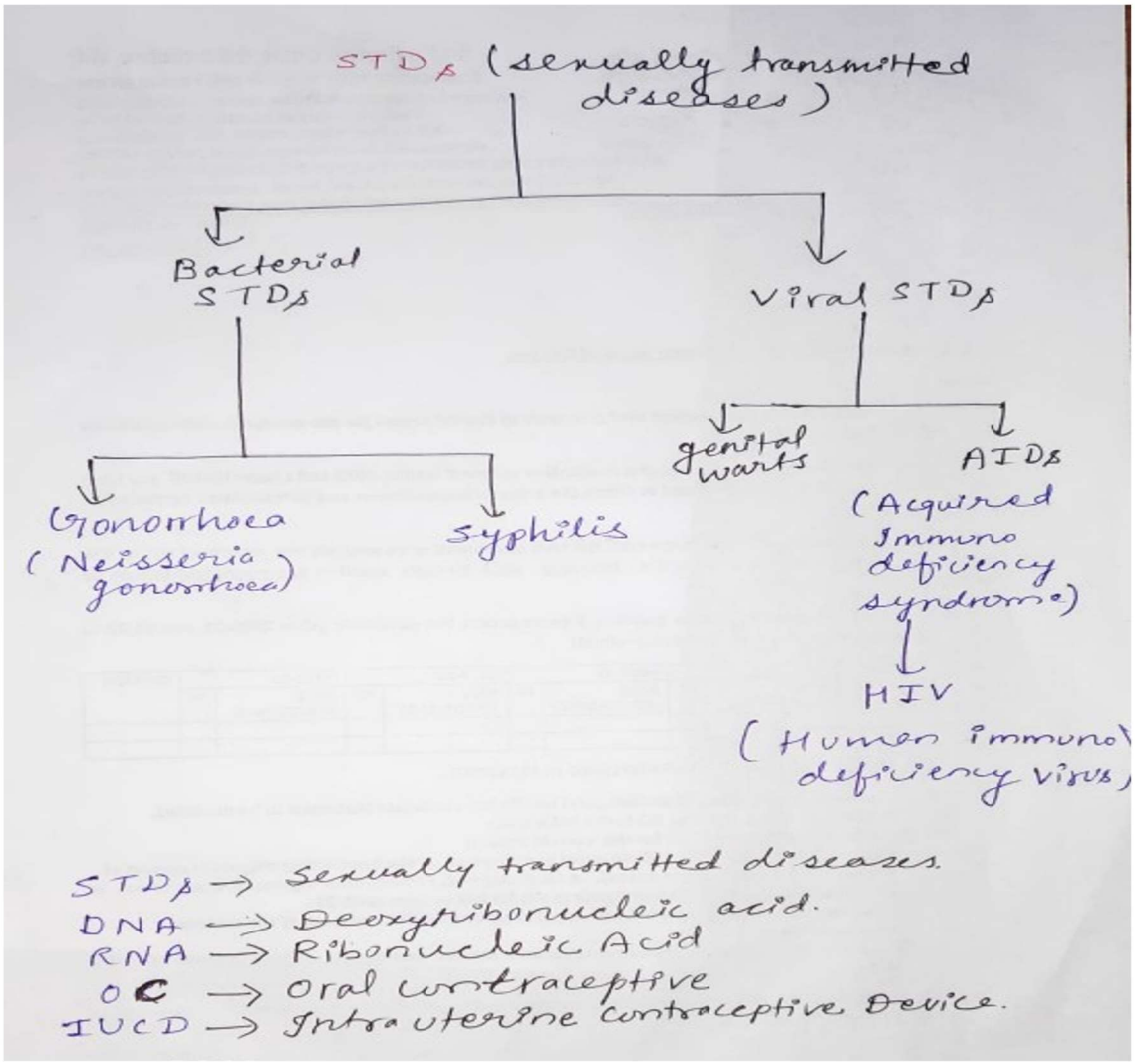


WHAT WILL HAPPEN IF THE OVUM IS NOT FERTILISED?

- The uterus prepares itself every month before the release of an ovum by the ovary. It becomes thick and spongy in order to nourish the upcoming embryo if the ovum gets fertilised.
- But however, in case if the egg is not fertilised, the lining of the uterus gets broken down and shed. This process is known as Menstruation.

SEXUALLY TRANSMITTED DISEASES: -

An infection/ disease transmitted through sexual contact, caused by bacteria, viruses or parasites. Example- HIV- AIDS (caused by virus), Syphilis and Gonorrhea (caused by bacteria).



METHODS TO AVOID PREGNANCY

- Mechanical barrier method- To create a barrier so that the male gamete cannot reach the female gamete.

- Hormonal method/Chemical method- Changing the hormonal balance of the body so that ovum is not released and fertilization cannot occur. These drugs/medications commonly need to be taken orally. However, since they change hormonal balances, they can cause side-effects too.
- Surgical method- If the vas deferens in the male is blocked (vasectomy), sperm transfer will be prevented. Similarly, If the fallopian tube in the female is blocked (tubectomy), the ovum will not be able to reach the uterus. In both cases fertilization will not take place. Surgical methods can be used to create such blocks. May cause infection if not performed properly.

LETS LEARN SOME DIFFERENCES BETWEEN:

	Pollination	**Fertilisation**
Definition	Transfer of pollen grain from another to stigma	Fusion of male and female gamete
Step	Takes place before fertilisation	Takes place after pollination
Process	Physical	Physical- chemical
Occurrence	Plants only	Plants and animals

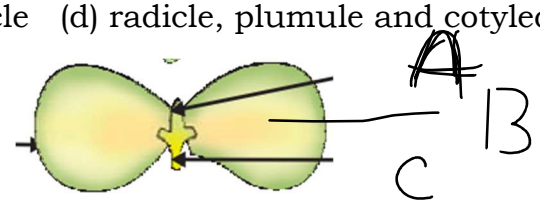
	Menarche	**Menopause**
Menstruation	Beginning of menstruation	End of menstruation
Age	10-13 years	45-50 years
	Vasectomy	**Tubectomy**
Sex	Male	Female
Process	Vas deferens are cut	Fallopian tube is cut
Function	Prevents passage of sperms from testes	Prevents passage of ova from ovary

MCQ:

1. In the below figure part A,B and C are sequentially

a) cotyledon , plumule and radicle b) plumule, cotyledon and radicle

(c) plumule, radicle and radicle (d) radicle, plumule and cotyledon



Ans: (b)

2. The development of a seedling from an embryo under appropriate condition is called

(a) regeneration (b) germination (c) vegetative propagation (d) pollination

Ans : (b) germination (Germination is a process occurring in plants in which the embryo develops into a seedling under appropriate condition.)

3. Site of fertilization in mammals is

(a) ovary (b) uterus (c) vagina (d) fallopian tube

Ans : (d) fallopian tube

4. By which method, asexual reproduction occurs in Amoeba

(a) fission (b) budding (c) germination (d) all of these

Ans : (a) fission

5. Which of the following is not an outcome of variations present in population?

(a) Bacterial resistance to heat (b) Different colour of eyes

(c) Maintenance of body design features (d) Survival of species over time

Ans : (c) Maintenance of body design features

Variations are not responsible for maintenance of body design features.

6. Asexual reproduction produces offspring that are

(a) genetically identical to their parents (b) genetically identical to their siblings

(c) none of the above (d) both (a) and (b)

Ans : (d) both (a) and (b)

7. Which of the following have buds on their leaves as vegetative reproducing structure?

(a) Rose (b) Strawberry (c) Bougainvillea (d) Bryophyllum

Ans : (d) Bryophyllum (Bryophyllum reproduces by the buds present in their

notches along the leaf margin of Bryophyllum which falls on the soil and develops into new plants).

8. The development of offspring from any part of body is called

(a) asexual reproduction (b) sexual reproduction

(c) vegetative reproduction (d) all the above

Ans : (a) asexual reproduction

9.The process of development of organism like itself is called

(a) budding (b) flowering (c) reproduction (d) none of the above

Ans : (c) reproduction

10.The migration of pollen grains to stigma is called as

(a) fertilization (b) pollination (c) fusion (d) reproduction

Ans: b

11.Oral-contraceptives prevent the

(a) fertilization (b) ovulation (c) implantation (d) entrance of sperms in vagina

Ans : (b) ovulation

12.Which of the following is embedded in the uterine wall?

(a) Zygote (b) Embryo's head (c) Placenta (d) Eggs

Ans : (c) Placenta

13.Fertilization occurs in human beings in

(a) uterus (b) ovary(c) oviduct (d) vagina

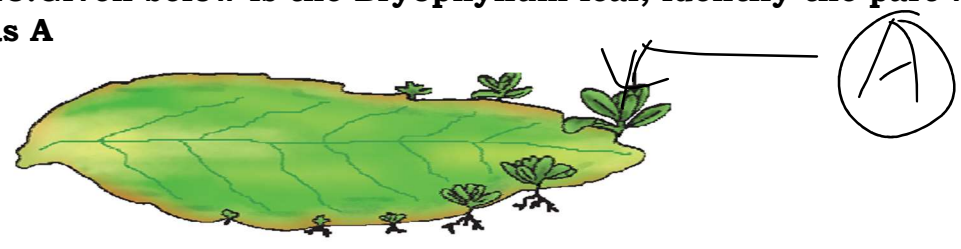
Ans : (c) oviduct

14. The anther contains

(a) sepals (b) ovules (c) carpel (d) pollen grains

Ans : (d) pollen grains

15.Given below is the Bryophyllum leaf, identify the part which is labelled as A



(a) Runner (b) Buds (c) spore (d) eye Ans: (b)

ASSERTION AND REASON:

DIRECTION : In the following questions, a statement of

assertion (A) is followed by a statement of reason (R). Mark the correct choice as a) Both A and R are true, and R is the correct explanation of A.

b) Both A and R are true, and R is not the correct explanation of A.

c) A is true but R is false.

d) A is false but R is true.

1. Assertion : DNA copying is necessary during reproduction.

Reason : DNA copying leads to the transmission of characters from parents to offspring.

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

2. Assertion : Sexual reproduction increases genetic diversities and plays a role in origin of new species.

Reason : Sexual reproduction involves formation of gametes and fusion of gametes.

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

3. Assertion : Vagina is also called as birth canal.

Reason : During birth, the baby passes through the vagina.

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

4. Assertion : Vasectomy is a surgical method or birth control.

Reason : In vasectomy, small portion of oviduct is cut or tied properly.

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

Vasectomy is a surgical method or birth control. in which small portion of the sperm duct is cut or tied properly.

5. Assertion : Pollen grains from the carpel stick to the stigma of stamen.

Reason : The fertilised egg cells grow inside the ovules and become seeds.

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

6. Assertion : Plasmodium reproduces by multiple fission.

Reason : Multiple fission is a type of asexual reproduction.

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

7. Assertion : At puberty, in boys, voice begins to crack and thick hair grows on face.

Reason : At puberty, there is decreased secretion of testosterone in boys.

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

8. Assertion : Spores are unicellular bodies.

Reason : The parent body simply breaks up into smaller pieces on maturation.

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

9. Assertion: Surgical methods are most effective methods of contraception.

Reason : Surgical method blocks gametes transport and hence prevent fertilisation.

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

VSA/SA

1.When a cell reproduces, what happens to its DNA?

Ans: Its DNA first doubles up followed by its equal and accurate division between two daughter cells.

2.Where is DNA found in a cell?

Ans Genes/Chromosomes.

3.How does the embryo gets nourishment from the mother?

Ans: Through placenta.

4.Why does the lining of uterus become thick and spongy every month?

Ans. To receive and nurture the growing embryo, lining of uterus become thick and spongy.

5.Give the respective scientific terms used for studying:

a. The mechanism by which variations are created and inherited and

b. The development of new type of organisms from the existing ones.

Ans:a. Heredity b. Fission.

6.What are sexually transmitted diseases? Name an STD which damages the immune system of human body

Ans. a. Diseases that spread through the sexual contact. b. AIDS

7.What happens if egg is not fertilized?

Ans : If fertilization does not occur then menstruation

occurs, i.e., blood and mucus come out through the vagina.

8.List two functions performed by testis in human beings.

Ans : a. Testis produce sperms.

b. Produces male sex hormone, testosterone.

9.“Variations” are seen in the organisms. State the two main causes of variation.

Ans : Variations are caused by: a. Change in the genetic material, i.e., DNA at the

time of DNA copying.

b. Environmental factors viz., light, temperature, nutrition, wind and water

supply, etc.

10.What happens when the following situations are initiated:

a. A Planaria is cut into three different pieces.

b. Leaf of the Bryophyllum with notches falls on the soil.

ANS:

a.Each piece grows into a complete organism.

b. Develops into new plants

LA

1.Why do we need to adopt contraceptive measures?

Ans :

a. Contraceptive measures are needed to be adopted

to prevent unwanted pregnancies.

b. To prevent sexually transmitted diseases.

c. Spacing between children.

2. a) Draw a labelled diagram of the longitudinal section of a flower.

b) which of the parts of flower convert into i) fruit ii) seed

Ans a) ncert text book

b) i) ovary converts into fruit ii) ovule convert into seed

3. How does the embryo get nourishment inside the mother’s body?

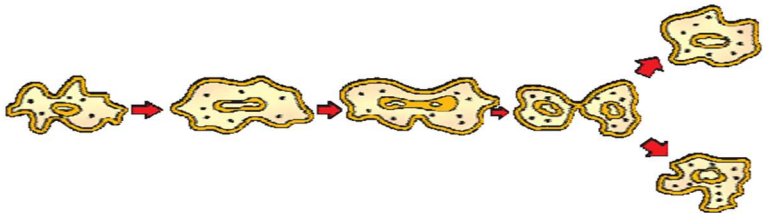
Solution: The embryo develops inside the mother's body for about nine months. Inside the uterus, the outer tissue surrounding the embryo develops finger-like projections called villi. These villi are surrounded by uterine tissue and maternal

blood. They provide a large surface area for exchange of oxygen and nutrients. Also, there is a special tissue called placenta, which is embedded in the uterine wall. The embryo receives the oxygen and nutrients from the mother's blood via the placenta. The waste materials produced by the embryo are also removed through the placenta.

4. f a woman is using a Copper-T, will it help in protecting her from sexually transmitted diseases?

Solution : Copper-T cannot protect the woman from acquiring sexually transmitted disease. It will protect her from only unwanted pregnancy.

5. Study the diagram given below:



a. Identify the process.

b. Which organism uses the above method of reproduction?

c. How is the above method different from the process of fragmentation?

VERY LONG ANSWER TYPE QUESTION

1.Differentiate between the following:

a. Placenta and uterus

b. Unisexual and bisexual flowers

c. Fertilization and germination

Ans:

2. Identify the following methods and giving one example of each:

a. Process in which reproduction takes place by breaking up of parent into fragments.

b. Process of dividing of organisms into many cells simultaneously.

c. Process of reproduction by formation of bud on parent body.

d. Process of reproduction by formation of spores.

e. Process used by multicellular organisms to reproduce by cutting into many pieces each piece forms a new individual.

Ans :

a. Fragmentation, Spirogyra

b. Multiple fission, Plasmodium

c. Budding, Hydra

d. Spore formation, Rhizopus

e. Regeneration, Planaria.

3. Explain what happens when:

a. Testosterone is released in males.b. Pollen grain falls on the stigma of the flower.

c. Egg fuses with sperm cell. d. Planaria is cut into many pieces.

e. Buds are formed on the notches of the Bryophyllum leaf.

4. Define the following processes:

a. Fertilization b. Menstruation c. Binary fission

d. Vegetative propagation e. Regeneration

Ans: given in notes

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

(i) Eggs develop

(ii) Fertilization takes place

(iii) Fertilized eggs get implanted.

b. Describe in brief, the changes the uterus undergoes:

(i) To receive the zygote

(ii) If zygote is not formed.

Ans:

Correct labelled diagram

(i) Ovary

(ii) Oviduct or fallopian tube

(iii) Uterus or uterus wall

b. (i) It becomes thicker due to development of blood vessels and glands in it.

(ii) It gets peeled and shed off along with mucus, blood, dead ovum during menstruation.

CASE BASED

Q. 1. In angiosperms, pollination is defined as the placement or transfer of pollen from the anther to the stigma of the same flower or another flower. Upon transfer, the pollen germinates to form the pollen tube and the sperm for fertilizing the egg. Pollination has been well studied since the time of Gregor Mendel. Pollination takes two forms: self-pollination and cross-pollination. Self-pollination occurs when the pollen from the anther is deposited on the stigma of the same flower, or another flower on the same plant. Cross-pollination is the

transfer of pollen from the anther of one flower to the stigma of another flower on a different individual of the same species. Self-pollination occurs in flowers where the stamen and carpel mature at the same time, and are positioned so that the pollen can land on the flower's stigma. Genetic diversity is required so that in changing environmental or stress conditions, some of the progeny can survive. Self-pollination leads to the production of plants with less genetic diversity, since genetic material from the same plant is used to form gametes. In contrast, cross-pollination—or out-crossing—leads to greater genetic diversity. Because cross-pollination allows for more genetic diversity, plants have developed many ways to avoid self-pollination. In some species, the pollen and the ovary mature at different times. By the time pollen matures and has been shed, the stigma of this flower is mature and can only be pollinated by pollen from another flower. Some flowers have developed physical features that prevent self-pollination. The primrose is one such flower. Primroses have evolved two flower types with differences in anther and stigma length. Many plants, such as cucumber, have male and female flowers located on different parts of the plant, thus making self-pollination difficult. In yet other species, the male and female flowers are borne on different plants (dioecious). All of these are barriers to self-pollination; therefore, the plants depend on pollinators to transfer pollen. The majority of pollinators are biotic agents such as insects (like bees, flies, and butterflies), bats, birds, and other animals. Other plant species are pollinated by abiotic agents, such as wind and water.

(i) Name two types of pollination.

(ii) Germination of pollen tube is an example which type of tropism?

(iii) Why is there more genetic diversity in cross pollination?

(iv) How is self-pollination prevented in case of cucumber and hence causing possibility of more genetic diversity?

(v) Give example of two biotic pollinators.

CHAPTER 10

HEREDITY AND EVOLUTION

Prepared by: - SMT SHILPI BILLAIYA,

KV DHANBAD NO. 01

Heredity and Evolution

Heredity : A recognisable feature of a human being (or any other organism) like height, complexion, shape of hair, colour of eyes and shape of nose and chin, etc., is called 'character' or 'trait'.

. The transmission of characters (or traits) from the parents to their offspring is called heredity. In most simple terms, heredity means continuity of features from one generation to the next.

. The hereditary information is present in the sex cells (or gametes) of the parents. Thus, gametes constitute the link between one generation and the next, and pass on the paternal (father's) and maternal (mother's) characters or traits to the offspring.

Variations : The offspring are never a true copy of their parents. In fact, no two individuals are exactly alike and the members of any one species differ from one another in some characters (or traits) or the other. These differences are known as variations, i.e., the differences in the characters (or traits) among the individuals of a species is called variation.

Accumulation of variations : Variations appear during reproduction whether asexual or sexual

. Minor variations may arise during asexual reproduction due to small inaccuracies in DNA copying.

. Sexual reproduction generates even greater diversity. This is so because sexual reproduction involves two parents (father and mother) and every offspring receives some characters of father and some of mother. Different offspring receive different combinations of characters of their parents and show distinct variations among themselves as well as from their parents.

During sexual reproduction variations arise due to –

Chance separation of chromosomes during gamete formation (gametogenesis)

Chance coming together of chromosomes during fertilisation

Mutations, i.e., alterations in the genetic material

Crossing over during meiosis

. The significance of a variation shows up only if it continues to be inherited by the offspring for several generations.

. The great advantage of variation to a species is that it increases the chances of its survival in a changing environment.

Gene as unit of heredity: Chromosome is a thread-like structure in the nucleus of a cell and is formed of DNA which carries the genes.

. Genes for controlling the same characteristic of an organism can be of two types : dominant or recessive. The gene which decides the appearance of an

organism even in the presence of an alternative gene is known as a **dominant gene** and the dominant gene is represented by a capital letter. The gene which can decide the appearance of an organism only in the presence of another identical gene is called as **recessive gene**. The corresponding recessive gene is represented by the corresponding small letter. Genotype is the description of genes present in an organism.

Mendel's experiments : Mendel selected garden pea (Pisum sativum) for series of hybridisation experiments because it has some special features.

Special features of garden pea plant are:

It is easy to grow.

Garden pea plant has distinct, easily detectable contrasting variants of features.

Mendel, in fact, noted seven pairs of such contrasting characters in garden pea plant.

The plant has bisexual flowers wherein artificial cross fertilisation could be easily achieved.

It has a short life cycle and, therefore, it is possible to study number of generations in less time.

Each pea plant produces many seeds in one generation.

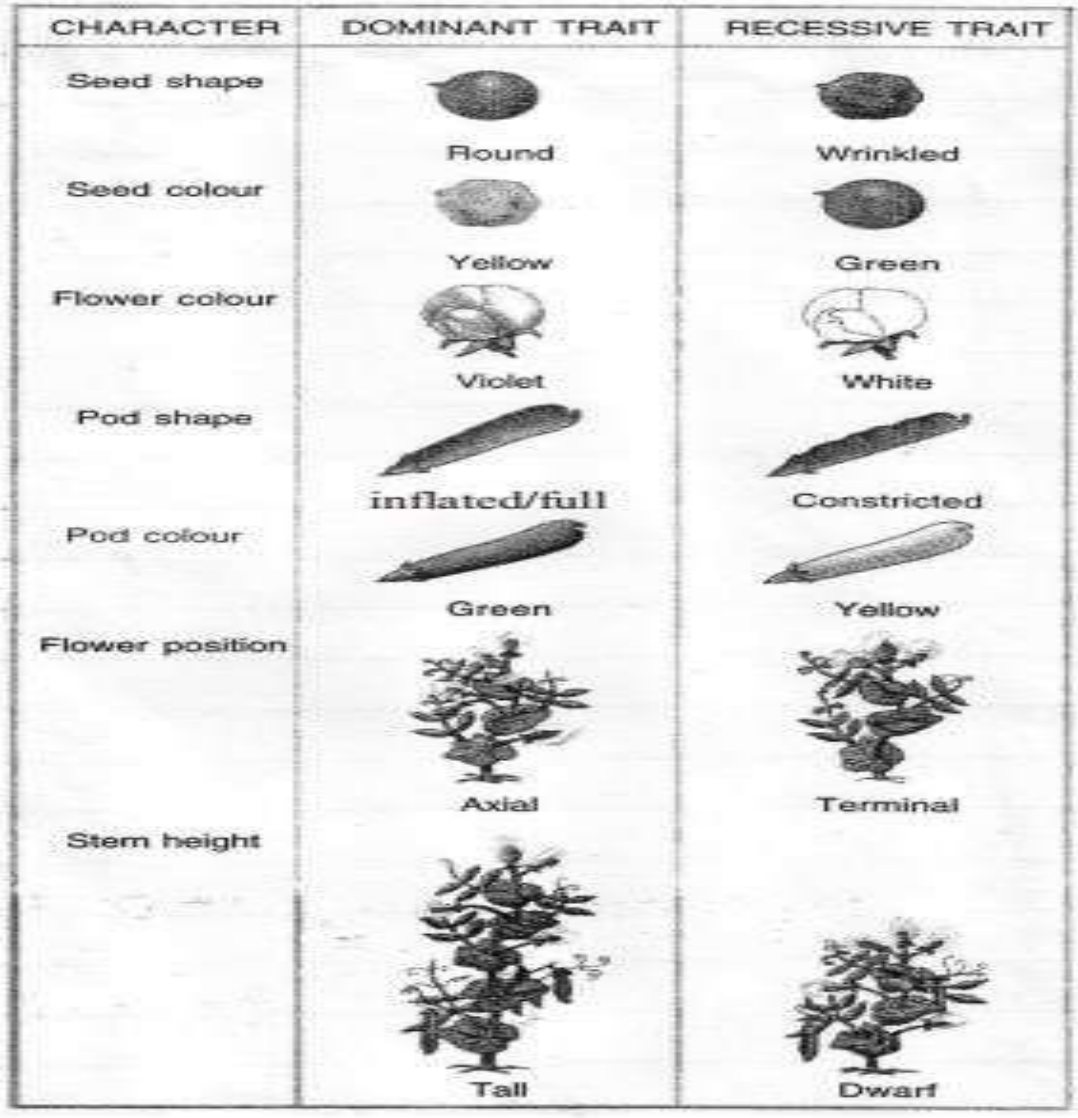
The characters which always appear in two opposing conditions are called contrasting characters.

PLANTS SELECTED BY MENDEL

Pisum sativum (garden pea). Mendel used a number of 7 contrasting characters for garden peas

(TABLE OF CONTRASTING CHARACTERS. SEVEN PARTS)		
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.

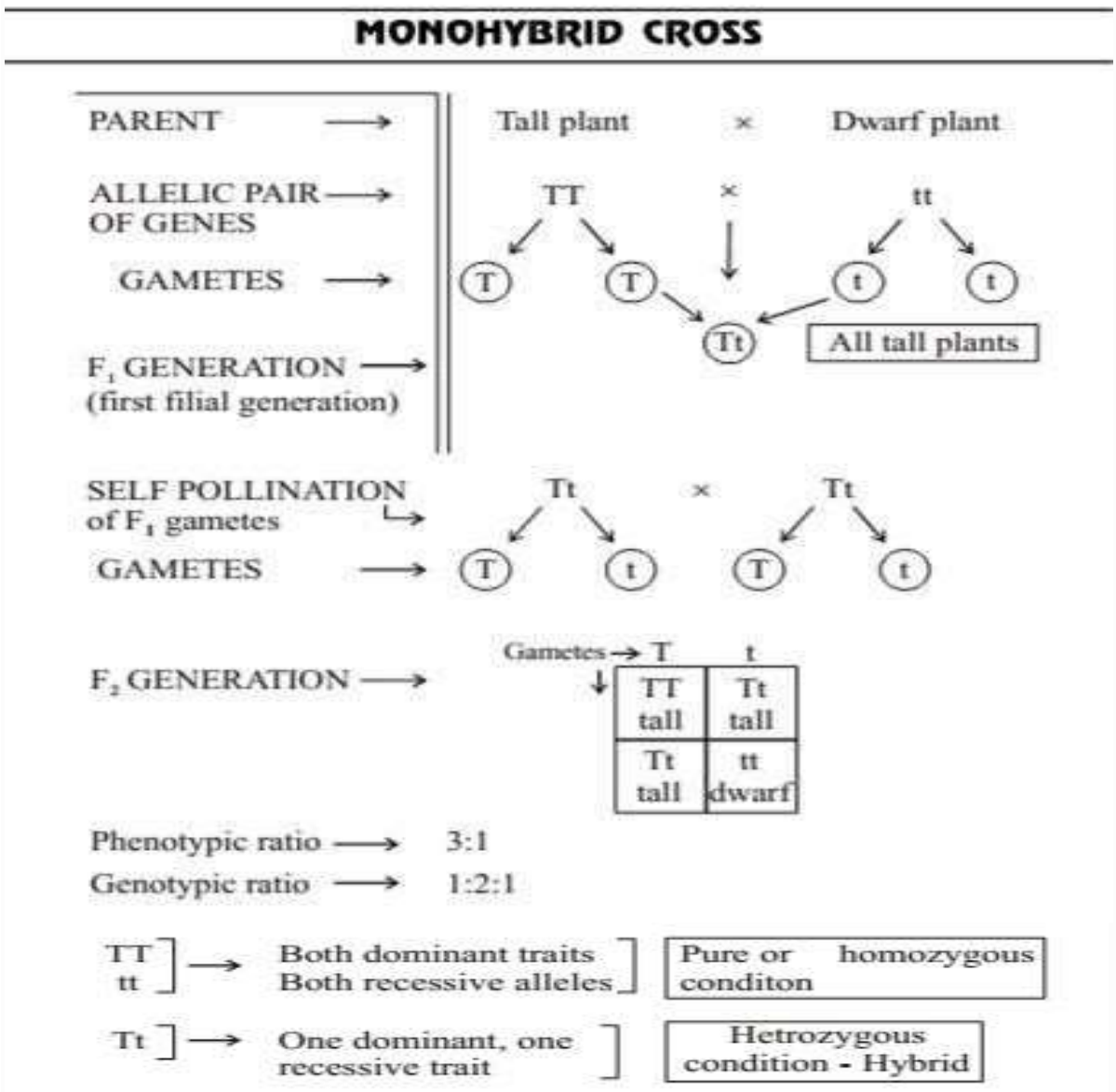


Mendel's Experiments

Mendel conducted a series of experiments in which he crossed the

pollinated plants to study one character (at a time)

- A Cross between two pea plants with one pair of contrasting characters is called a monohybrid cross.
- Cross between a tall and a draft plant (short).



Phenotype ® Physical appearance [Tall or Short]

Genotype ® Physical appearance [Tall or short]

Observations of Monohybrid Cross

1. All F1 progeny were tall (no medium height plant (half way characteristic)
2. F2 progeny ¼ were short, 3/4 were tall
3. Phenotypic ratio F2 – 3 : 1 (3 tall : 1 short)

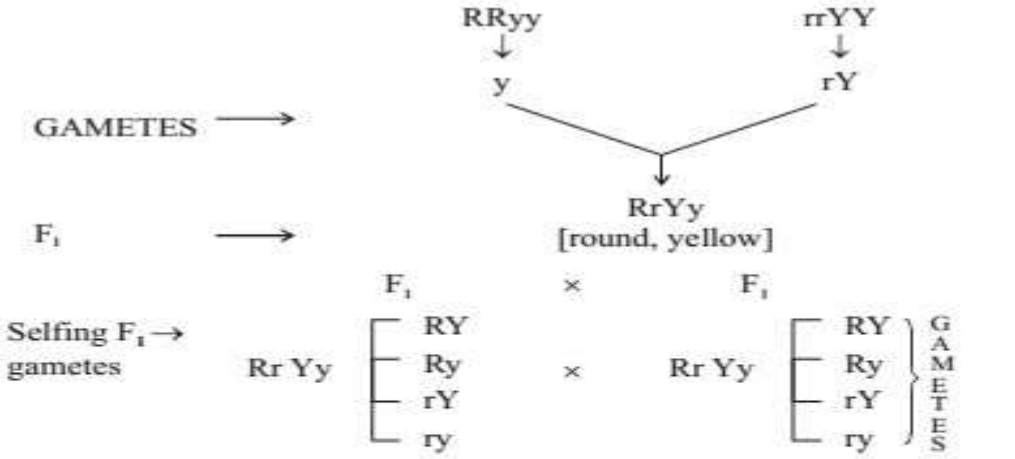
$$\begin{pmatrix} TT : Tt : tt \\ 1 : 2 : 1 \end{pmatrix}$$

Genotypic ratio F2 – 1:2:1

Dihybrid Cross

A cross between two plants having two pairs of contrasting characters is called a dihybrid cross.

Parent → *Round* × *Wrinkled*
Generation *Green seeds* *Yellow seeds*



F1 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

1. When **RRyy** was crossed with rrYY in F1 generation all were Rr Yy round and yellow seeds.
2. Self-pollination of F plants gave parental phenotype and two mixtures (recombinants round yellow & wrinkled green) seeds plants in the ratio of 9:3:3:1

Conclusions

1. Round and yellow seeds are **DOMINANT** characters
2. The occurrence of new phenotypic combinations shows that genes for round and yellow seeds are inherited independently of each other.

From these observations, Mendel put forward the rules of inheritance

Mendel's law of dominance states that

When parents with pure, contrasting traits form of trait appears in the next generation . The hybrid off springs will exhibit only the dominant trait in the phenotype.” Law of dominance is known as the first law of inheritance.

Law of Segregation

Every individual possesses a pair of alle from the alleles. A gamete formation, a gamete receives only dominant or recessive in a particular gen

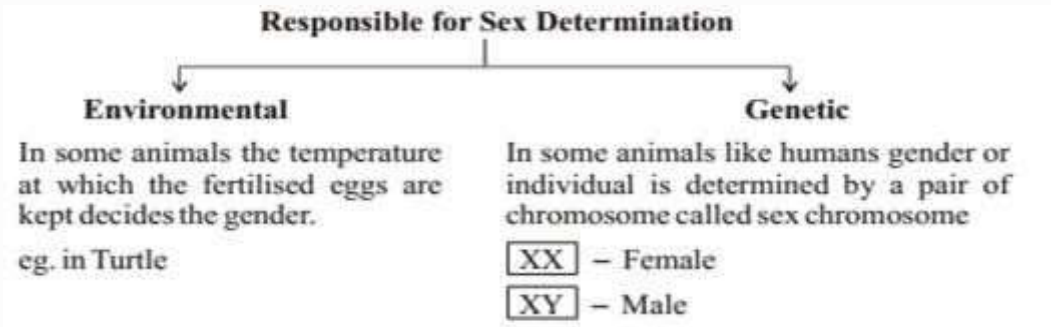
Law of Independent Assortment

Alleles of different characters separate during gamete formation. In the above true were independently from those of seed colour.

SEX DETERMINATION

Determination of the sex of an offspring.

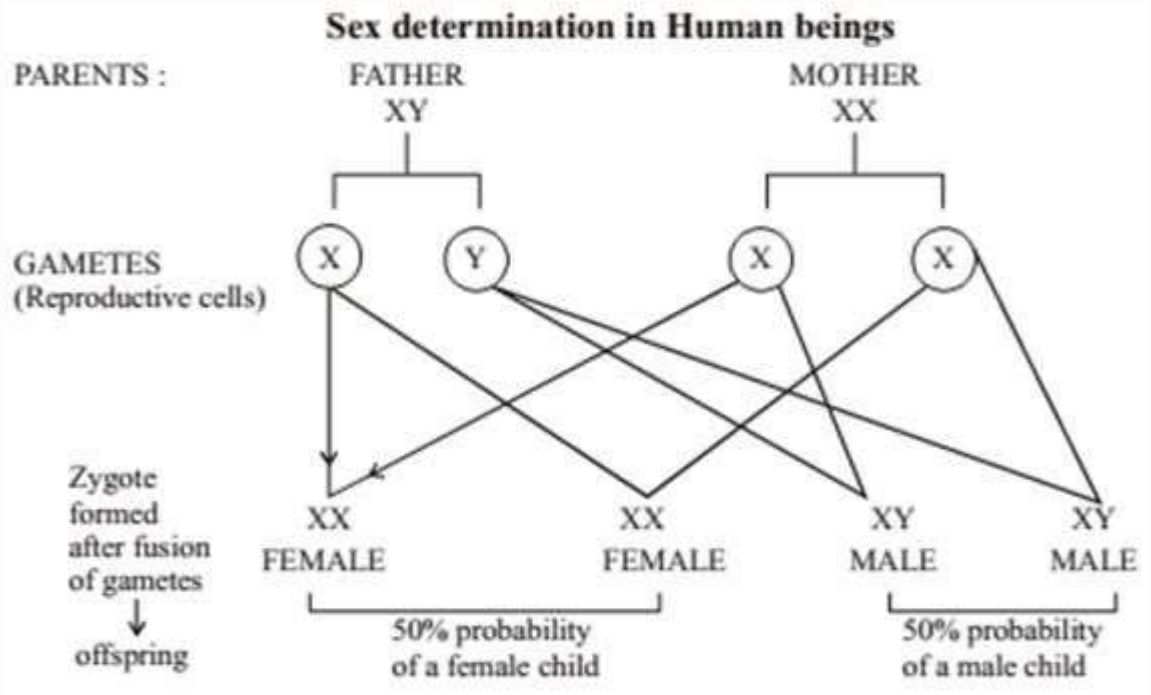
FACTORS



Sex Chromosomes

In human beings, there are 23 pairs of chromosomes. Out of these 22 chromosomes, pairs are called autosomes and the last pair of chromosomes that help in deciding the gender of that individual is called the sex chromosome.

XX – female
XY – male



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 of 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.

Some important definitions

- Genetics: Branch of science that deals with Heredity and variation.

  Heredity: It means the transmission of features/ characters/ traits from one generation to the next generation.
- Variation: The differences among the individuals of a species/population are called variations. It takes place due to environmental changes, crossing over, and recombination of genes and mutation.
- **Genotype:** The complete set of genes in an organism's genome is called genotype.
- **Phenotype:** The observable characteristics in an organism make the phenotype. A phenotype is a modified genotype and many of the phenotypes cannot be inherited.
- Clones are those organisms that are exact copies of each other.

I . MULTIPLE CHOICE QUESTIONS

Q1) Mendel conducted his famous breeding experiments by working on the following:

(a) Drosophila

(b) Escherichia Coli

(c) Pisum Sativum

(d) All of these

Correct Answer: Option (c)

Q2) Which of the following is an example of genetic variation?

(a) One person has a scar, but his friend doesn't

(b) One person is older than the other

(c) Reeta eats meat, but her sister Geeta is a vegetarian

(d) Two children have different eye colour

Correct Answer: Option (d)

Q3) In peas, a pure tall (TT) is crossed with a pure short plant(tt). The ratio of pure tall plants to pure short plants in the F2 generation is:

(a) 1:3

(b) 3:1

(c) 1:1

(d) 2:1

Correct Answer: Option (c)

Q4) Humans have two different sex chromosomes, X and Y. Based on Mendel's laws, a male offspring will inherit which combination of chromosomes?

(a) Both the X chromosomes from one of its parents

(b) Both the Y chromosomes from one of its parents

(c) A combination of X chromosomes from either of its parents

(d) A combination of X and Y chromosomes from either of its parents

Correct Answer: Option (d)

Q5) Two pea plants, one with round green seeds (RR yy) and another with wrinkled yellow (rrYY) seeds, produce F_1 progeny that have round yellow (RrYy) seeds. When F_1 plants are self-pollinated, the F_2 progeny will have a new combination of characters. Choose the new combinations from the following:

(i) Round, yellow **(ii) Round, green**

(iii) Wrinkled, yellow **(iv) Wrinkled, green**

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

(c) (ii) and (iii) (d) (i) and (iii)

Correct Answer: Option (b)

Q6) Two pink-coloured flowers on crossing resulted in 1 red, 2 pink and 1 white-flower progeny. The nature of the cross will be:

(a) double fertilization

(b) self-pollination

(c) cross-fertilization

(d) no fertilization

Correct Answer: Option (c)

Q7) A zygote which has an X chromosome inherited from the father will develop into a:

(a) boy

(b) girl

(c) X chromosome does not determine the sex of a child

(d) either boy or girl

Correct Answer: Option (b)

Q8) In humans, if gene B gives brown eyes and gene b gives blue eyes, what will be the colour of the eyes of the person having combination (i) Bb (ii) BB:

(a) (i) Brown (ii) Brown

(b) (i) Blue (ii) Blue

(c) (i) Blue (ii) Brown

(d) (i) Brown (ii) Blue

Correct Answer: Option (a)

Q9) What is the probability that the male progeny will be a boy?

(a) 50 % (b) 56 %

(c) 47.43 % (d) It varies

Correct Answer: Option (a)

Q10) In pea plants, yellow seeds are dominant to green seeds. If a heterozygous yellow-seeded plant is crossed with a green-seeded plant, what ratio of yellow and green-seeded plants would you expect in the F_1 generation?

(a) 9:1

(b) 3:1

(c) 1:3

(d) 50:50

Correct Answer: Option (d)

II.ASSERTION REASON based Questions

For question numbers 11-20, a statement of assertion followed by a statement of reason is given. Choose the correct answer out of the following choices.

(a) Both assertion and reason are true, and reason is correct explanation of the assertion

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

(c) Assertion is true, but reason is false.

(d) Assertion is false, but reason is true.

11. Assertion : Mendel successfully postulated laws of heredity

Reason : He recorded and analysed results of breeding experiments quantitatively.

12. Assertion : The principle of segregation given by Mendel is the principle of purity of gametes.

Reason : Gametes are pure for a character and do not mix up.

13. Assertion : Test cross is a back cross.

Reason : In test cross, individual is crossed with recessive parent

14. Assertion : Pure lines are called true breeds.

Reason : True breeds are used for cross breeding.

15. Assertion : In a monohybrid cross, offspring of F1 generation express dominant character.

Reason : Dominance occurs only in heterozygous state.

16. Assertion : The traits that are obtained from parents are inherited traits.

Reason : These traits were developed in the parents during their lifetime.

17. Assertion: If blood group of both mother and father is 'O' then the blood group of children will also be O.

Reason: Blood group in humans is determined by many alleles of a gene viz. I A, I B, I O.

18. Assertion: In grasshoppers, females are heterogametic and males are homogametic.

Reason: In grasshoppers, male has only one sex chromosome (XO) whereas the female has sex chromosomes (XX).

19. Assertion: If mother is homozygous for black hair and father has red hair then their child can inherit black hair.

    Reason: Gene for black hair is recessive to gene for red hair in humans.

20. Assertion: A child which has inherited X chromosome from father will develop into a girl child.

    Reason: Girl child inherits X chromosome from father and Y chromosome

    from mother.

Answers

11. a	12. a	13. b	14. b	15. c
16. c	17. b	18. d	19. c	20. C

III. Case Study/Passage Based Questions

Case Study 1

A scientist cross pure-bred tall (dominant) pea plant with pure-bred dwarf (recessive) pea plant he will get pea plants of F1 generation. If now self-cross the pea plant of F2 generation is done, then we obtain pea plants of F2 generation.

(a) State the type of plants not found in F2 generation but appeared in F2 generation, mentioning the reason for the same

Answer – In the F1 generation, Dwarf trait is recessive trait which was not expressed. After self-pollination, the recessive trait gets expressed in F2 generation

(b) State the ratio of tall plants to dwarf plants in F2 generation. Write the full form of
DNA.

Answer- Ratio – 3:1

Full form of DNA – Deoxyribonucleic acid

(c) What do the plants of F2 generation look like?

Answer – All plants of F1 generation will be tall plants.

(d) How does the creation of variations in a species promote survival?

Answer – Variations promote the survival only when the species wants to allow by itself for survive to the continuous changing environment and conditions. During variations, different species get different kinds of advantages depending on the nature.

Case Study – 2

The rules for inheritance of such traits in human beings are related to the fact that both the father and the mother contribute practically equal amounts of genetic material to the child. This means that each trait can be influenced by both paternal and maternal DNA. Thus, for each trait there will be two versions in each child. What will, then, the trait seen in the child be?

i) What were the contrasting traits used by mendel?

Ans: Tall and dwarf plant, round/ wrinkled seeds, white / violets flower and on the basis of pod colour etc.

ii) What was the phenotypic ratio of monohybrid cross?

Ans: 3:1 here, 3 is for tall plants and 1 is dwarf plants.

iii) What was the genotypic ratio of monohybrid cross? Ans: 1:2:1 **iv)**

How does the traits get expressed?

Ans: Genes control traits, the diploid organism inherit two alleles from a gene i.e one is from father and one is from mother.

v) Write the monohybrid cross between tall and dwarf plants?

Ans: TT × tt

👇 👇

F1: Tt × Tt

👇

F2: TT Tt Tt tt

Case Study – 3

Pure bred pea plant with smooth seeds (dominant characteristic) were crossed with pure bred pea plant with wrinkled seeds (recessive characteristic) . The F1 generation was self pollinated to give rise to the F2 generation.

(a) What is the expected observation of the F1 generation of plants ?

Answer – All of them have smooth seeds.

(b) What is the expected observation of the F2 generation of plants ?

Answer- ¼ of them have wrinkled seeds and ¾ of them have smooth seeds

(c) What will be the genotypic ration of F2 offspring , also mention whether it will be homozygous or heterozygous ? Answer- Genotypic ratio = 1: 2: 1

- Homozygous dominant
- Heterozygous dominant
- Homozygous recessive

IV. SHORT ANSWER QUESTIONS

Q. 21) In an asexually reproducing species if trait X exists in 5% of a population and trait Y exists in 70% of the same population, which of the two traits is likely to have arisen earlier? Give reason.

Ans. Trait Y which exists in 70% (larger fraction) of the population, is likely to have arisen earlier because in asexual reproduction, identical copies of DNA are produced and variations occur negligibly.

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

Q. 22) Give the pair of contrasting traits of the following characters in the pea plant and mention which is dominant and which is recessive.

i. **Yellow seed ii. Round seed**

Ans. i. Yellow – dominant; Green – recessive

ii. Round – dominant; Wrinkled – recessive

Note: Remember this chart

Characteristic studied	Dominant character	Recessive character
Stem length	Long 	Short 
Flower Position	Axillary 	Terminal 
Flower colour	Blue 	White 
Pod shape	Inflated 	Constricted 
Pod colour	Green 	Yellow 
Seed shape	Round 	Wrinkled 
Seed colour	Yellow 	Green 

Q. 23) In a pea plant, find the contrasting trait if:

a. **The position of the flower is terminal.**

b. **The flower is white in colour.**

c. **Shape of the pod is constricted.**

Ans. a. Axial position of the flower. b.
Purple colour of the flower.

c. Inflated shape.

Q.24) Why did Mendel choose a pea plant for his experiments?

Ans. Mendel chose a pea plant for his experiments because:

i. It is easy to grow.
ii. It is naturally self-pollinating and so is very easy to raise pure-breeding individuals.
iii. It has a short life span as it is an annual crop and so it was possible to follow several generations.
iv. It is easy to cross-pollinate.
v. It has deeply contrasting characters.
vi. The flowers are bisexual.

25) What is a gene? Where are genes located?
Ans. It is the basic unit of heredity. It is a specific part (DNA segment) of a chromosome that controls the expression of a character. Genes are located on chromosomes.

Q.26) A Mendelian experiment consisted of breeding pea plants bearing violet flowers with pea plants bearing white flowers. What will be the result in F1 progeny?
Ans. All F1 progeny will bear violet flowers as violet is a dominant trait. VV x vv

Gametes: V, v

F1 progeny: Vv (all violet)

Gametes	V
v	Vv

Q. 27) What are monohybrid and dihybrid cross?

Ans. Monohybrid cross: The 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.

Dihybrid Cross: The cross between two plants having two pairs of contrasting characters is called a dihybrid cross. Example: Cross between a round and green seed plant with a wrinkled and yellow seed plant.

Q. 28) In a pea plant, the trait of flowers bearing purple color (PP) is dominant over white color (pp). Explain the inheritance pattern of F1 and F2 generations with the help of a cross following the rules of inheritance of traits. State the visible characters of F1 and F2 progenies. Ans. Parents: PP and pp

F1: PP x pp

Gamet	p

Gametes: P, p

F2: Pp x Pp

p	Pp

Progeny: Pp – Means all F1 progenies bear purple color flowers.
Gametes: P, p, P, p

progeny bear white colour flowers.

Gametes	P	p
P	PP	Pp
p	Pp	pp

Progeny: PP, Pp, Pp, pp – Means 3 F2 progenies bear purple colour flowers, and 1

Q.29) State Mendel's laws of inheritance.

Ans. Mendel's Law of Inheritance.

i. Law of Dominance: Out of a pair of contrasting characters present together, only one is able to express itself while the other remains suppressed. The one that expresses is the dominant character and the one unexpressed is recessive. ii. Law of Segregation: The two members of a pair of factors separate during the formation of gametes.

iii. Law of Independent Assortment: When there are two pairs of contrasting characters, the distribution of the members of one pair into the gametes is independent of the distribution of the other pair.

Q. 30) Mustard was growing in two fields – A and B. While Field A produced browncolored seeds, field B produced yellow-colored seeds. It was observed that in field A, the offspring showed only the parental trait for consecutive generations, whereas in field B, the majority of the offspring showed a variation in the progeny.
What are the probable reasons for these?

Ans. In field A, the reason for the parental trait in consecutive generations of offspring is self-pollination.
In field B, variation is seen to occur because of the recombination of genes as crosspollination is taking place.

V. LONG ANSWER QUESTION

31) After self-pollination in pea plants with round, yellow seeds, the

Seeds	Number
Round, yellow	**630**
Round, green	**216**
Wrinkled, yellow	**202**
Wrinkled, green	**64**

Analyze the result and describe the mechanism of inheritance which explains these
following types of seeds were obtained by Mendel results.

Ans. The ratio obtained is 9:3:3:1 in which parental as well as new combinations are observed. This indicated that progeny plants have not inherited a single whole gene set from each parent.
Every germ cell takes one chromosome from the pair of maternal and paternal chromosomes. When two germ cells combine, the segregation (separation) of one pair of characters is independent of the other pair of characters.

Q . 32) A tall pea plant was crossed with a dwarf one. F1 generation was allowed to self-pollinate and F2 generation was also obtained. Answer the following questions: i. What would be the phenotype of plants in the F1 generation? ii. What would be the phenotypic ratio in the F2 generation? iii. Give a reason for your observation in the F1 generation.

Ans. Parents: PP and pp
F1: PP x pp

Gametes	P
p	Pp

Gametes: P, p

Progeny of F1: Pp

F2: Pp x Pp

Gametes	P	p
P	PP	Pp
p	Pp	pp

Progeny of F2: PP, Pp, Pp, pp
Gametes: P, p, P, p

i. All tall pea plants.

ii. Phenotypic ratio = 3:1 [i.e., 3 tall and 1 dwarf]

iii. The tall trait of the pea plant is a dominant trait over the short trait, a recessive trait.

Q. 33) Mention the function of cellular DNA. Talking tallness as a characteristic of a plant, explain how proteins control the characteristic.

Ans. Cellular DNA is the information source for making proteins in the cell. A section of DNA that provides information for one protein is called the gene for that protein. Let us take the example of tallness as a characteristic. We know that plants have hormones that can trigger growth. Plant height can thus depend on the amount of a particular plant hormone. The amount of the plant hormone made will depend on the efficiency of the process for making it. Consider now an enzyme that is important for this process. If this enzyme works efficiently, a lot of hormones will be made, and the plant will be tall. If the gene for that enzyme has an alteration that makes the enzyme less efficient, the amount of hormone will be less, and the plant will be short. Thus, genes control characteristics or traits.

34) Pooja has green eyes while her parents and brother have black eyes. Pooja's husband Ravi has black eyes while his mother has green eyes and father has black eyes.

a. **On the basis of the above-given information, is the green eye colour a dominant or recessive trait? Justify your answer.**
b. **What is the possible genetic makeup of Pooja's brother's eye colour?**
c. **What is the probability that the offspring of Pooja and Ravi will have green eyes? Also, show the inheritance of eye colour in the offspring with the help of a suitable cross.**
d. **50% of the offspring of Pooja's brother are green-eyed. With the help of cross show how this is possible.**

Ans. a. Yes, green eye colour is recessive as it will express only in homozygous condition.
b. BB or Bb

c. Pooja (bb) x Ravi (Bb)

Gametes: b, b, B, b

d. Pooja's brother (Bb) x Wife (bb)

Gametes: B, b, b, b

Progeny: Bb, Bb, bb, bb – means 50% of the offspring can have green eye color as per the cross shown.

Gametes	b	b
B	Bb	Bb
b	bb	bb

Progeny: Bb, Bb, bb, bb – means 50% of the offspring can have green eye color.

Q. 35) Two pea plants – one with round yellow seeds (RRYY) and

Gametes	B	b
b	Bb	bb
b	Bb	bb

another with wrinkled green (rryy) seeds produce F1 progeny that has round, yellow (RrYy) seeds. When F1 plants are self-pollinated, which new combination of characters is expected in F2 progeny? How many seeds with these new combinations of characters will be produced

when a total of 160 seeds are produced in the F2 generation? Explain with reason.

Ans. New combinations would be Round green and Wrinkled yellow.
The phenotype ratio will be 9:3:3:1

Round green = $^{3}/_{9+3+3+1}$ x 160 = $^{3}/_{16}$ x 160 = 30 seeds
Wrinkled yellow = $^{3}/_{9+3+3+1}$ x 160 = $^{3}/_{16}$ x 160 = 30 seeds.
New combinations are produced because of the independent inheritance of seed shape and seed colour traits.

VI.VERY LONG ANSWER QUESTIONS

Cross	Progeny
i. RRYY x RRYY **Round yellow x Round yellow**	
ii. RrYy x RrYy **Round yellow x Round yellow**	
iii. rryy x rryy **Wrinkled green x wrinkled green**	
iv. RRYY x rryy **Round yellow x wrinkled green**	

Ans. i. RRYY x RRYY

Gametes	RY
RY	RRYY

Progeny: RRYY(Round yellow)

Q36) In the following crosses write the characteristics of the progeny:
Gametes: RY, RY

ii. RrYy x RrYy

Gametes: RY, Ry, rY, ry

iii. rryy x rryy

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

Progeny:- Round yellow : Round green : Wrinkled yellow : Wrinkled green = 9:3:3:1

Gametes: ry, ry

Gametes	ry
ry	rryy

Progeny: rryy (wrinkled green)

iv. RRYY x rryy

Gametes	RY
ry	RrYy

Gametes: RY, ry

Progeny: RrYy (Round yellow)

37) Two human beings who can both roll their tongues produced 11 children. 3 of these children could not roll their tongues and 8 children could roll their tongues. a. Which trait (rolling or not rolling) is controlled by the recessive allele?

b. **State all possible genotypes of the F1 generation of the cross.**

c. **Show the inheritance of the tongue rolling in humans in the given example using a suitable cross. What percentage of offspring will show the same genotype as the parents?**

d. If one of the parents could not roll their tongue, with the help of a cross, calculate the ratio of tongue-rollers to non-tongue-rollers in the offspring.

Ans. a. Rolling is dominant and not rolling is recessive.

b. RR (homozygous dominant), Rr (heterozygous dominant), rr (homozygous recessive)

c. Rr x Rr

Gametes: R, r, R, r

Gametes	R	r
r	Rr	rr
r	Rr	rr

Progeny: Rr, Rr, rr, rr

Gametes	R	r
R	RR	Rr
r	Rr	rr

Progeny: RR, Rr, Rr, rr – means 50% of the offspring will show the same genotype as the parents.

d. Rr x rr

Gametes: R, r, r, r

The ratio of tongue roller to non-tongue roller offspring = 2:2 = 1:1

Q.38) What are chromosomes? Mention the total number of chromosomes along with the sex chromosomes that are present in a human female and a human male. Explain how in sexually producing organisms the number of chromosomes in the progeny remains the same as that of the parents.

Ans. Chromosomes: Thread-like structures made up of DNA found in the nucleus. A human male has 22 pairs of chromosomes along with the XY sex chromosome.

A human female has 22 pairs of chromosomes along with the XX sex chromosome.

The original number of chromosomes becomes half during gamete formation. When the gamete fuse, the original number of chromosomes is restored in the progeny.

Q. 39) In humans, there is a 50% probability of the birth of a boy and a 50% probability that a girl will be born. Justify the statement on the basis of the mechanism of sex determination in human beings.

Ans. In human beings, the genes inherited from our parents decide whether we will be boys or girls. Women have a perfect pair of sex chromosomes (XX). But, men have a mismatched pair (XY).

All children will inherit an X chromosome from their mother regardless of whether they are boys or girls. Thus, the sex of the children will be determined by what they inherit from their father. A child who inherits an X chromosome from her father will be a girl, and one who inherits a Y chromosome from him will be a boy.

Parents: Male (XY) x Female (XX)

Gametes: X, Y (from male) and X, X (from female)

Q 40.) (a) Why is the F_1 progeny always of tall plants when a tall plant is crossed with a short pea plant?

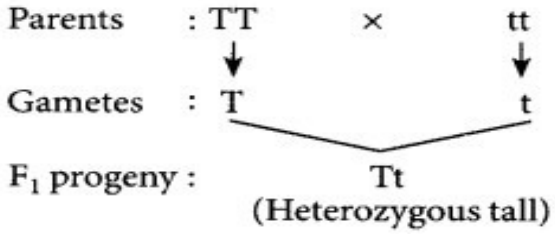
Gametes	X	Y
X	XX (Female)	XY (Male)
X	XX (Female)	XY (Male)

(b) **How is F_2 progeny obtained by self-pollination of F_1 progeny different from F_1 progeny? Give reason for this observation.**

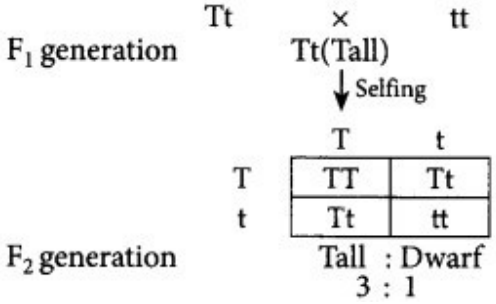
(c) **State a conclusion that can be drawn on the basis of this observation. (2020)**

Answer:

(a) **When a tall plant (TT) is crossed with a short tea plant (tt), only tall plants are obtained in F_1 progeny. It is because out of two contrasting traits only one appears in the progeny of first generation. This means that the trait which appears in F_1 generation is dominant and the trait which does not express is recessive. The character TT for tall plant is dominant, so all the plants are tall.**



(b) On selfing F_1 progeny



In F_2 generation we obtained both tall and dwarf plants. Appearance of suppressed recessive trait in individuals of F_2 generation in Mendelian cross indicates that characters of recessive traits are not lost. When the F_1 generation plants were allowed to self-fertilise both the parental trait were expressed in definite proportion in F_2 generation.

(c) Above observation shows that only one dominant allele is expressed. This is called law of dominance. In a heterozygous individual, two dissimilar alleles remain together and do not get mixed up. At the time of gamete formation, they separate so that each gamete receives only one allele is always pure. This is called "law of purity of gametes".

CHAPTER 11

LIFE PROCESSES

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KV GARHWA

LIFE PROCESSES

NOTES

LIFE PROCESSES

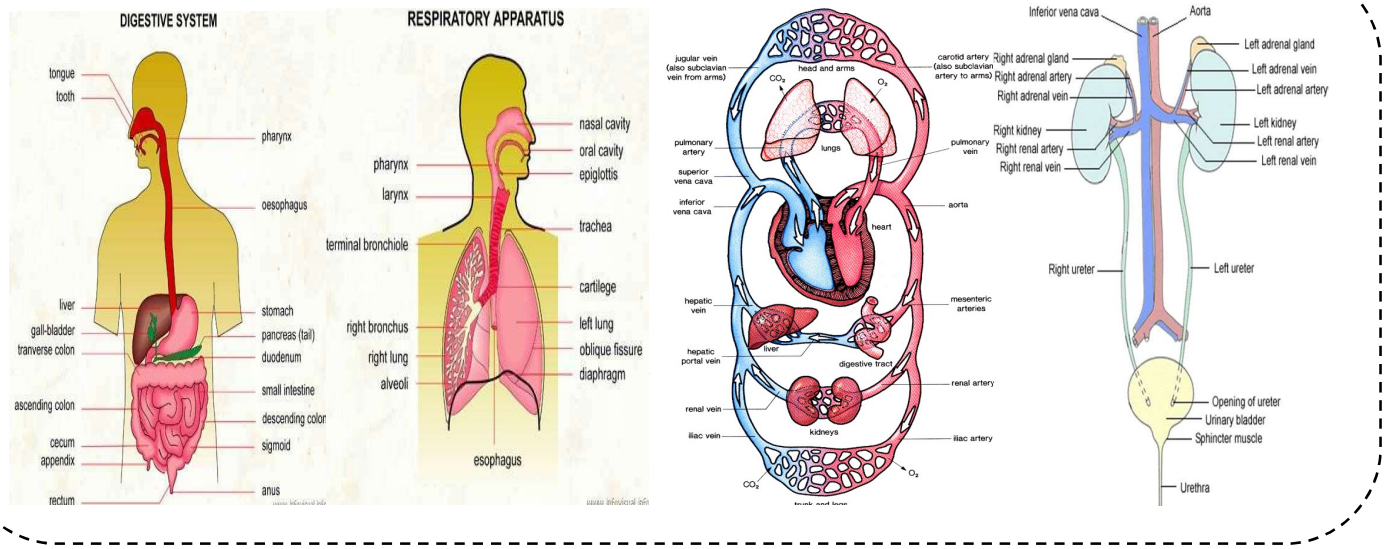
Life processes are the basic processes in living organisms which are necessary for maintaining their life. The basic life processes are – nutrition, respiration, transportation, and excretion.

i) **Nutrition: is the process of taking food by an organism and its utilization by the body for life processes.**

ii) **Respiration: is the process by which food is burnt in the cells of the body with the help of oxygen to release energy.**

iii) **Transportation: is the process by which food, oxygen, water, waste products are carried from one part of the body to the other,**

iv) **Excretion: is the process by which waste products are removed from the body.**



NUTRITION

Nutrition is the process of taking food by an organism and its utilization by the body to build the body, for growth, to repair the damaged parts of the body and for energy.

Life on earth depends on carbon-based molecules and most of the food are also carbon-based molecules. The outside raw materials used by living organisms are food, water and air.

Modes of nutrition:- There are two main modes of nutrition. They are autotrophic nutrition and heterotrophic nutrition.

i)Autotrophic nutrition :- is nutrition in which organisms prepare their own food from simple inorganic substances like carbon dioxide and water in the presence of sunlight and chlorophyll.

Eg :- all green plants and some bacteria.

ii)Heterotrophic nutrition :- is nutrition in which organisms get their food directly or indirectly from plants.

Eg :- all animals fungi and some bacteria.

Types of heterotrophic nutrition :- There are three main types of heterotrophic nutrition. They are saprophytic, parasitic and holozoic nutritions.

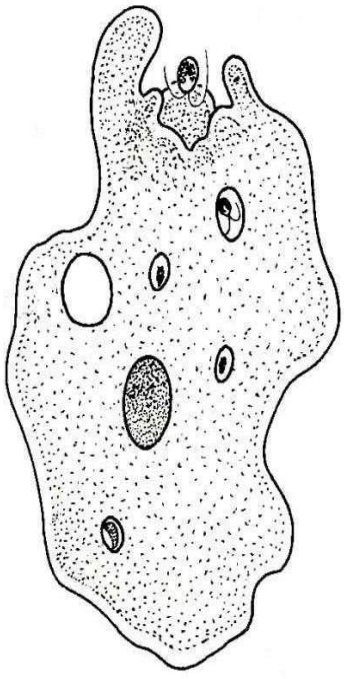
i) **Saprohytic nutrition :**- is nutrition in which organisms get their food from dead and decaying organisms. They break down the food material outside their body and then absorbs it. Eg :- mushroom, bread mould, yeast, some bacteria etc.

ii) **Parasitic nutrition** :- is nutrition in which organisms get their food from living organisms (host) without killing them. Eg :- cuscuta, orchids, ticks, lice, leeches, round worm, tape worm, plasmodium etc.

iii) **Holozoic nutrition** :- is nutrition in which organisms take food directly and then digests and absorbs it. Eg :- amoeba, paramaecium, birds, fishes, humans etc

Saprotroph (Mushroom)

Parasite (Cuscuta)



Holozoic (Amoeba)

Autotrophic Nutrition

It is a type of nutrition in which inorganic materials such as carbon-dioxide, is used up to synthesize organic food by a process known as photosynthesis. For example, green plants use autotrophic mode of nutrition. Organisms which use autotrophic mode of nutrition are known as autotrophs.

Nutrition in plants :-

Photosynthesis :- is the process by which plants prepare food by using carbon dioxide and water in the presence of sunlight and chlorophyll. The food prepared is carbohydrate which is stored in the form of starch. Oxygen is released in this process.

Equation of photosynthesis :-

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

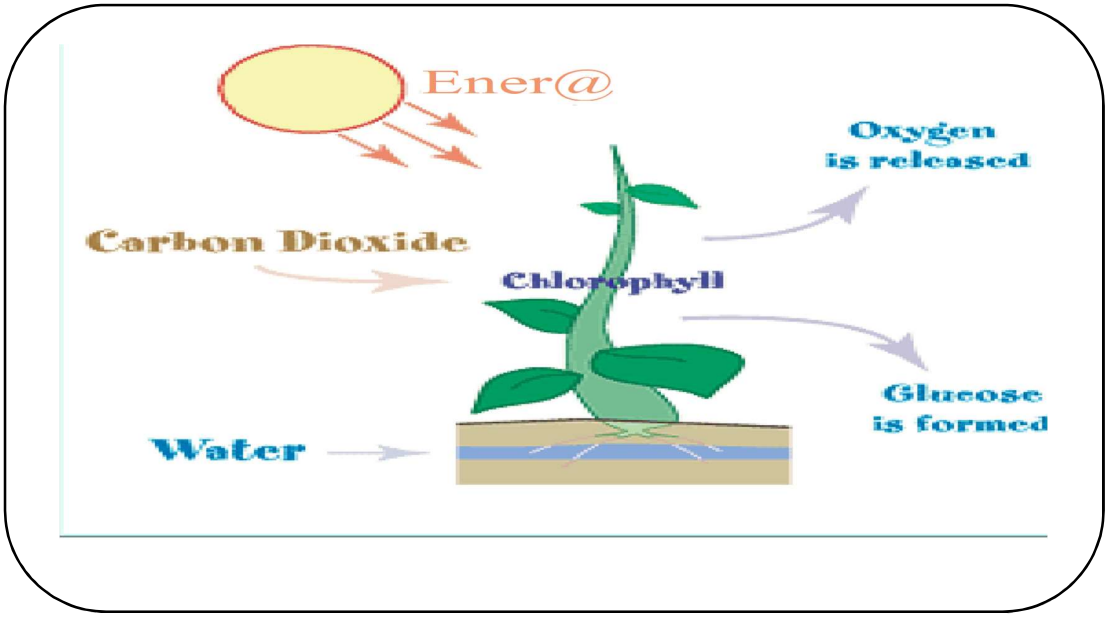
Process of photosynthesis :-

Photosynthesis takes place in three main steps. They are :-

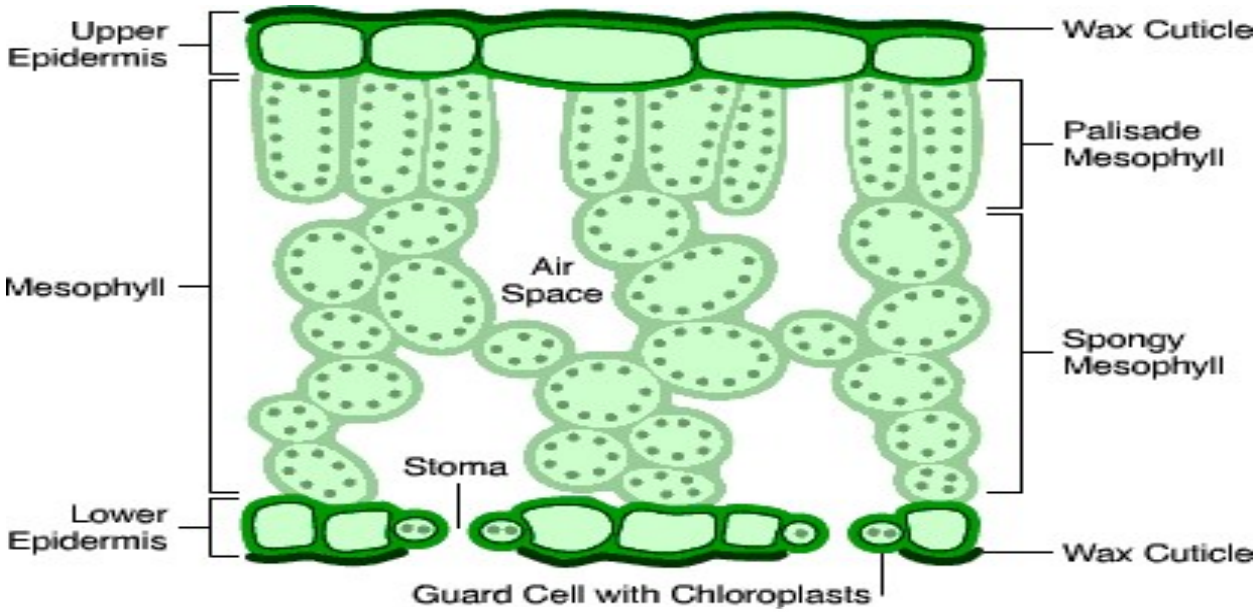
i) Absorption of light energy by chlorophyll.

ii) Conversion of light energy into chemical energy and splitting up of water molecules into hydrogen and oxygen.

iii) Reduction of carbon dioxide by hydrogen to form carbohydrates.



Chlorophyll :- are the green pigments present in the leaves. If we observe a cross section of a leaf under a microscope, we can see cells containing green dot like structures called chloroplasts which contain chlorophyll.



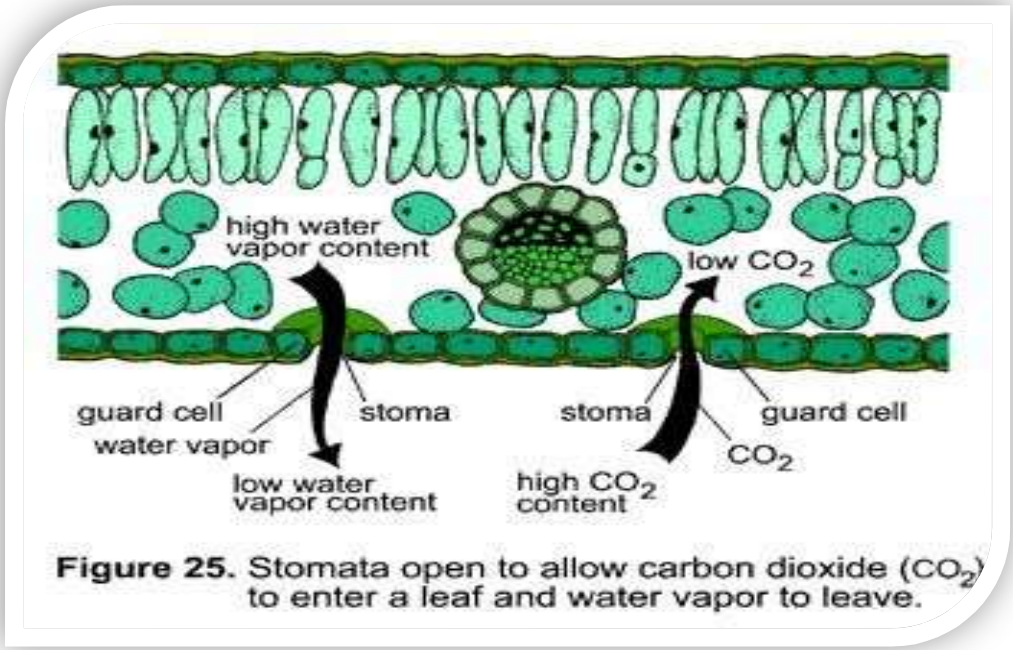
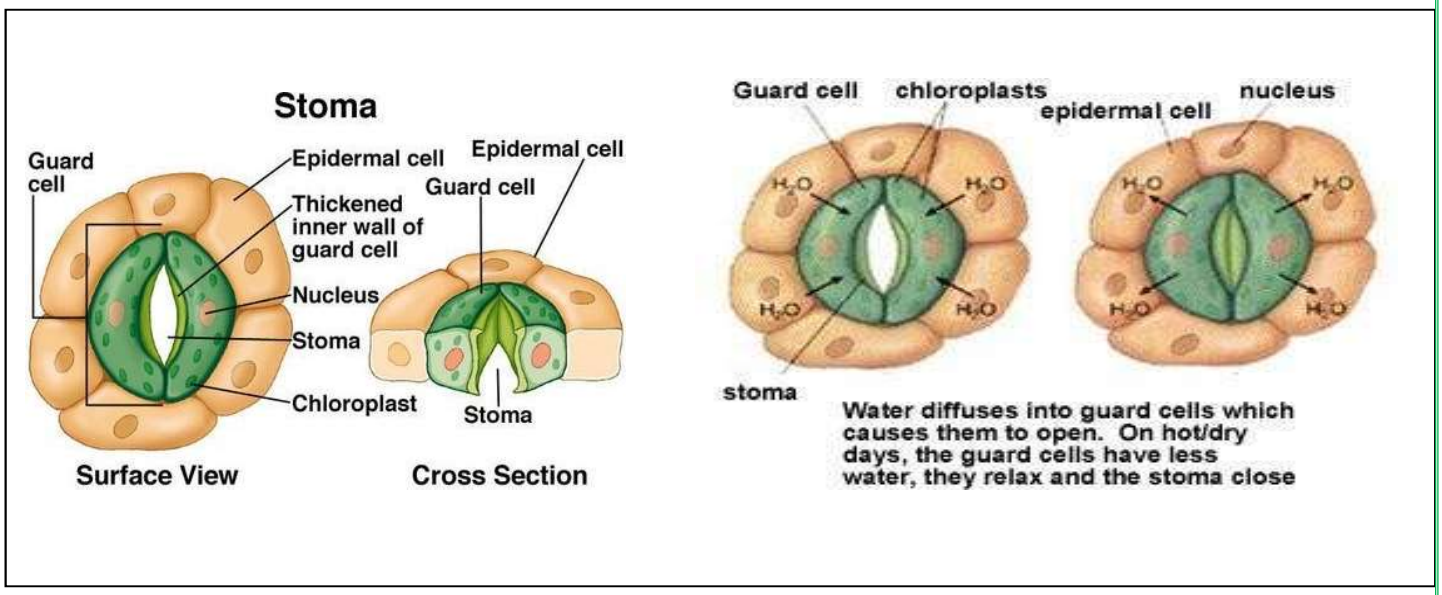


Figure 25. Stomata open to allow carbon dioxide (CO_2) to enter a leaf and water vapor to leave.

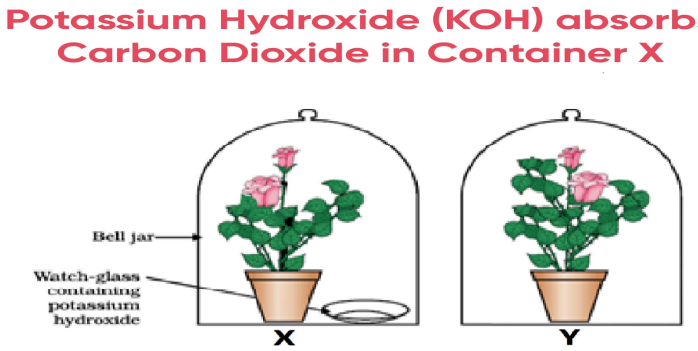
Stomata :- are tiny pores present in the leaves through which exchange of gases takes place. Each stoma has a pair of guard cells which controls the opening and closing of the stomatal pore. When

water enters the guard cells, it swells and the pore opens and when the guard cells lose water, it shrinks and the pore closes**.**



<u>Activity to show that carbon dioxide is necessary for photosynthesis</u>:-

Take two potted plants of the same size and keep them in a dark room for three days so that all the starch is used up. Then keep the plants on separate glass plates. Keep a watch glass containing some potassium hydroxide near one plant to absorb carbon dioxide. Cover both the plants with bell jars and seal the bottom of the jars with vaseline to make it air tight. Keep the plants in sunlight for three hours. Then take a leaf from each plant and test for starch. The leaf of the plant kept in the jar containing potassium hydroxide does not show the presence of starch. This shows that carbon dioxide is necessary for photosynthesis.

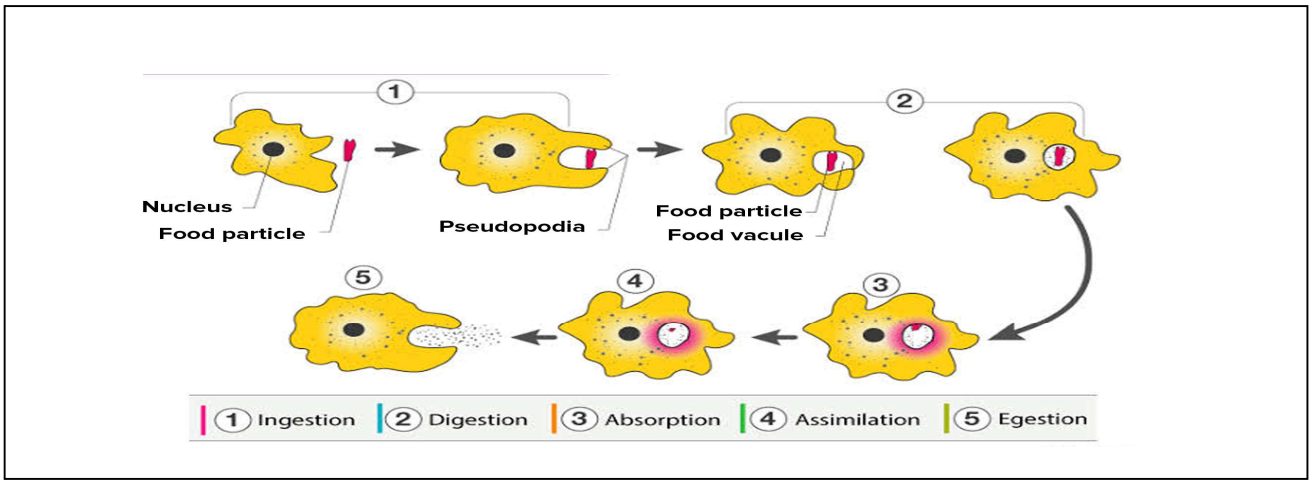


Nutrition in animals

a) Nutrition in amoeba :

Amoeba is a unicellular animal living in water. It takes in food by forming finger like projections called pseudopodia and forms a food vacuole. Inside the food vacuole the food is digested and absorbed.

The undigested food is then sent out through the surface of the cell.



Nutrition in Human Beings

Nutrition in human beings takes place in the digestive system. It consists of the alimentary canal and glands which produce enzymes which breaks down food into smaller molecules.

The main organs of the digestive system are mouth, oesophagus, stomach, small intestine, large intestine, and anus. The main glands are salivary glands, gastric glands, liver, pancreas and intestinal glands. Humans consists of alimentary canal which starts from mouth and ends at anus.

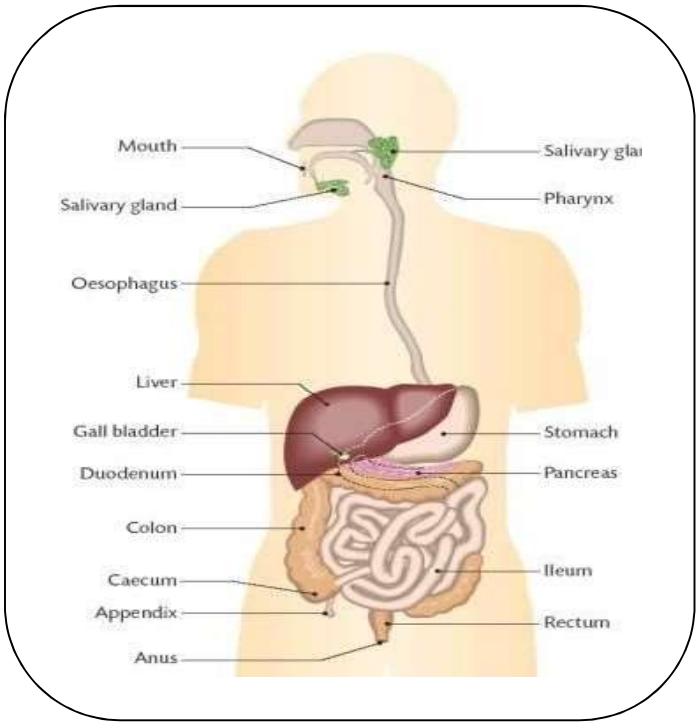


Fig.3. Human Digestive System

In the mouth :- the food is broken down into smaller particles by the teeth and mixed with saliva from the salivary glands. Saliva contains the enzyme salivary amylase which converts starch into sugar. Then the food passes through the oesophagus into the stomach.

Dental caries also known as tooth decay or a cavity, is an infection, bacterial in origin that causes the demineralization and destruction of the hard tissues of the teeth. This is due to the production of acid by bacterial fermentation of food debris accumulated on the tooth surface. By brushing the teeth regularly, the formation of these acids can be prevented.

In the stomach :- the gastric glands produce gastric juice which contains the enzyme pepsin, hydrochloric acid and mucous. Pepsin breaks down proteins. Hydrochloric acid makes the medium acidic and helps in the action of pepsin. Mucous protects the walls of the stomach from the action of the acid. Then the food passes into the small intestine.

In the upper part of the small intestine called duodenum:- the food is mixed with bile from liver and pancreatic juice from the pancreas. Bile breaks down fats into smaller globules. Pancreatic juice contains the enzymes trypsin and lipase. Trypsin breaks down proteins and lipase break down fats.

In the small intestine :- the glands the walls of the small intestine produces intestinal juice. The enzymes of the intestinal juice coverts carbohydrates into glucose, fats into fatty acids and glycerol and proteins into amino acids. The walls of the small intestine have several finger-like projections called villi having blood vessels. It helps to increase the surface area for the absorption of digested food. The digested food is absorbed by the blood and transported to all cells in the body. Then the undigested food passes into the large intestine.

In the large intestine :- water is absorbed and the waste material is removed through the anus.

RESPIRATION

- It is a metabolic process which involves breakdown of food to release energy is known as respiration.

Respiration is the process by which food is burnt in the cells of the body with the help of oxygen to release energy. It takes place in the mitochondria of the cells.

The energy released during respiration is used to make ATP molecules (Adenosine tri phosphate) from ADP molecules (Adenosine di phosphate) and inorganic phosphate.

$$\text{ADP} + \text{Phosphate} \xrightarrow[\text{from respiration}]{\text{Energy}} \text{ATP}$$

Energy is stored in the cells in the form of ATP molecules. When the cells need energy, ATP is broken down in the presence of water to form ADP and energy is released.

$$\text{ATP} \xrightarrow{\text{water}} \text{ADP} + \text{Energy}$$

Types of respiration :-

There are two main types of respiration. They are aerobic and anaerobic respiration.

i) **Aerobic respiration**:- takes place in the presence of oxygen. It produces more energy. The end products are carbon dioxide, water and energy. It takes place in most organisms.

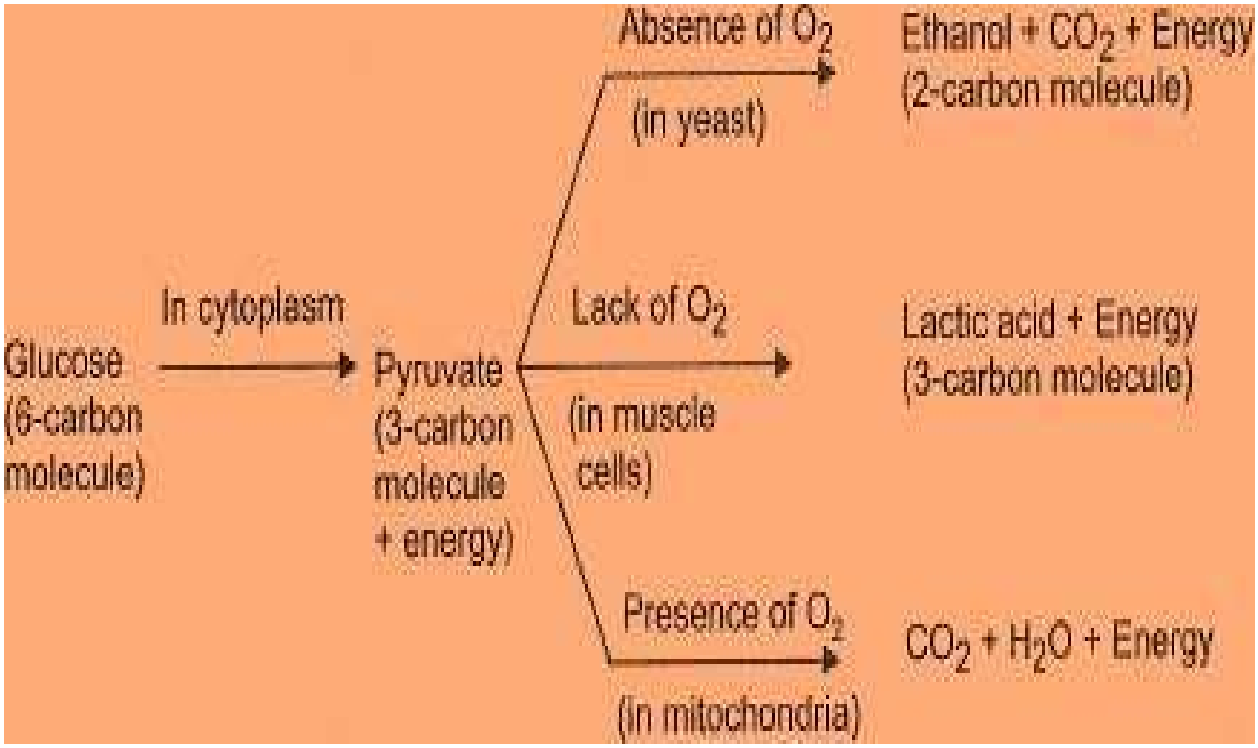
In aerobic respiration glucose is converted into pyruvate in the cytoplasm in the presence of oxygen and then in the presence of oxygen, pyruvate is converted into carbon dioxide, water and energy in the mitochondria. (Shown in diagram)

ii) **Anaerobic respiration:-** takes place in the absence of oxygen. It produces less energy. The end products are lactic acid or ethanol, carbon dioxide, and energy. It takes place in muscle cells and yeast.

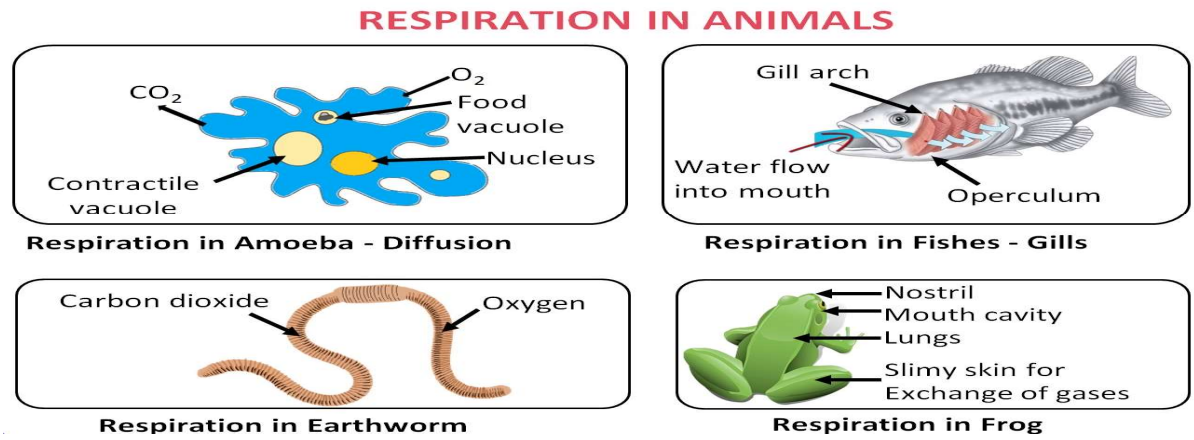
In anaerobic respiration in muscle cells, glucose is converted into pyruvate and in the absence of oxygen pyruvate is converted into lactic acid and energy. (Shown in diagram)

In anaerobic respiration in yeast, glucose is converted into pyruvate and in the absence of oxygen pyruvate is converted into ethanol, carbondioxide and energy. This process is called fermentation. (Shown in diagram)

Breakdown of glucose by different Respiration pathways:



Respiration in animals:



Respiration in Human Beings

Human respiratory system starts consists of nostrils, nasal cavity, pharynx, trachea, bronchi, bronchioles and then lungs. In lungs, alveoli are present, where exchange between the oxygen and carbon-dioxide takes place.

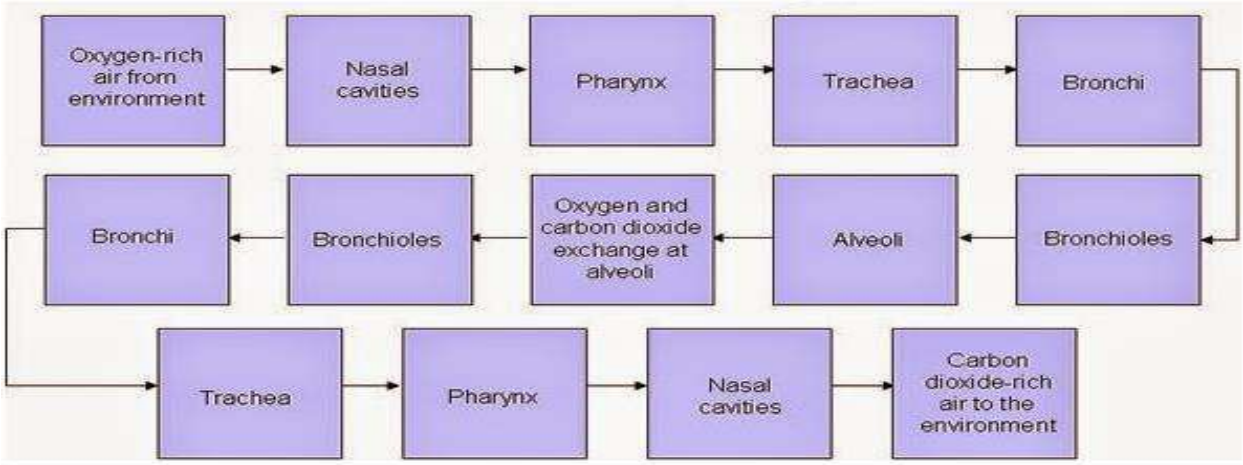
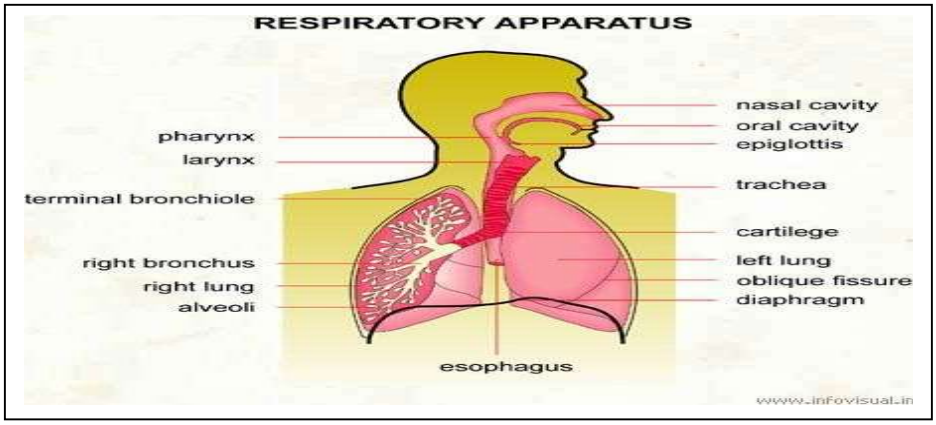
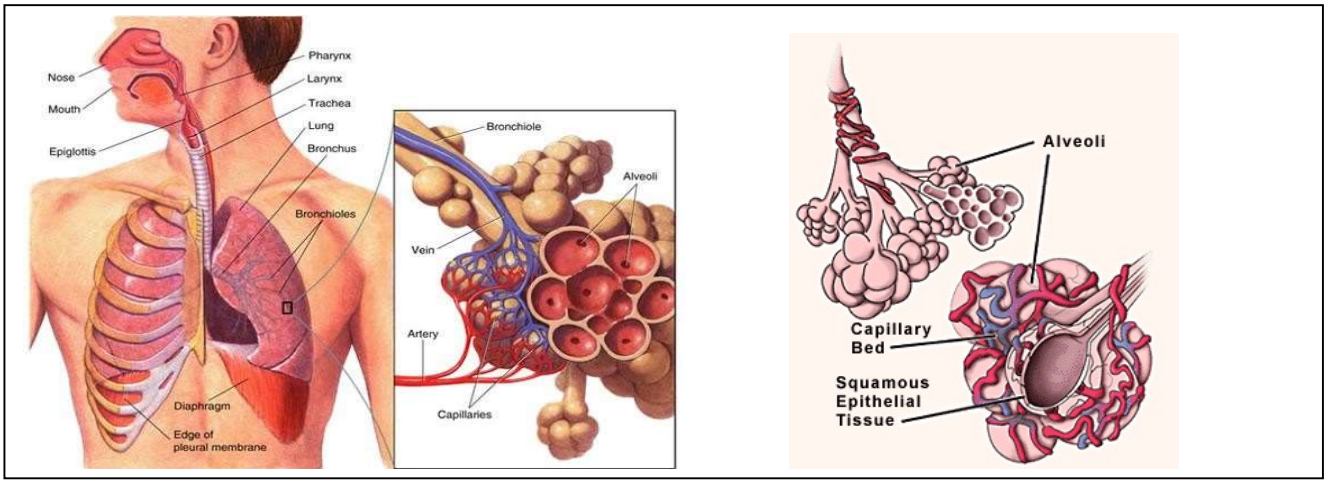


Fig.6. Passage of air in Humans

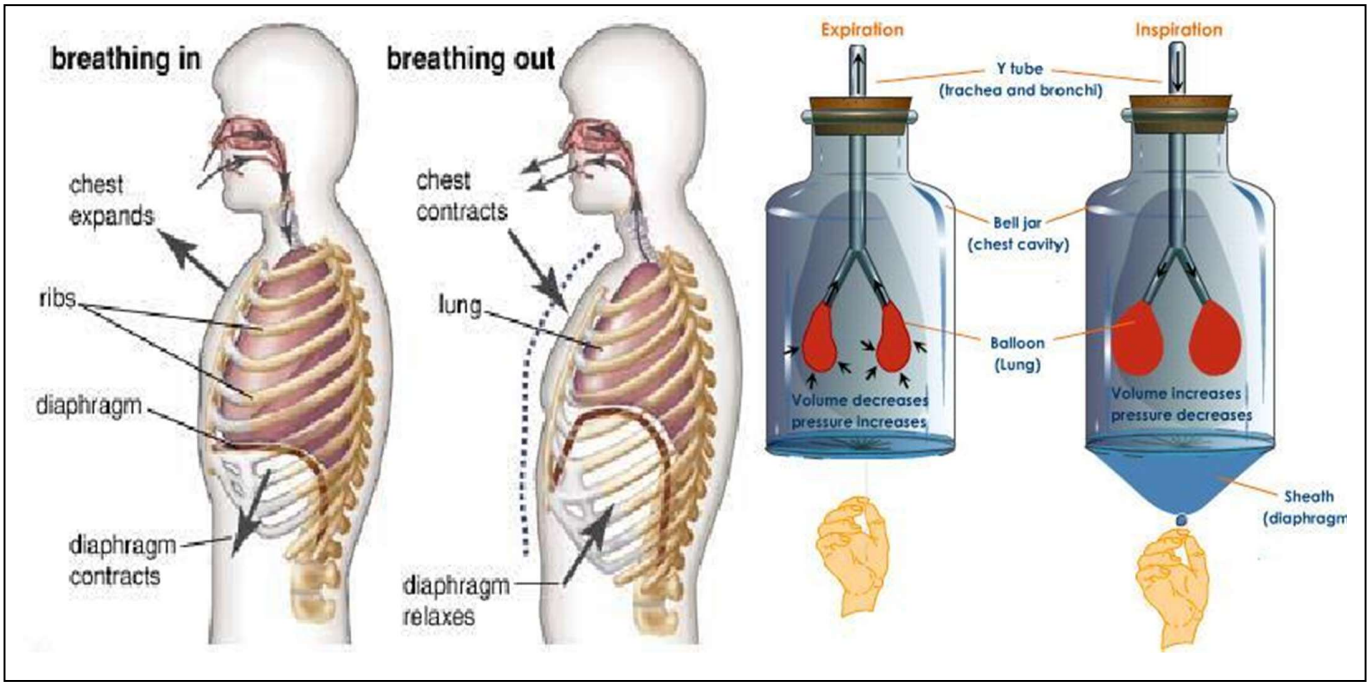
Humans have a respiratory pigment known as haemoglobin to carry the oxygen to different parts of the body and to remove carbon-dioxide from the body. Compared to oxygen, carbon-dioxide is more soluble in water, so it is usually transported in dissolved form.



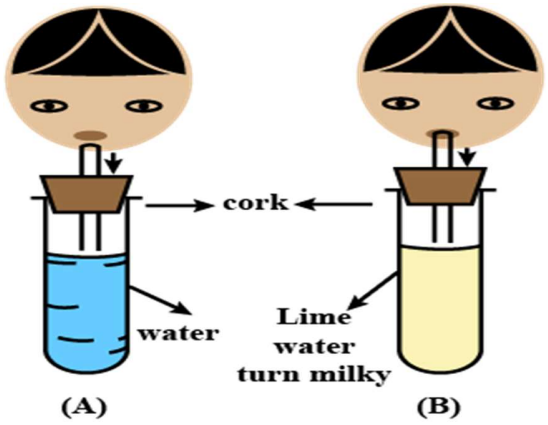
Air enters through the nostrils. The hairs and mucous traps the dust particles. It then passes through the pharynx, larynx, trachea, bronchi and enters the lungs. The trachea has rings of cartilage which prevents it from collapsing when there is no air in the trachea. The bronchi divide into smaller tubes called bronchioles which ends in tiny air sacs called alveoli. The alveoli are supplied with blood vessels through which exchange of gases takes place. The alveoli help to increase the surface area for the exchange of gases.



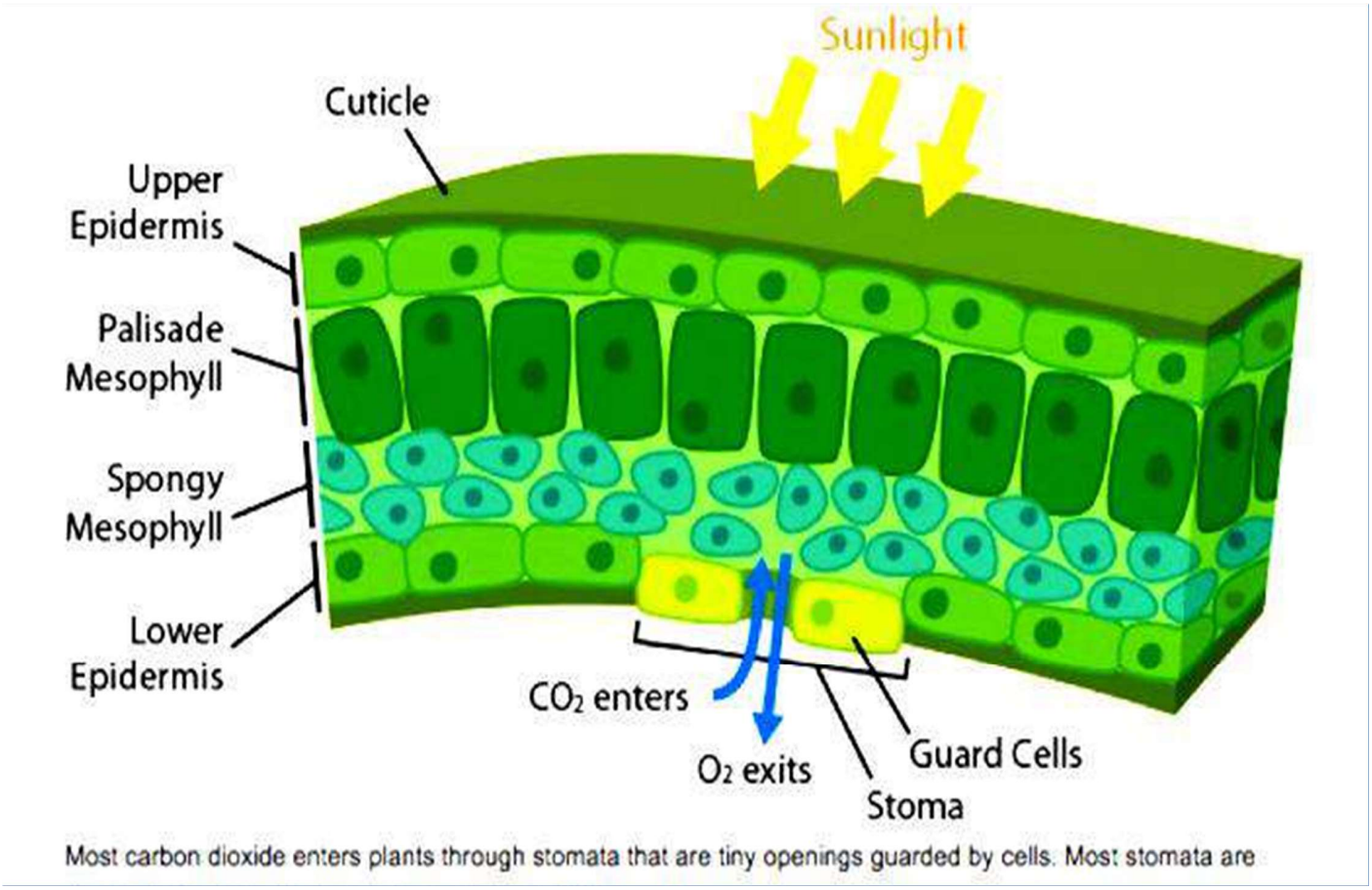
Mecahanism of breathing :- When we breathe in air, the muscles of the diaphragm contracts and moves downward and the chest cavity expands and air enters into the lungs. When we breathe out air, the muscles of the diaphragm relax and moves upward and the chest cavity contracts and air goes out of the lungs.



Activity: Limewater can be used to detect carbon dioxide. If carbon dioxide is bubbled through limewater, then it turns from clear to cloudy/milky in colour. This is why limewater used in a simple respirometer can show that more carbon dioxide is present in exhaled air compared to inhaled air.



Respiration in Plants



Most carbon dioxide enters plants through stomata that are tiny openings guarded by cells. Most stomata are

TRANSPORTATION

Transportation in Human Beings

The main transport system in human beings is the circulatory system. It consists of blood, arteries, veins capillaries and heart.

i) **Blood** :- transports food, oxygen and waste products. It consists of plasma, red blood cells (RBC), white blood cells (WBC) and platelets. Plasma transports food, water, carbon dioxide, nitrogenous waste etc. Red blood cells transport oxygen. White blood cells kill harmful microbes and protects the body. Platelets help in clotting of blood and prevents loss of blood during injury.

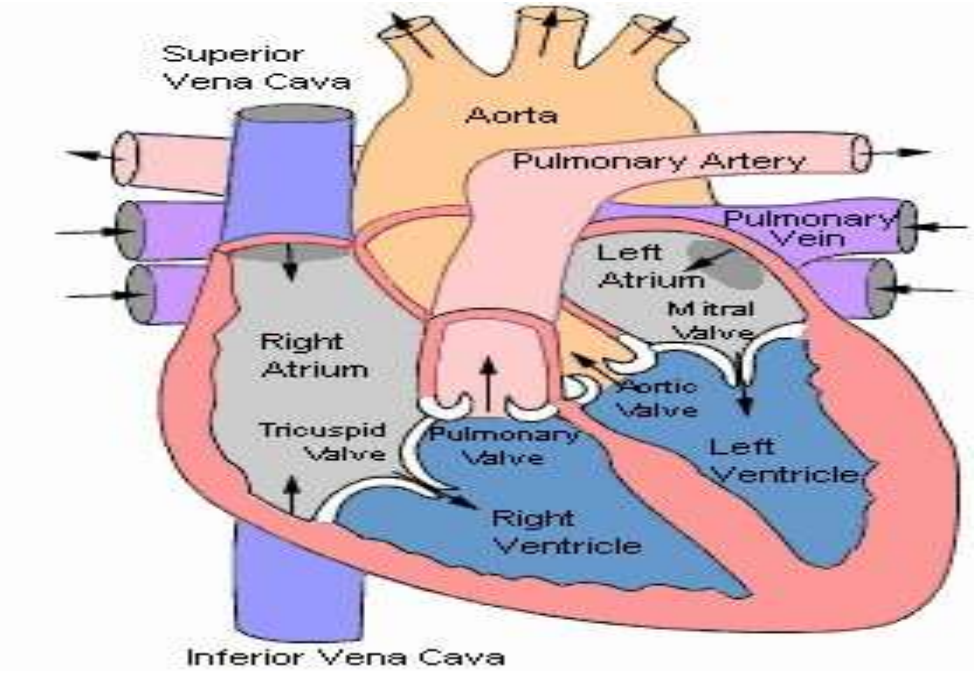
There are three type of blood vessels through which blood flows in our body.

ii) **Arteries** :- carry pure blood from the heart to all parts of the body. They are thick walled and do not have valves.

iii) **Veins** :- carry impure blood from all parts of the body to the heart. They are thin walled and have valves.

iv) **Capillaries** :- are very narrow blood vessels which connects arteries and veins together. The exchange of food, water, oxygen, carbon dioxide etc. between the blood and cells take place through the capillaries.

v) **Heart** :- It is a muscular organ which pumps blood to all parts of the body. It has four chambers. The upper chambers are called atria and the lower chambers are called ventricles. Since the ventricles pump blood to the different organs its walls are thicker than the atria. The right and left chambers are separated by a septum. It prevents the mixing of oxygenated and deoxygenated blood The atria and ventricles have valves between them to prevent blood flowing backward.



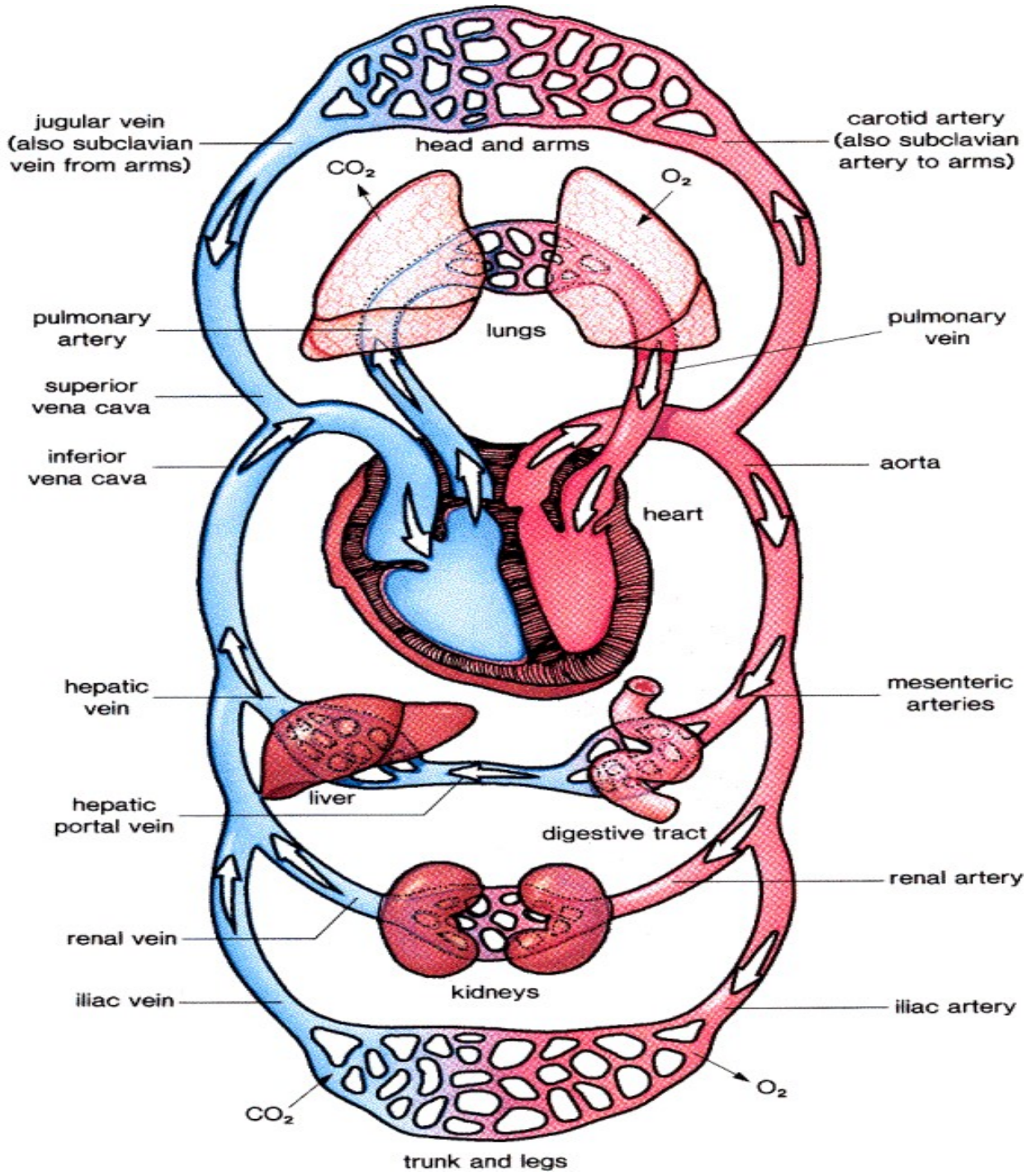


Fig. Structure of Human Heart & Double circulation

<u>Working of the heart (Circulation of blood)</u> :-

When the left atrium relaxes oxygenated blood from the lungs flows into it through the pulmonary vein. When it contracts, the left ventricle expands and the blood flows into it. Then the left ventricle contracts

and the oxygenated blood is pumped out through the aorta to all parts of the body. After circulating through all parts of the body the deoxygenated blood enters the right atrium through the vena cava.

When the right atrium contracts, the right ventricle expands and the blood flows into it. Then the right ventricle contracts and the blood is pumped to the lungs through the pulmonary artery. In the lungs carbon dioxide is removed and oxygen is absorbed and the oxygenated blood again enters the left atrium and the process repeats. Since blood flows through the heart twice in one cycle, it is called double circulation.

Lymph :- It is a colourless fluid present in intercellular spaces. It is formed from the plasma which escapes from the capillaries. Lymph drains into lymphatic capillaries which forms lymph vessels and joins into large veins. Lymph transports digested fats and drains excess fluids from intercellular spaces back into the blood. It contains lymphocytes which kills germs and protects the body.

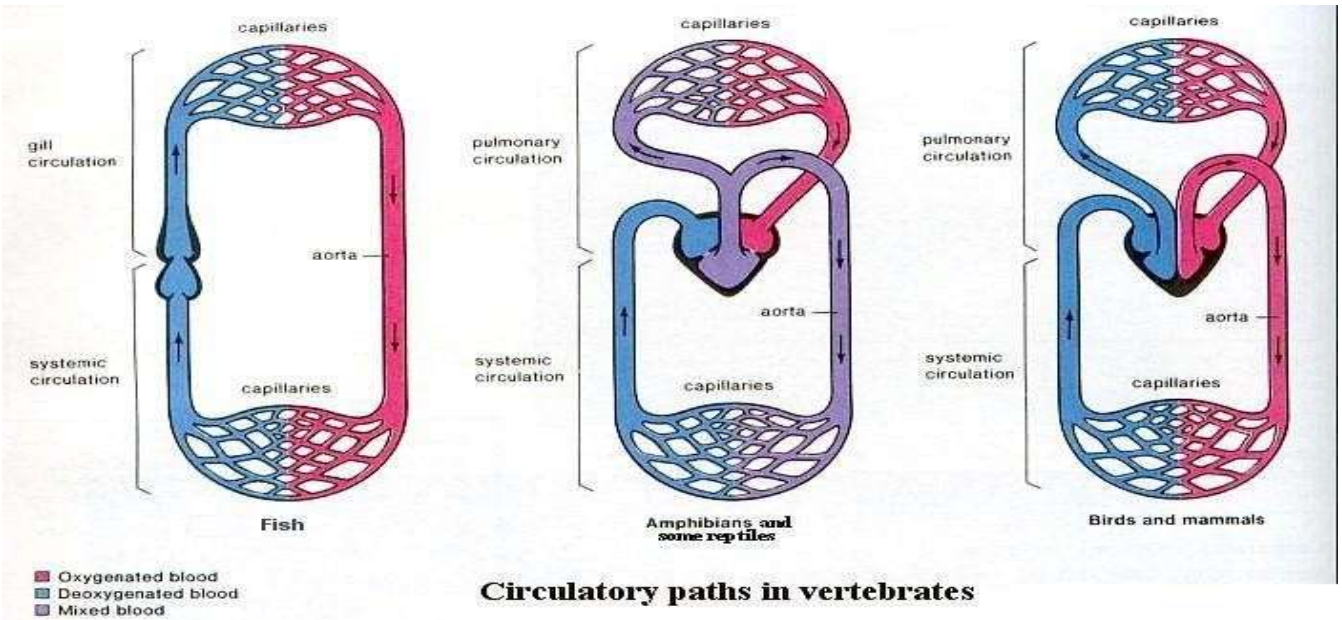
Hearts of mammals, birds, amphibians, reptiles, and fishes:

i) The heart in mammals and birds have four chambers and the right and left sides of the heart is separated by a septum. This prevents mixing of oxygenated and deoxygenated blood and provides efficient supply of oxygen. This is necessary because they need more energy to maintain their body temperature.

ii) The heart in amphibians and reptiles have three chambers and allows some mixing of oxygenated and deoxygenated blood because they do not use energy to maintain their body temperature. Their body temperature is the same as the temperature of the surroundings.

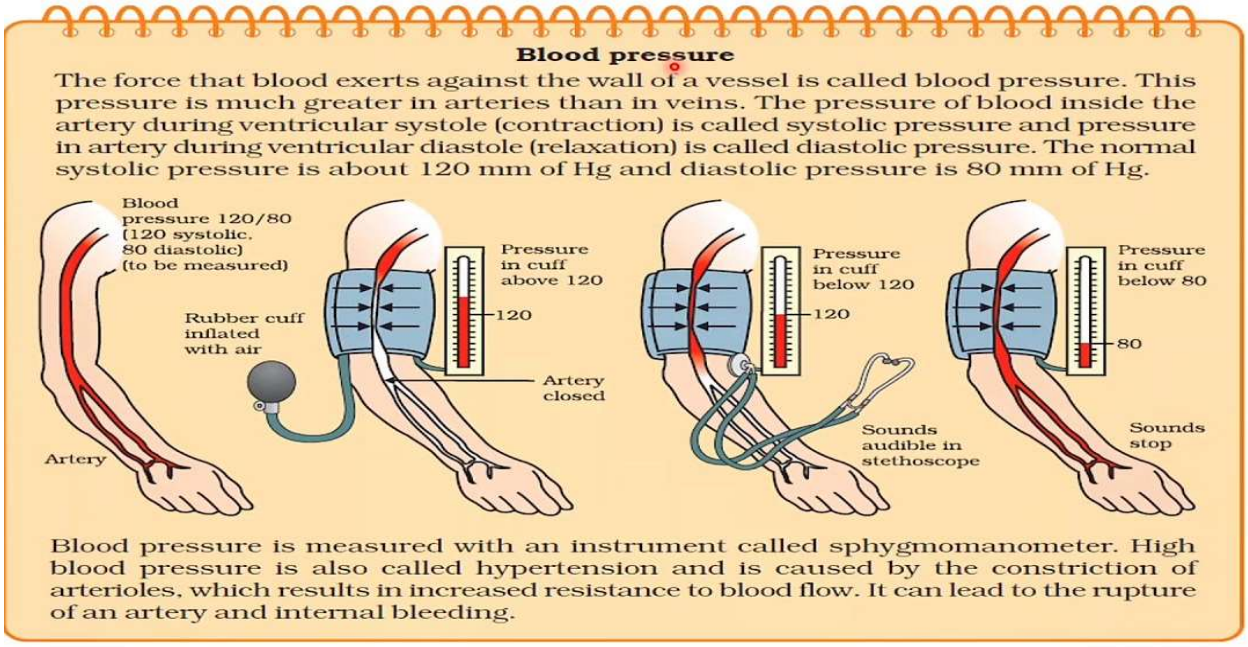
iii) The heart in fishes have only two chambers and blood is oxygenated in the gills.

Note: Fishes have two chambered heart, amphibians and reptiles have three chambered heart except crocodile which possess 4 chambered heart. Birds and mammals have 4 chambered heart.



Circulatory paths in vertebrates

Blood pressure: The force that blood exerts on the walls of blood vessels is known as blood pressure.



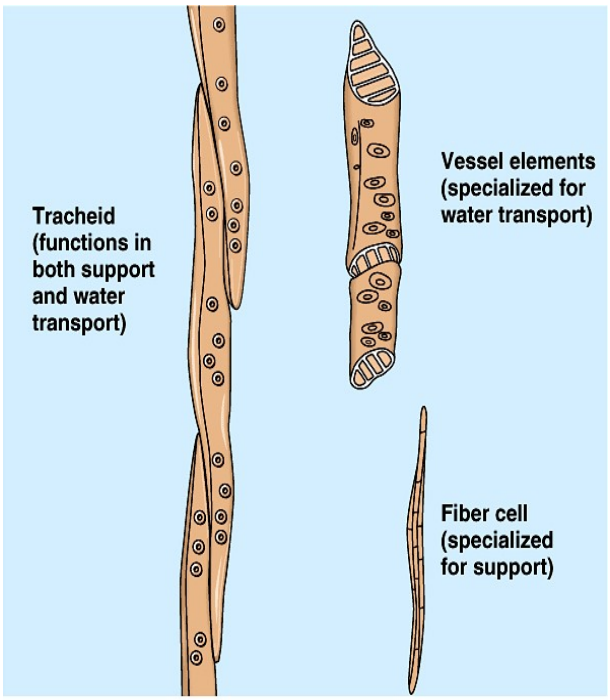
Note: The force that the blood exerts against the wall of the vessel is known as blood pressure. Pressure of blood inside the artery during ventricular contraction is known as systolic pressure whereas the pressure in the artery during ventricular relaxation is known as diastolic pressure. The normal blood pressure is 120/80 mm of Hg. Blood pressure is measured by an instrument called **SPHYGMOMANOMETER.**

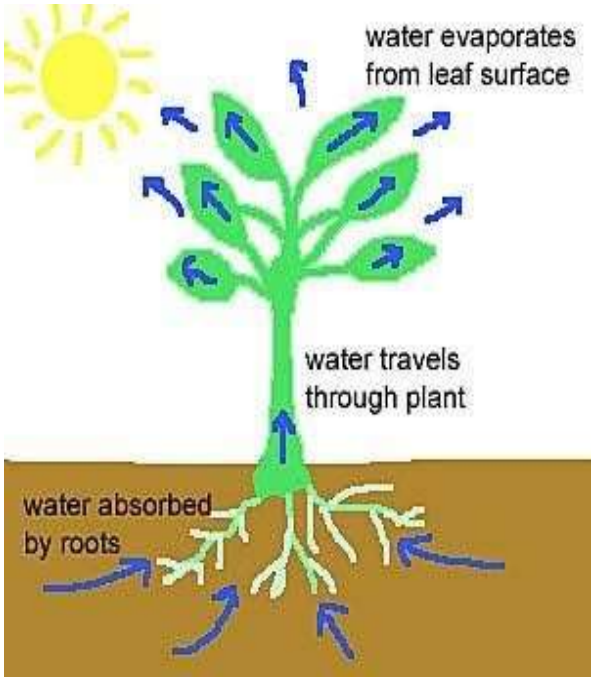
Artery	Capillary	Vein
They carry blood away from the heart	**One cell thick smallest vessel**	**They carry blood towards the heart**
They carry oxygenated blood except the pulmonary artery.	**Help in the exchange of the material between the blood and surrounding cells.**	**They carry deoxygenated blood except pulmonary vein.**
They have thick walls and do not have valves.	**They do not have valves**	**They have thin walls and also possess valves.**

Transportation in Plants

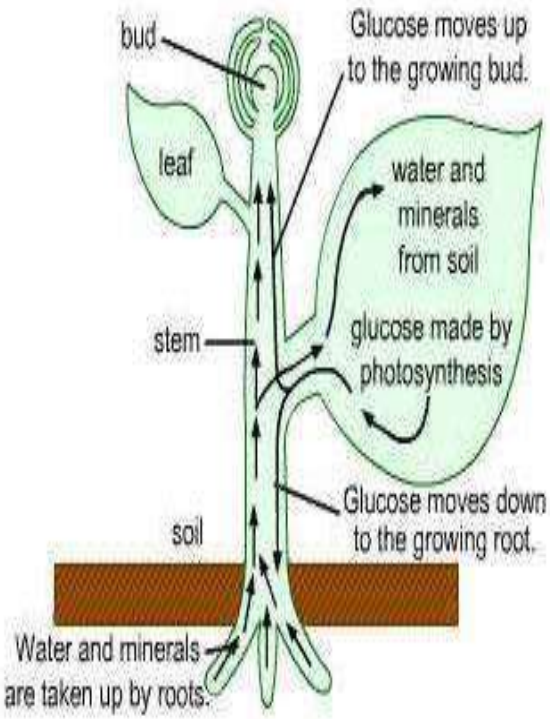
- Loss of water in the form of water vapour from the aerial parts of the plants is known as transpiration. The transpiration creates a suction which pulls the water up to the higher plants.
- In plants, transportation of materials like food, water and minerals takes place through conducting tissues called xylem and phloem.

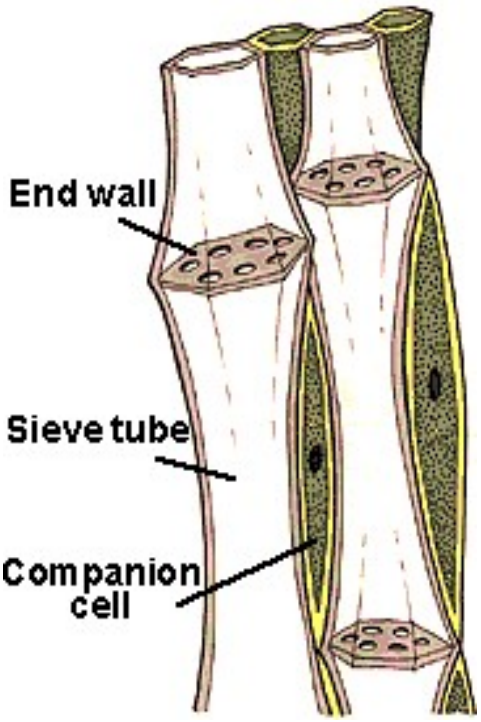
i) **Xylem** :- transports water and minerals from the roots to all parts of the plant. It consists of xylem vessels and tracheids. Water and minerals enter the roots by diffusion. Then due to transpiration, the suction force helps in the upward movement of water and minerals.





ii)Phloem :- transports food from the leaves to the other parts of the plant. This process is called translocation. The phloem consists of sieve tubes and companion cells. Food from the leaves is transferred to the xylem by the energy of ATP molecules. Due to osmotic pressure water enters the phloem and helps in the transport of food.





EXCRETION

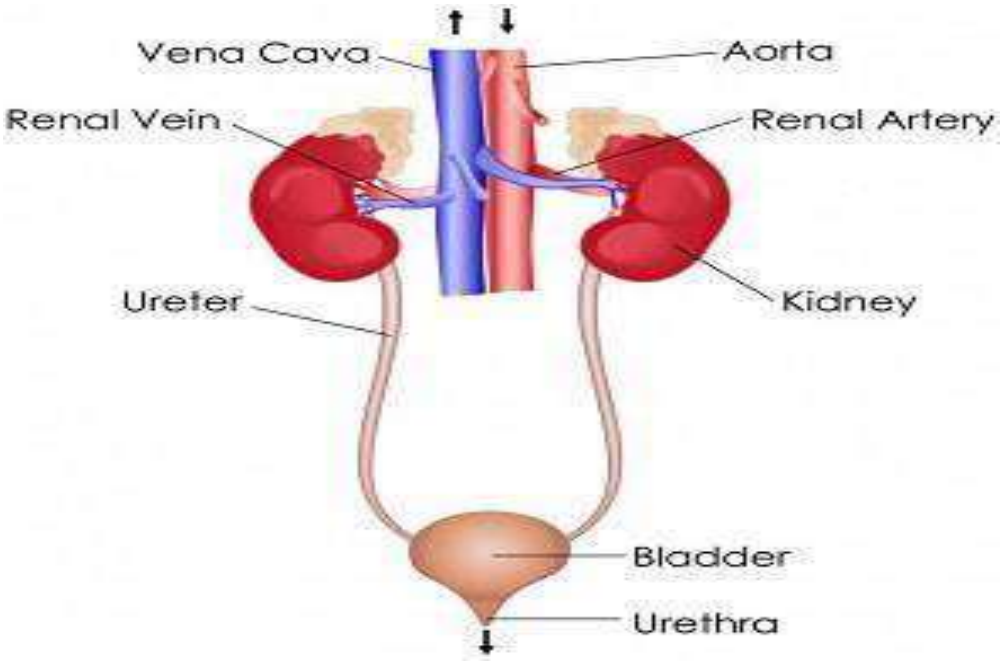


Fig. Human Excretory System

- The process involved in the removal of nitrogenous waste from the body is known as excretion.
- Excretory system of humans consists of a pair of kidneys, a pair of ureters, urinary bladder and urethra.
- The basic filtration unit of the kidneys is known as nephrons.
- Nephron are the structural and functional unit of kidneys.
- They consist of bowman's capsule and renal tubule.
- For the formation of urine, some substances such as glucose, amino acids are selectively reabsorbed.
- Amount of water reabsorbed depends on how much water is there in the body.
- Urinary bladder is a muscular structure and it is under nervous control.

Nephrons: These are the basic unit of human kidney. They are also known as filtering unit of kidney because they perform the function of filtration of blood to remove urea and excess ions and other things by forming concentrated urine. They reabsorb most of the water from waste containing blood.

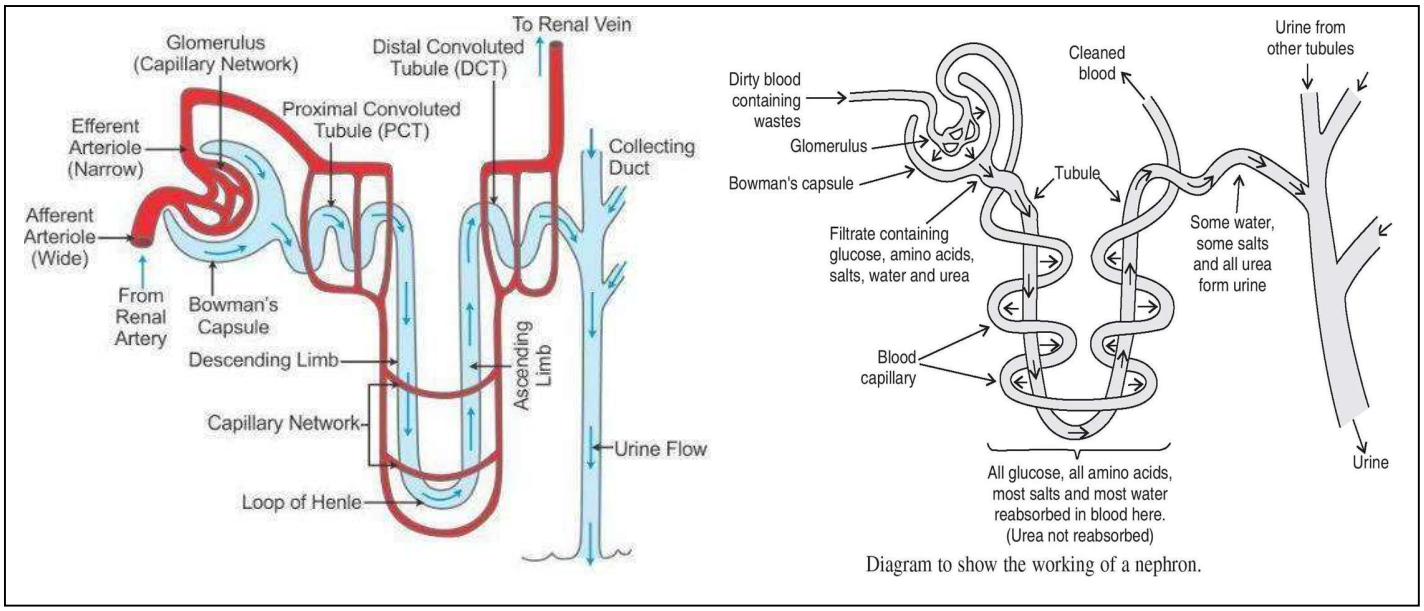
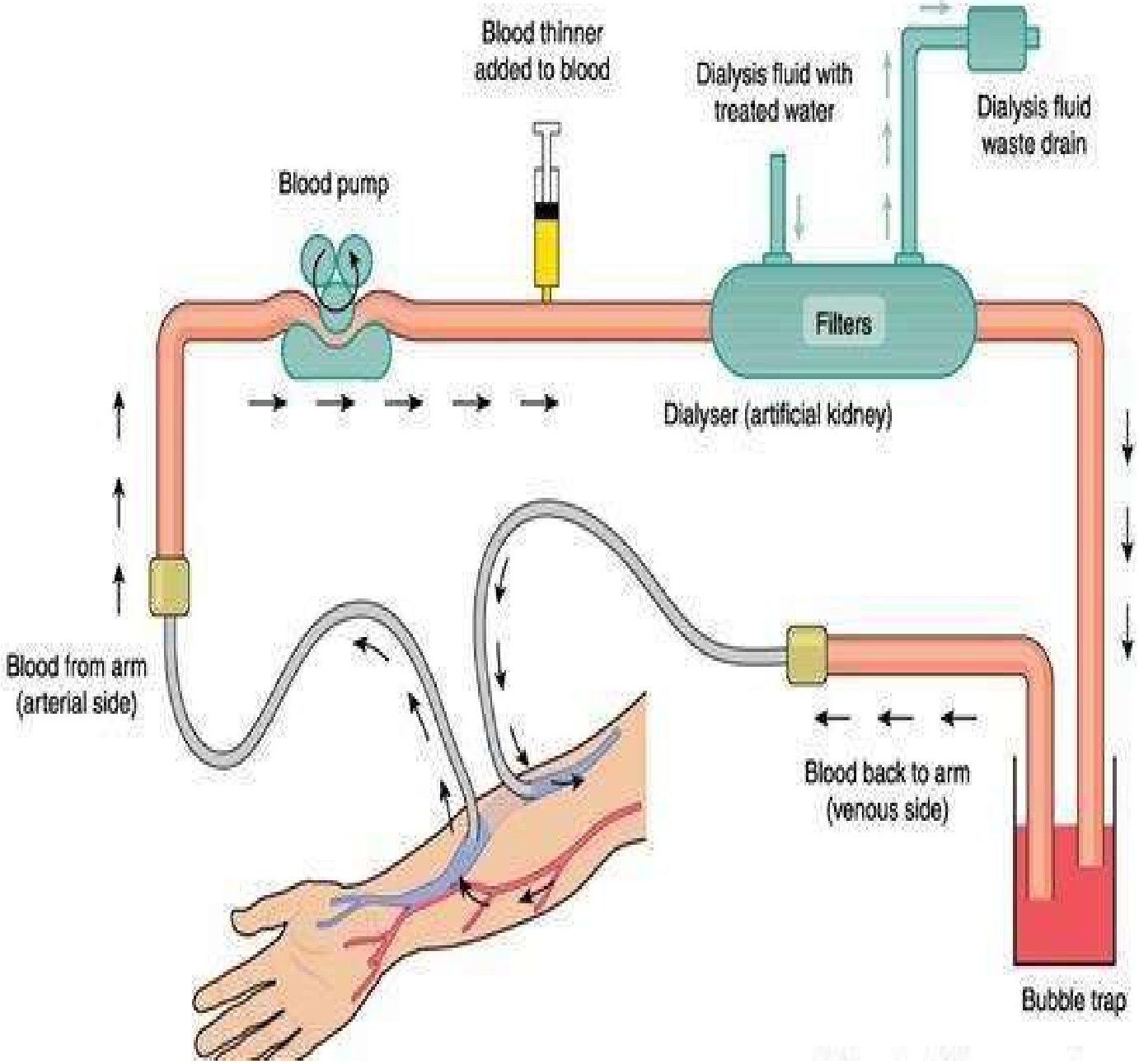


Diagram to show the working of a nephron.

Each nephron has a cup like structure called Bowman's capsule containing a bundle of capillaries called glomerulus. The Bowman's capsule leads into a tubular structure which joins into a collecting duct. The renal artery brings the nitrogenous waste like ammonia, urea, uric acid (urine) along with excess water, salts etc. into the nephron. It filters the nitrogenous waste, water and salts which passes through the tubular structure into the collecting duct. The waste then passes through the ureters into the urinary bladder and is then sent out through the urethra as urine. The useful products like amino acids, glucose, salts etc. are reabsorbed by the capillaries around the tubular structure and goes into the real vein.

Hemodialysis/ Dialysis

Hemodialysis is a treatment to filter wastes and water from your blood, as your kidneys did when they were healthy. **Hemodialysis** helps control blood pressure and balance important minerals, such as potassium, sodium, and calcium, in your blood. Dialysis is done after our kidney fails to work. The name of machine which carry out this process is known as Dialyser (Artificial Kidney).



Excretion in Plants: In plants the gaseous waste products produced during respiration (CO2) and photosynthesis (O2) are removed through the stomata. Excess water is removed through the stomata. This process is called transpiration.

Some waste products are stored in the leaves and removed when the leaves dry and fall off. Some waste products are stored in vacuoles. Some waste products like gums and resins are stored in the old xylem cells. Some waste products are removed through the roots.

Organ Donation:

Organ donation is the process of surgical removal of an organ or tissue from the body of a donor, in order to transplant the same into the body of a recipient on need, legally with consent of the donor. Organ donation is a very noble act. It allows the organs of a dead person to be used to prolong and enhance the life of a living human being, whose self-organ(s) is damaged due to injury or disease.

Organ donation is very important. Every year, around two lakh kidneys are required to be donated in India. But the number received is just 7000 -8000. The number of heart, liver and other organs is even less. Due to this, thousands of people die, suffering from organ failure and lack of organs for transplantation. This condition can be made better by donating organs. The government of India celebrates Organ donation day on 13 August every year, to spread awareness regarding this noble cause.

QUICK REVISION / SUMMARY OF CHAPTER

Life processes

- Constantly exhibit the functions of maintenance and repair in living organisms
- Some Examples- Digestion, Respiration, Circulation etc.

Nutrition

- Process of obtaining nutrients from the environment i.e., intake of food and then its digestion in the body.
- Two types – Autotrophic (self-sufficient for food) and Heterotrophic (dependent on others for food).

Autotrophic nutrition

- Synthesis of food by photosynthesis- 'photo' means light and 'synthesis' means production. It is the production of food with the help of sunlight.
- Photosynthesis equation-

  $6CO_2+6H_2O$ give $C_6H_{12}O_6+6O_2$

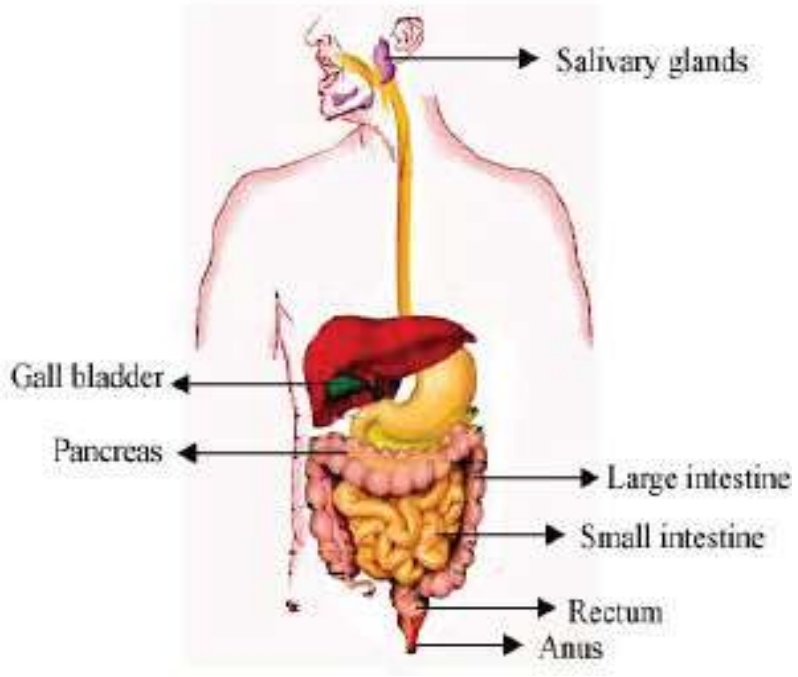
- Events of photosynthesis are as follows: Absorption of light energy chlorophyll which is the green pigment and gives energy for activation of reaction. Then the splitting of water into its constituent's hydrogen and oxygen leading to the Synthesis of ATP and $NADPH_2$ and finally reduction of CO_2 to carbohydrates.

Heterotrophic nutrition

- Generally, take up energy from plants and animals by using them as food.

- Mostly of three types—holozoic, parasitic, and saprophytic.
- Digestion- mechanical and chemical reduction of ingested nutrients which can be then converted to energy for use.
- Human digestive system- consists of the long alimentary canal that includes mouth, pharynx, oesophagus, stomach, small intestine, large intestine, rectum and anus.
- Organs for assistance- pancreas, liver

Nutrition in humans:



- Saliva is secreted by salivary glands located under the tongue which contains digestive enzymes like salivary amylase, which break down starch into sugar. So, digestion of carbohydrates starts in the mouth itself.
- Tongue helps in chewing, moistening, rolling and swallowing of food.
- The food from mouth then goes down the oesophagus, which is the food pipe to the stomach, through the movement of walls of oesophagus (peristalsis)
- Stomach mixes the food hence received with various digestive juices.
- Inner lining of stomach secretes:
    - Mucus – protects the lining of stomach from being corroded by the acid.
    - Hydrochloric acid – creates an acidic medium and dissolves bit of food.
    - Digestive juices – break down protein into simpler substances.

The food from stomach eventually moves into the small intestine.

- Digestion in small intestine: It is the longest part (about 7.5 m long) of alimentary canal. It is the site where complete digestion of carbohydrates, proteins, and fats takes place. It gets intestinal juices from two different glands – liver and pancreas that help in the further digestion of food.

➢ Liver is the largest gland of the body and secretes bile juice. Bile juice is stored in the gall bladder and has a significant role in the digestion of fats.

➢ Pancreas has enzymes that help in total digestion of all food components.

- The digestive tract and associated glands together constitute the digestive system.

Respiration

- It is controlled by enzymes and energy is released from the breakdown of organic substances. It is of two types that are aerobic and anaerobic

Aerobic respiration

- Oxidation of food materials by oxygen
- Produces 36 ATP
- The steps followed in cellular respiration

First step is breakdown of glucose (6C) into pyruvates (3C) in the cytoplasm

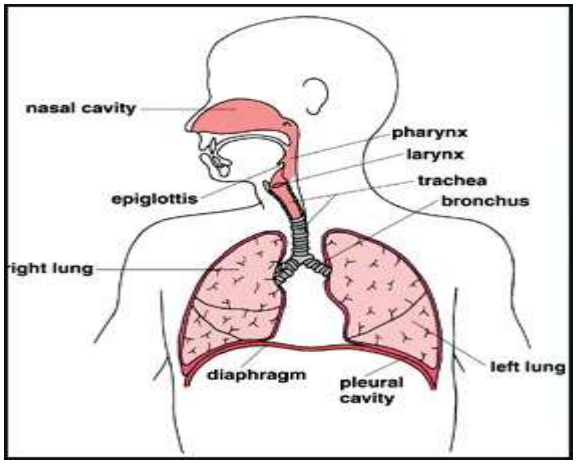
Second step- Pyruvate is then broken down to CO_2 and water and it takes place in the mitochondria where energy is produced in ATP form.

Anaerobic respiration

- It is the Oxidation of nutrients without using up the molecular oxygen
- It gives 2 ATPs.
- **First step-** glycolysis in cytoplasm, 2 pyruvates produced
- **Second step is the** breakdown of pyruvic acid into ethanol and water and energy (in yeast) and lactic acid and energy (in muscle cells)

Human respiration

- It consists of the nose, pharynx, trachea, bronchi, bronchioles and alveoli



- Bronchioles then divide into many alveoli which are sites of gaseous exchange.
- O_2 present in alveolar blood vessels is then transported to various cells of the body.

Hemoglobin pigment present in blood is majorly responsible for transportation of carbon dioxide and oxygen.

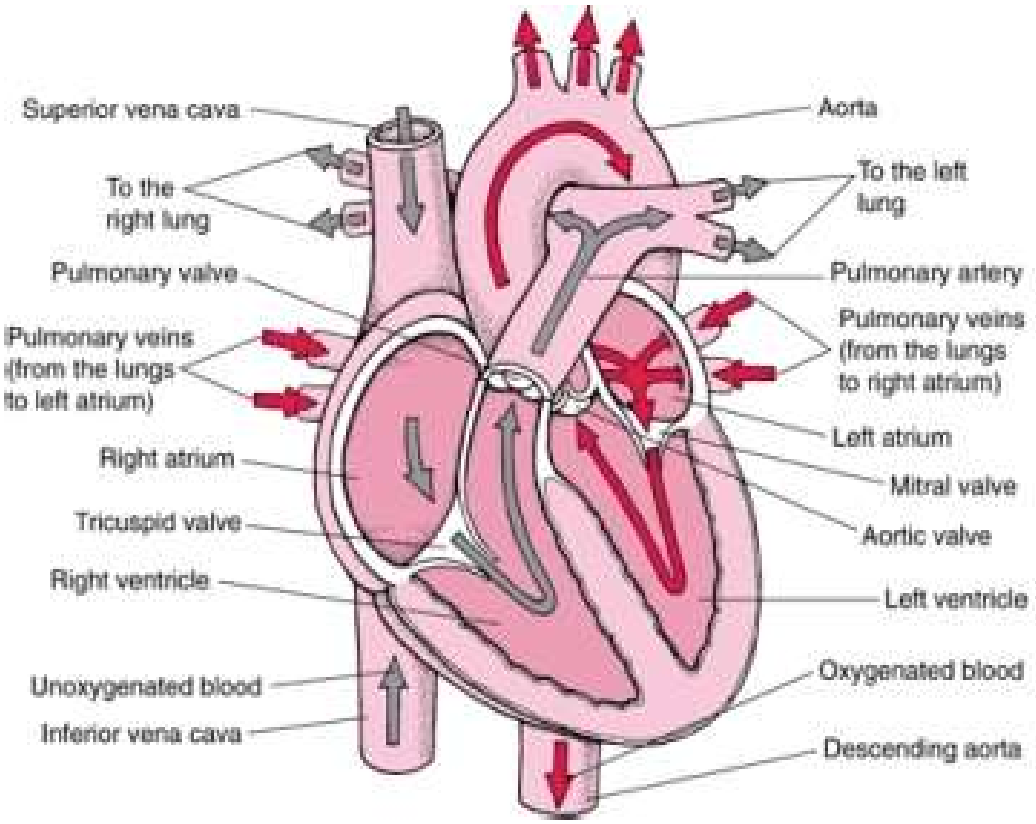
Transportation

First and foremost, things, a liquid medium is required always for transportation.

Transportation in humans

- Double circulation occurs in human beings i.e.; the blood goes through the heart twice during each cardiac cycle.
- Blood and lymph are both involved in transportation
- Components of blood are RBCs, WBCs, platelets, and plasma.
- Three types of blood vessels are arteries, veins and capillaries.
- Arteries carry oxygenated blood in them, except one that is pulmonary artery
- Veins carry deoxygenated blood in them, except pulmonary vein

The Human heart is divided into four chambers – right auricle, right ventricle, left auricle, and left ventricle



- The Right side of the heart gets deoxygenated blood from different cells of the body
- The Left side of the heart receives oxygenated blood from lungs.

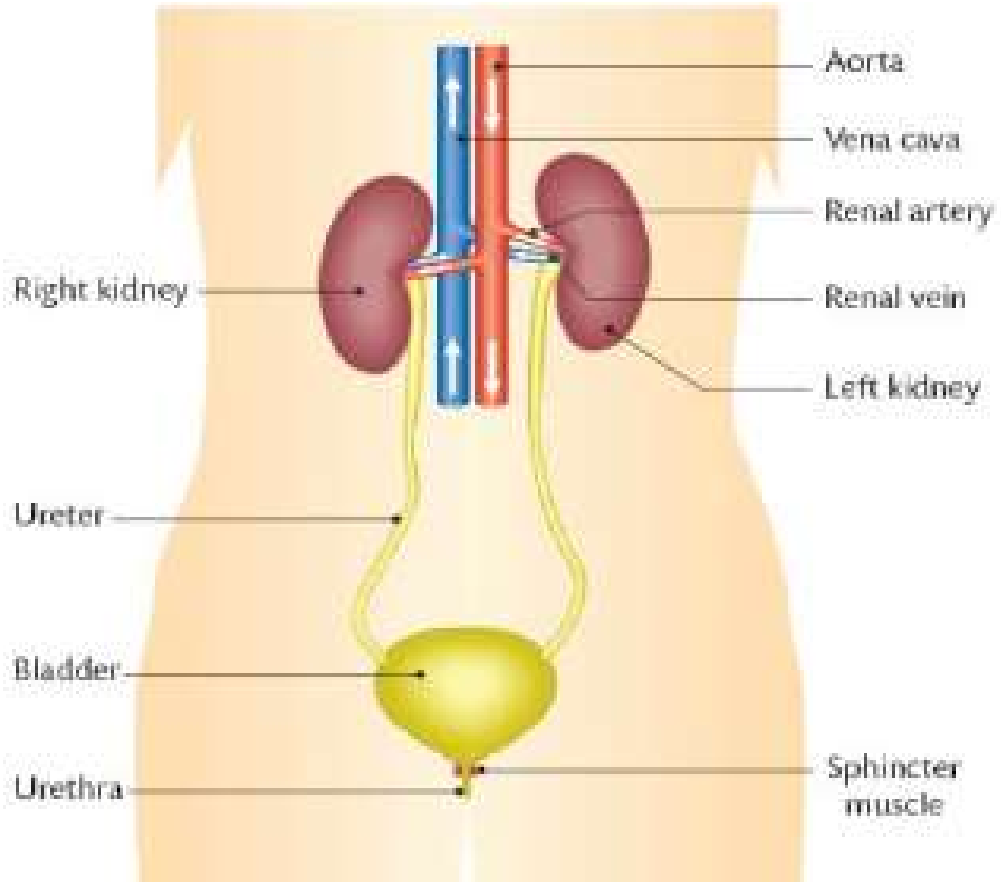
Transportation in plants

- Transportation of water is through xylem tissues
- Transport of water occurs due to transpiration pull, root pressure and difference in pressure gradient.
- Transport of food or translocation takes place through phloem and it requires energy.

Excretion

It involves the removal of harmful metabolic wastes from the body of organisms by various processes.

Excretion in humans



The excretory system consists of- a pair of kidneys, a pair of ureters, a urinary bladder, and a urethra.

- Nitrogenous wastes such as urea and uric acid are removed
- Nephron- basic filtration unit
- Main components of the nephron - glomerulus, Bowman's capsule, renal tube
- The process of Removing of nitrogenous wastes through artificial kidney is called **dialysis.**

EXERCISE (PRACTISE QUESTIONS)

A-MCQs

1. **The breakdown of pyruvate to give carbon dioxide, water and energy takes place in**

(a) cytoplasm.

(b) mitochondria.

(c) chloroplast.

(d) nucleus.

2. **In which of the following groups of organisms, food materials are broken down outside the body and absorbed?**

(a) Mushroom, green plants, Amoeba

(b) Yeast, mushroom, bread mould

(c) Paramecium, Amoeba, Cuscuta

(d) Cuscuta, lice, tapeworm

3. **Which of the following statements about the autotrophs is incorrect?**

(a) They synthesise carbohydrates from carbon dioxide and water in the presence of sunlight and chlorophyll

(b) They store carbohydrates in the form of starch

(c) They convert carbon dioxide and water into carbohydrates in the absence of sunlight

(d) They constitute the first trophic level in food chains

4. **The opening and closing of the stomatal pore depend upon**

(a) Oxygen

(b) Temperature

(c) water in the guard cells

(d) concentration of CO_2

5. **Choose the correct path of urine in our body**

(a) kidney →ureter →urethra →urinary bladder

(b) kidney →urinary bladder →urethra →ureter

(c) kidney →ureters →urinary bladder →urethra

(d) urinary bladder →kidney →ureter →urethra

6. **Which of the equations show correct conversion of CO_2 and H_2O into carbohydrates in plants?**

(a)

$$6CO_2 + 6H_2O \xrightarrow[\text{Heat energy}]{\text{Chlorophyll}} C_6H_{12}O_6 + 6O_2 + 12H_2O$$

(Glucose)

(b)

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

(Glucose)

(c)

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

(Glucose)

(d)

$$6CO_2 + 12H_2O \xrightarrow[\text{Heat energy}]{\text{Chlorophyll}} C_6H_{12}O_6 + 6O_2 + 6H_2O$$

(Glucose)

7. In normal expiration, the diaphragm is

(a) Arched

(b) Flattened

(c) Perforated

(d) None of these

8. How is food transported from phloem to the tissues according to plants' needs?

(a) food is transported along with the water in the plant's body.

(b)food is transported in only one direction like water in the plant body through xylem.

(c) food is transported from a region with low concentration to higher concentration.

(d)food is transported from a region where it is produced to other parts of the plants.

9. The correct pathway of blood in circulatory system is

(a) atria → ventricles → arteries → veins

(b) ventricles → atria → veins → arteries

(c) ventricles → veins → arteries → atria

(d) veins → ventricles → atria → arteries

10. Which of the following events in the mouth cavity will be affected if salivary amylase is lacking in the saliva?

(a) Starch breaking down into sugars.

(b)Proteins breaking down into amino acids.

(c) Absorption of vitamins.

(d)Fats breaking down into fatty acids and glycerol.

11. Full form of ATP?

(a) Adenosine Triphosphate

(b) Adenosine Tetraphosphate

(c) Adenine Triphosphate

(d) Adinosine Tripolymer

12. Name the substances whose build up in the muscles during vigorous physical exercise may cause cramps?

(a) Ethanol + Carbon dioxide + Energy

(b) Lactic acid + Energy

(c) Carbon dioxide + Water + Energy

(d) Pyruvate

13. Why blood is red?

(a) due to presence of oxygen

(b) due to presence of haemoglobin

(c) due to presence of CO2

(d) due to presence of WBC

14. Single circulation, i.e., blood flows through the heart only once during one cycle of passage through the body, is exhibited by which of the following:

(a) hyla, rana, draco

(b) whale, dolphin, turtle

(c) labeo, chameleon, salamander

(d) hippocampus, exocoetus, anabas

15. The autotrophic mode of nutrition requires

(a) carbon dioxide and water.

(b) chlorophyll.

(c) sunlight.

(d) all of the above

16. Identify the correct path of urine in the human body.

(a) Kidney → urinary bladder → urethra → ureter

(b) Urinary bladder → ureter → kidney → urethra

(c) Kidney → ureter → urethra → urinary bladder

(d) Kidney → ureter → urinary bladder → urethra

17. Chyme is ____.

(a) Digestive enzyme secreted by stomach.

(b) Hormone secreted by islets of Pancreas

(c) food which enters into the intestine from the stomach.

(d) Part of bile juice which stores in gall bladder

18. Water absorption in plants can be increased by keeping the potted plants:

(a) in the shade

(b) in dim light

(c) under the fan

(d) covered with a polythene bag

19. Which is the correct sequence of parts in the human alimentary canal?

(a) Mouth →stomach →small intestine →oesophagus →large intestine

(b) Mouth →oesophagus →stomach →large intestine →small intestine

(c) Mouth →stomach →oesophagus →small intestine →large intestine

(d) Mouth →oesophagus →stomach →small intestine →large intestine

20. Coagulation of blood in a cut or wound is brought about by:

(a) plasma (b) platelets (c) WBC (d) RBC

B-ASSERTION AND REASON QUESTIONS

Following questions consist of two statements – Assertion (A) and Reason (R). Answer these questions selecting the appropriate option given below:

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

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

(c) A is true but R is false.

(d) A is false but R is true.

1. Assertion (A): Diffusion does not meet high energy requirements of multi-cellular organisms

Reason (R) : Diffusion is a fast process but occurs at the surface of the body.

2. Assertion (A): Kidneys perform a dual function in our body.

Reason (R): Selective reabsorption occurs in the glomerulus.

3. Assertion (A): Mammals has double circulation.

Reason: Higher energy need due to endothermy (warm blooded).

4. Assertion (A): The purpose of making urine is to filter out undigested food from intestine

Reason (R): Kidneys filter the waste and produce urine

5. Assertion (A): Arteries always carry oxygenated blood.

Reason (R): Arteries transport blood from the heart to different parts of the body.

6. Assertion (A): The inner lining of the small intestine has numerous finger-like projections called villi.

Reason (R) : The villi increase the surface area for absorption.

7. Assertion (A) : Photosynthesis takes place in green parts of the plants.

Reason (R) : Photosynthesis always takes place in leaves.

8. Assertion (A) : Ureters are the tubes which carry urine from kidneys to the bladder.

Reason (R): Urine is stored in the urethra.

9. Assertion (A): Tracheal cartilage is present in the throat.

Reason (R): The larynx plays an important role in human speech.

10. Assertion (A): During transpiration the evaporating water carries away heat energy.

Reason (R): Due to water loss the osmotic pressure inside leaves increases.

11. Assertion (A): In a healthy adult, the initial filtrate in the kidneys is about 180 L daily, but the actual volume excreted is only a litre a day.

Reason (R): Most of the filtrate is lost from the body in the form of sweat.

C-CASE STUDY QUESTIONS

1.There is a range of strategies by which the food is taken in and used by the organisms in heterotrophic nutrition. Some organism breakdown the food material outside the body and then absorb it. Others take in whole material and break it down inside their bodies. What can be taken in and broken down depends on the body design and functioning. Some others derive nutrition from plants and animals without killing them.

i) Organisms which derive nutrition from plants and animals without killing them.

a. Parasites

b. Saprophytes

c. Heterotrophs

d. Autotrophs

ii) In which part of amoeba complex food particles are broken down into simpler ones.

a. Cytoplasm

b. Pseudopodia

c. Nucleus

d. Food vacuole

iii) Which of the following is an example of saprotroph.

a. Cuscuta

b. Sugarcane

c. Bread mould

d. Amoeba

iv) Taking in whole material and breaking it down inside the body is

a. Parasitic nutrition

b. Holozoic nutrition

c. Saprophytic nutrition

d. Symbiosis

v) Heterotrophic nutrition involves

a. Production of simple sugar from inorganic compounds

b. Utilisation of chemical energy to prepare food

c. Utilisation of energy obtained by plants

d. All of these

2. Ragya experienced muscular cramps during the training session for his upcoming football match. Mr. Ashutosh, her coach advised him on a schedule of some aerobic exercises to overcome his problem of muscular cramps. Ragya followed her coach's advice and did not face the problem of muscular cramps again during his match.

i) Which life process is depicted by the above passage?

(a) Respiration

(b) Digestion

(c) Nutrition

(d) Excretion

ii) Lack of oxygen in muscles often leads to cramps due to

(a) Conversion of pyruvate to ethanol

(b) Conversion of glucose to pyruvate

(c) Conversion of pyruvate to glucose

(d) Conversion of pyruvate to lactic acid

iii)Lactic acid is produced by _____ respiration in yeast.

(a) aerobic

(b) anaerobic

(c) oxidative

(d) none of these

iv)Why there is an increase in lactic acid concentration in the blood at the beginning of the exercise?

(a) Lack of oxygen

(b) Excess of oxygen

(c) Lack of carbon dioxide

(d) Excess of carbon dioxide

v) What else can be done for quick relief from muscular cramps?

(a) Massage

(b) by applying heating pad or an ice pack

(c) painkillers

(d) all of these

3. Blood transport food and waste materials in our bodies. It consists of plasma as a fluid medium. A pumping organ is required to push the blood around. The blood flows through the chambers of the organ in a specific manner and direction. While flowing throughout the body, blood exert a pressure against the wall or a vessel.

i) Which life process is depicted by the above passage?

(a) Respiration

(b) Digestion

(c) Transportation

(d) Excretion

ii) Name the blood pumping organ.

(a) Lungs

(b) Heart

(c) Kidney

(d) Liver

3)Oxygenated blood from lungs enters the left atrium through .....

(a) Vena cava

(b) Pulmonary artery

(c) Pulmonary vein

(d) Aorta

4)Deoxygenated blood leaves through the right ventricle through .....

(a) Vena cava

(b) Pulmonary artery

(c) Pulmonary vein

(d) Aorta

5)Which of the following statements is true about the heart?

(i) It is a hollow muscular organ.

(ii) It is a four chambered having three atria and one ventricle.

(iii) It has different chambers to prevent the oxygen - rich blood from mixing with the blood containing carbon dioxide.

(iv) Arteries always carry blood away from the heart.

(a) (i) and (ii)

(b) (ii) and (iii)

(c) (i), (ii) and (iii)

(d) (i), (iii) and (iv)

4. Amoeba is an animal having no fixed shape ingests food particles by formation of temporary finger-like projections. The food vacuole inside amoeba breaks down the food into small and soluble molecules. The digested food is thrown out by the amoeba by the rupture of cell membrane and it goes on for the search of next food particle.

i) Which type of organism is Amoeba?

(a) Unicellular

(b) Microscopic

(c) Multicellular

(d) Both a and b

ii)What are the temporary projections made in amoeba called?

(a) walking legs

(b) limbs

(c) Pseudopodia

(d) None of the above

iii)What type of nutrition is followed by amoeba?

(a) Parasitic

(b) Holozoic

(c) Saprotrophic

(d) Autotrophic

iv)The process of throwing out of undigested food in Amoeba is called

(a) Egestion

(b) Digestion

(c) Nutrition

(d) None of the above

v) Give an example of an organism which follows the same mode of nutrition in amoeba.

(a) Vertebrates

(b) Fungi

(c) Tapeworm

(d) Cuscuta plants

5. Our body needs to remove the wastes that build up from cell activities and from digestion. If these wastes are not removed, then our cells can stop working and we can get very sick. The organs of excretory system consist of a pair of kidneys, a pair of ureters, a urinary bladder and a urethra. Each kidney is made up of nearly one million complex tubular structures called nephrons. The formation of urine involves various processes that take place in the different parts of the nephrons. Each nephron consists of a cup- shaped upper end called Bowman's capsule containing a bunch of capillaries called glomerulus. Bowman's capsule leads to tubular structure, proximal convoluted tubule, loop of Henle and distal convoluted tubule which ultimately join the collecting tubule.

i) .The following substances are the excretory products in animals. Choose the least toxic form.

a. Urea

b. Uric acid

c. Ammonia

d. All of these

ii). Glomerular filtrate is first collected by

a. Distal convoluted tubule

b. proximal convoluted tubule

c. Bowman's capsule space

d. loop of Henle

iii). The outline of principal events of urination is given below in random order.

I) stretch receptors on the wall of urinary bladder send signals to the CNS.

II) The bladder fills with urine and become distended.

III) Micturition (voiding out urine)

IV) CNS passes on motor messages to initiate the contraction of smooth muscles of bladder and simultaneous relaxation of urethral sphincter.

The correct sequence of the events is

a. I → II → III→ IV

b. IV → III → II→ I

c. II → I→ IV → III

d. III → II→ I→ IV

iv) . Urine formation occurs through

a. Ultrafiltration, reabsorption, secretion.

b. Secretion, osmosis, ultrafiltration and reabsorption.

c. Only filtration and absorption.

d. Only osmosis and secretion.

D-VERY SHORT ANSWER QUESTIONS

e. How do stomata open?

f. What advantage over an aquatic organism does a terrestrial organism have with regard to obtaining oxygen for respiration?

g. Name the intermediate and the end products of glucose breakdown in aerobic respiration.

h. What are villi? What are its functions?

i. (i) Write the balanced chemical equation for the process of photosynthesis,

(ii) When do the desert plants take up carbon dioxide and perform photosynthesis?

j. Give one reason why multicellular organisms require special organs for exchange of gases between their body and their environment.

k. State two differences between arteries and veins.

E-SHORT ANSWER QUESTIONS

a. Draw a neat labelled diagram of Human heart also show the flow of oxygenated and deoxygenated blood).

b. Explain the process of nutrition in Amoeba.

c. Draw a diagram of human excretory system (special emphasis on Nephron).

d. (a) "The breathing cycle is rhythmic whereas exchange of gases is a continuous process". Justify this statement.

(b) What happens if the conducting tubes of the circulatory system develop a leak? State in brief, how could this be avoided?

(c) How does the opening and closing of stomata take place?

e. Name the respiratory organs of (i) fish (ii) mosquito (iii) earthworm.

F-LONG ANSWER QUESTIONS

a. State the role of the following in human digestive system:

(I) Digestive enzymes (II) Hydrochloric acid (III) villi

b. List the three steps in photosynthesis.

b. What is hemodialysis? Explain the steps of it.

c. (a) Explain how does the exchange of gases occur in animals (human).

(b) How are water and minerals transported in plants?

(c) Explain the phenomena of photosynthesis by using section of a leaf.

e. List any 3 functions of the major circulatory fluids of our body.

ANSWER KEY

S No	MULTIPLE CHOICE QUESTIONS
1	B
2	B
3	C
4	C

5	B
6	C
7	A
8	D
9	A
10	A
11	A
12	B
13	B
14	D
15	D
16	D
17	C
18	C
19	D
20	B
S No	**ASSERTION AND REASON QUESTIONS**
1	C
2	C
3	A
4	D
5	A
6	A

7	C
8	C
9	B
10	C
11	C
S No	**CASE STUDY QUESTIONS**
	QUE 1
1	A
2	D
3	C
4	B
5	C
	QUE 2
i)	A
ii)	D
iii)	B
iv)	A
v)	D
	QUE 3
1	C
2	B
3	C
4	B

5	D
	QUE 4
i)	D
ii)	C
iii)	B
iv)	A
v)	A
	QUE 5
1	A
2	C
3	C
4	A