



Government of Karnataka



**Karnataka Residential Educational
Institutions Society - Bengaluru**

Luminous Science

For Higher Grades

**10TH SCIENCE STUDY MATERIAL
2020-2021**

“Every thing is theoretically impossible, until it is done”

- Robert A. Heinlein

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For Higher Grades

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**Karnataka Residential Educational
Institutions Society - Bengaluru**

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INSTRUCTIONS TO THE STUDENTS/TEACHERS

Dear teachers/students,

1. This study material is not the substitute of Text book.
2. At first go through the text book chapter wise to develop a basic concept of the various topics of the chapter.
3. Study material topic wise relating it with the text book to develop lateral thinking.
4. Give more attention on the table, charts and diagrams given in the study material.
5. First practice to solve the previous years question papers.
6. Practice the CBSE/state board **model/sample question** papers to clear your concept more and more to the topic concerned.
9. Make a group of 4 to 5 student to prepare and to solve **HOT and Value based** questions.
10. In case of any difficulty in understanding the topic take the help of concern subject teacher.
11. This study material has been made in such a way that students will be fully guided to prepare for the exam in the most effective manner, securing higher grades.
12. To make the students understand the chapter completely, each chapter has been divided in to individual topics and each key points has easy to understand theory.
13. We have prepared the study material and have listed some of the important / twisted/direct/ indirect/applied questions from CBSE question papers and other resources.
14. Majority of questions is answered in this study material and did not solve the exercises questions which will be given by your teacher.
15. Using keys points assume/imagine to construct the different types of questions which will be given in board examinations.
16. Students must draw and practice all **30 diagrams** with their labelings listed in last pages.
17. Try to prepare **diagram oriented questions** with help of your teachers.

QUESTION PAPER PATTERN
IMPORTANCE GIVEN TO THE OBJECTIVES

Sl.No	Objectives	%	Marks
1	Knowledge	20	16
2	Understanding	40	32
3	Application	20	16
4	Skill	20	16
	Total	100	80

EXAM QUESTION PATTERN 8 8 8 9 4 1

SL. NO.	QUESTION TYPE	NO. OF QUESTIONS AND MARKS
1	MULTIPLE CHOICE QUESTIONS	8X1=8
2	VERY SHORT ANSWER QUESTIONS	8X1=8
3	TWO MARK QUESTIONS	8X1=8
4	THREE MARK QUESTIONS	9X3=27
5	FOUR MARK QUESTIONS	4X4=16
6	LONG ANSWER QUESTION	5X1=5
		38 QUESTIONS AND 80 MARKS

MARKS DISTRIBUTION FOR THEMES AND UNITS COVERED

Sl.No.	THEMES	UNITS	TOTAL MARKS
1	Materials in Daily Life	1. Acids, Bases and Salts 2. Metals and Non-metals 3. Carbon and its Compounds 4. Periodic Classification of Elements	25
2	World of Living	6. Life Processes 7. Control and Coordination 8. How do Organisms Reproduce? 9. Heredity and Evolution	22
3	Natural Phenomena	10. Light – Reflection and Refraction	12
4	How do things work?	12. Electricity 13. Magnetic Effects of Electric Current	13
5	Natural Resources	14. Sources of Energy 15. Our Environment 16. Sustainable Management of Natural Resources	08
		TOTAL	80

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ACIDS, BASES AND SALTS

KEY POINTS

- ❖ Acids are sour in taste. They turn blue litmus red. Acids are the substances that furnish H^+ ions in aqueous solution.
- ❖ If in an aqueous solution, concentration of acid is low, it is called dilute solution and if concentration of acid is high, it is called concentrated solution.
- ❖ Hydrochloric acid is released in stomach to make medium acidic in nature. It leads to coagulation of protein and helps in their digestion. HCl kills bacteria coming to the stomach along with the food.
- ❖ When a burning matchstick is brought near the hydrogen gas, it burns with a pop sound.
- ❖ When CO_2 gas is passed through lime water, it turns milky. If CO_2 is passed in excess, milkiness disappears.
- ❖ There are many natural substances like onion peels, red cabbage leaves, beetroot extract, and coloured petals of some flowers. They are called **indicators** because they indicate the presence of acid or base by showing the change in colour.
- ❖ Acids react with certain metal oxides to form salt and water. Acids react with metal carbonates and hydrogen carbonates to produce carbon dioxide gas.
- ❖ Strong bases react with active metals to produce hydrogen gas. Bases react with non-metallic oxides to produce salt and water.
- ❖ Both acids and bases conduct free electric current in their aqueous solution due to the presence of free ions.
- ❖ Strength of an acid or base depends on the number of H^+ ions or OH^- ions produced by them respectively. More the H^+ ions produced by an acid, stronger is the acid. More the OH^- ions produced by a base, stronger is the base.

Indicators:

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

Types of Indicators

1) Natural indicators Found in nature in plants. Litmus, red cabbage leaves extract, flowers of Hydrangea plant and turmeric.

Synthetic indicators These are chemical substances. Ex: Methyl orange and phenolphthalein

Olfactory indicators These substances have different odour in acid and bases. Ex: Vanilla, onion and clove oil.

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

	S.No.	Indicator	Smell/Colour in acidic solution	Smell/Colour in basic solution
Natural Indicator	1.	Litmus	Red	Blue
	2.	Red cabbage leaf extract	Red	Green
	3.	Flower of hydrangea plant	Blue	Pink
	4.	Turmeric	No change	Red

Chemical Properties of Acids and Bases

Reaction of Metals with

Acids

Acid + Metal \rightarrow Salt + Hydrogen gas

e.g., $2\text{HCl} + \text{Zn} \rightarrow \text{ZnCl}_2 + \text{H}_2$

Bases

Base + Metal \rightarrow Salt + Hydrogen gas

e.g., $2\text{NaOH} + \text{Zn} \rightarrow \text{Na}_2\text{ZnO}_2 + \text{H}_2 \uparrow$

(Sodium zincate)

acid

and base gives salt and hydrogen gas. Hydrogen gas released can be tested by bringing burning candle near gas bubbles, it burst with pop sound.

Reaction of Metal Carbonates/ Metal Hydrogen Carbonates with Acids and Bases

Acid + Metal Carbonate / Metal hydrogen Carbonate \rightarrow Salt + CO_2 + H_2O

Base + Metal Carbonate / Metal Hydrogen Carbonate \rightarrow Salt + CO_2 + H_2O

Ex:- $2\text{HCl} + \text{Na}_2\text{CO}_3 \rightarrow 2\text{NaCl} + \text{CO}_2 + \text{H}_2\text{O}$

$\text{HCl} + \text{NaHCO}_3 \rightarrow \text{NaCl} + \text{CO}_2 + \text{H}_2\text{O}$

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

$\text{Ca}(\text{OH})_2 + \text{CO}_2 \rightarrow \text{CaCO}_3 + \text{H}_2\text{O}$

(Lime water turns milky.)

❖ When excess CO_2 is passed, $\text{CaCO}_3 + \text{CO}_2 + \text{H}_2\text{O} \rightarrow \text{Ca}(\text{HCO}_3)_2$ (Milkyness disappears.)

Reaction of Acids and Bases with Each Other

Acid + Base \rightarrow Salt + H_2O

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

$\text{HCl} + \text{NaOH} \rightarrow \text{NaCl} + \text{H}_2\text{O}$

IF: Strong acid + Weak Base \rightarrow Acidic salt + H_2O

Weak acid + Strong Base \rightarrow Basic salt + H_2O

Strong acid + Strong Base \rightarrow Neutral salt + H_2O

Weak Acid + Weak Base \rightarrow Neutral salt + H_2O

❖ p^{H} of stomach is 1.5 – 3.0 due to secretion of HCl . In case of indigestion, acidity increases which can be neutralized by antacids like milk of magnesia.

❖ Cold drinks, chocolates and sweets are most harmful for health as well as tooth. They produce acids in mouth which are responsible for tooth decay (p^{H} lower than 5.5)

❖ Salts of a strong acid and a strong base are neutral with pH value of 7.

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

❖ A salt is soluble if it dissolves in water to give a solution with a concentration of at least moles per litre at room temperature.

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

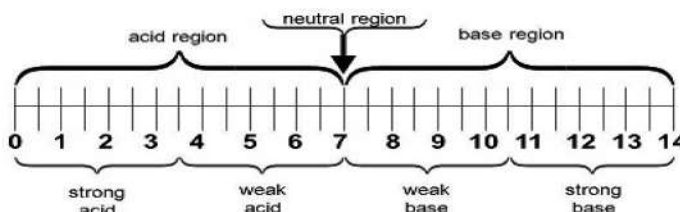
$\text{pH} = 7 \rightarrow$ neutral solution

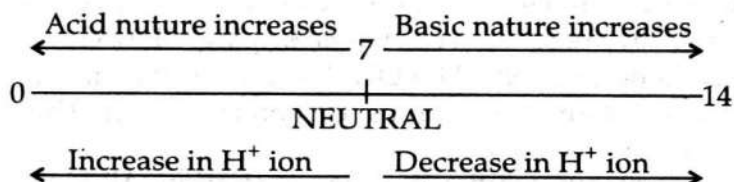
pH less than 7 \rightarrow acidic solution

pH more than 7 \rightarrow basic solution

On diluting an acid pH increases \uparrow

On diluting a base: pH decreases \downarrow





Importance of pH in everyday life

- Plants and animals are pH sensitive
- Our body works within the pH range of 7 to 7.8
- When pH of rain water is less than 5.6, it is called **acidrain**.
- Specific pH range for healthy soil.
- Plants require a specific pH range for their healthy growth.
- Self defence by animals and plants, honey bee stinging and nettle leaves inject methanoic acid to cause irritation (remedy – usage of mild acid like **baking soda**)

Know the Terms

- ❖ Those substances which turn blue litmus solution red are called acidic. The term 'acid' has been derived from the Latin word 'acidus' which means sour. Acids are sour in taste. They give H^+ ions in aqueous solution.
- ❖ Example: HCl , H_2SO_4 , HNO_3 , CH_3COOH .
- ❖ These substances which change their colour (or odour) in acidic or basic solutions are called **indicators**.
- ❖ The acids which are obtained from minerals are called **mineral acids**. Those acids which are obtained from plants and animals are called organic acids. Those acids which contain minimum amount of water are called **concentrated acids**.
- ❖ The acids which ionise almost completely are called **strong acids**, Ex. mineral acids like hydrochloric acid, nitric acid
- ❖ The acids which ionise partially or to a lesser extent are called **weak acids**,
- ❖ Ex. acetic acid, oxalic acid, organic acids
- ❖ Substances that furnish hydroxide ions (OH^-) in aqueous solution are called bases. Bases have bitter taste and produce blue colour in litmus solution.
- ❖ The substances / bases which ionise completely to furnish OH^- ions are called **strong bases**, Ex:- KOH , $NaOH$ etc.
The bases which ionise only partially are called **weak bases** Ex:- $Mg(OH)_2$, $Cu(OH)_2$ etc.
- ❖ Water soluble bases are called **alkalies**, e.g., $NaOH$, KOH . Thus, all alkalies are bases but all bases are not alkali.
- ❖ When a concentrated acid or base is diluted, a vigorous reaction takes place. The process is called **dilution**. It is an exothermic process as a lot of heat is produced.
- ❖ The process of forming ions in aqueous solution is called **ionisation**. All ionic compounds like $NaCl$, $NaNO_3$, Na_2SO_4 form ions in aqueous solution.
- ❖ A **universal indicator** is a mixture of many different indicators which shows a gradual but well marked series of colour changes over a very wide range of change in concentration of

- H^+ ions.
- ❖ **pH** is the scale for measuring hydrogen ion concentration. The concentrations of H^+ are generally small, therefore concentrations of H^+ are expressed in terms of pH. pH is defined as negative logarithm of H^+ concentration or H_3O^+ concentration.
 - ❖ $pH = -\log [H^+]$ or $pH = -\log [H_3O^+]$
 - ❖ The reaction in which base or basic oxide reacts with acid or acidic oxide is called **neutralisation reaction**.
 - ❖ Example: $NaOH_{(aq)} + HCl_{(aq)} \rightarrow NaCl_{(aq)} + H_2O$
 - ❖ A salt is an ionic compound that results from the neutralization reaction of an acid and a base. Salts are composed of related numbers of cations and anions, so that, the product is electrically neutral.
 - ❖ **Aqueous solution** is one in which the solvent is liquid water.
 - ❖ **Precipitate** is a substance to be deposited in solid form a solution.

Important questions and answers

1. Dry hydrogen chloride gas does not turn blue litmus, whereas hydrochloric acid does. Why?

Ans. In the dry state, hydrogen chloride (HCl) does not release H^+ ions. Therefore, it cannot behave as an acid. When dissolved in water, it forms hydrochloric acid. It dissociates to give H^+ ions in solution and behaves as an acid

2. Fresh milk has a pH of 6. When it changes to curd, will its pH value increase or decrease? Why?

Ans: When milk is turned into curd then its pH value will decrease due to the production of lactic acid in curd which is acidic in nature. When milk turns into curd then it starts showing all properties of acid. It turns sour and the pH value decreases from 6.

3. Brushing our teeth twice a day is a well known saying. Justify this statement.

Ans. We should brush our teeth twice a day as bacteria present in the mouth produce acids by degradation of sugar and food particles remaining in the mouth after eating. To prevent this is to clean the mouth using toothpaste which are basic in nature. These can neutralize the excess acid and prevent tooth decay.

4. A student prepared solutions of (i) an acid and (ii) a base in two separate beakers. She forgot to label the solutions and litmus paper is not available in the laboratory. Since both the solutions are colorless, how will she distinguish between the two?

Ans: In the absence of litmus paper, a reagent phenolphthalein can be used. The solution which develops pink colour with phenolphthalein is a base and the other is acid

5. I give different smell in acid and base solution.

Ans: olfactory indicator

6. I am an oxide capable of showing properties for both acids and bases.

Ans: amphoteric oxide

7. I am a covalent compound and conducts electricity in aqueous medium.

Ans: KCl and HCl both are covalent compounds.

8. I am derived from tomato and turn blue litmus into red.

Ans: citric acid

9. While diluting an acid, why is it recommended that the acid should be added to water and not water to the acid?

Ans: Dilution of a concentrated acid is a highly exothermic reaction and a lot of heat is generated. Care must be taken while mixing concentrated acid with water. The acid must always be added slowly to water with constant stirring. Water is added to the concentrated acid, the heat generated may cause the mixture to splash out and cause burns. The glass container may also break due to excessive local heating.

10. Why does an aqueous solution of acid conduct electricity?

Ans: The aqueous solution of an acid conduct electricity because the acid solution have ions & the movement of these ions in solution helps for flow of electricity current through the solution & the ions are H^+ ions.

11. How is the concentration of hydronium ions (H_3O^+) affected, when a solution of an acid is diluted?

Ans: When a solution of an acid is diluted i.e., water is added to it, the concentration of H_3O^+ ions per unit volume decreases.

12. What is the change in pH values of milk when it changes into curd? Explain.

Ans: pH decreases. It is due to the formation of lactic acid in curd. Since, acids generally have a low pH value, so, when milk changes to curd its pH will decrease.

13. A local magician was showing magic in a village street. He took egg shell and poured solution over it. As a result, effervescences were formed. When he took a burning matchstick over it, it went off.

(a) Identify the solution poured and the substance present in egg shell.

(b) What is the reason behind effervescences?

(c) Write its balanced chemical equation.

(d) Give the common name of the substance present in the egg shell

Ans: (a) Solution is an acid. Substance in egg shell is calcium carbonate.

(b) Effervescence is due to the evolution of CO_2 gas.

(c) $2HNO_3 + CaCO_3 \rightarrow 2Ca(NO_3)_2 + H_2O + CO_2$

(d) Limestone

14. What is neutralization reaction?

Ans: The reaction between an acid and a base to give a salt and water.

15. Why should curd and sour substances not be kept in brass and copper vessels?

Ans: Acids present in them reacts with the metal to liberate hydrogen gas and harmful substances, there by spoiling the food.

16. While diluting an acid, why is it recommended that the acid should be added to water and not water to the acid?

Ans: The process of dissolving an acid or a base in water is a highly exothermic. 1. the heat generated may cause the mixture to splash out and cause burns. 2.The glass container may also break due to excess heat produced.

17. Why does dry HCl gas not change the colour of the dry litmus paper?

Ans: Acid dissociates in to ions only in the aqueous solution.

18. What is the difference between strong acid and concentrated acid?

Ans: Acid which dissociates in to ions completely is called strong acid where as the concentrated acid is the one which has less water content.

19. Why do acids not show acidic behavior in the absence of water?

Ans: the dissociation of hydrogen ions from an acid occurs only in the presence of water.

20. What is meant by acid rain? How it is harmful to aquatic organisms?

Ans: When the pH of rain water is less than 5.6 we call it as acid rain.It destroys eggs of the aquatic organisms.

21. To the three solutions listed below, a few drops of phenolphthalein and blue litmus were added separately. Specify the colour change in each case, if any:

(i)Sodiumcarbonate (ii) Nitric acid acid (iii) Sodium chloride (iv) Distlled water

Ans:

Name of the solution		Colour change phenolphthalein	Colour change with blue litmus
(i)	Sodium carbonate	Turns pink	No change
(ii)	Nitric acid	No change	Turns red
(iii)	Sodium chloride(salt)	No change	No change
(iv)	Distlled water	No change	No change

22. Though the compounds such as glucose and alcohol have, hydrogen atoms in their molecules yet they are not categorised as acids.Why?

Ans: Glucose and alcohol do not produce H^+ ions, when dissolved in water. The acids contain hydrogen. When acid is dissolved in water, it produces H^+ ions.

METALS AND NON-METALS

KEY POINTS

*Metals are mostly solids, possess high density. They have high melting and boiling points. They have lustre and they are sonorous. They are good conductors of heat and electricity.

*Most of the metals are hard. However some of the metals like sodium, potassium are soft metals and can be cut with knife.

*All metals are solids except Mercury, Cesium, Francium, Germanium and Gallium which are low melting solids. Gallium becomes liquid if kept on palm. But Gallium has very high boiling point which makes it useful for high temperature thermometers.

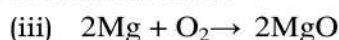
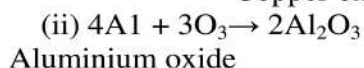
Property	Metals	Non-Metals
1. Lustre	Metals have shining surface.	They do not have shining surface. • Except Iodine.
2. Hardness	They are generally hard. • Except Sodium, Lithium and Potassium which are soft and can be cut with Knife.	Generally soft. • Except Diamond, a form of carbon which is the hardest natural substance.
3. State	Exist as solids. • Except Mercury.	Exist as solids or gaseous • Except Bromine.
4. Malleability	Exist as solids. • Except Mercury.	Non-metals are non-malleable.
5. Ductility	Metals can be drawn into thin wires.	They are non-ductile.
6. Conductor of heat & electricity	Metals are good conductor of heat and electricity,	Non-metals are poor conductor of heat and electricity. • Except Graphite.
7. Density	Generally have high density and high melting point. • Except Sodium and Potassium	Have low density and low Melting point.
8. Sonorous	Metals produce a sound on striking a hard surface.	They are not sonorous.
9. Oxides	Metallic oxides are basic in nature.	Non-metallic oxides are acidic in nature.

I. Physical Properties

*Reaction with Air:

Metals combine with oxygen to form metal oxide. $\text{Metals} + \text{O}_2 \rightarrow \text{Metal oxide}$

Examples:



Different metals show different reactivities towards O₂

*Na and K react so vigorously that they catch fire if kept in open so they are kept immersed in kerosene.

*Surfaces of Mg, Al, Zn, Pb are covered with a thin layer of oxide which prevent them from further oxidation.

*Fe does not burn on heating but iron fillings burn vigorously.

*Cu does not burn but is coated with black copper oxide.

*Au and Ag do not react with oxygen.

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

Examples: $\text{Al}_2\text{O}_3 + 6\text{HCl} \rightarrow 2\text{AlCl}_3 + 3\text{H}_2\text{O}$ $\text{Al}_2\text{O}_3 + 2\text{NaOH} \rightarrow 2\text{NaAlO}_2 + \text{H}_2\text{O}$
Sodium Aluminate

(B) Reaction of Metals with Water:

Metal + Water \rightarrow Metal oxide + Hydrogen

Metal oxide + Water \rightarrow Metal hydroxide

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

Metal A + Salt solution B \rightarrow Salt solution A + Metal B

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

Fe + CuSO₄ \rightarrow FeSO₄ + Cu

*All the metals do not react with the same rate. Some react very fast, some react moderately whereas others react very slowly. The series of metals in decreasing order of reactivity is called **reactivity or activity series of metals**. The metals at the top are most reactive whereas metals at the bottom are less reactive.

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

*Metals react with dilute acids to form salt and hydrogen gas. The metal replaces hydrogen of the acid to form salt.

***Aqua Regia** is a mixture of conc. HCl and conc. HNO₃ in the ratio of 3: 1. It can dissolve gold and platinum. Regia is a strong oxidising agent due to the formation of NOCl (Nitrosyl chloride) and chlorine produced reaction of two acids.

***Alloys** are homogenous mixture of two or more metals. One of them can be non-metal also, e.g.,

Brass is an alloy of copper and zinc. When a metal is alloyed with mercury, it is called **amalgam**.

*Metal, in reactivity series, if placed above hydrogen, can displace hydrogen from dilute acids (HCl and H₂SO₄).

Ionic Compounds

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

Properties of ionic Compounds

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

Occurrence of Metals

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

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

Know the Terms:

The ability of a metal due to which it can be beaten into sheets is called **malleability**. Iron, copper, zinc and aluminium are available in the form of a sheets. Aluminium, steel, copper, brass and bronze are used in making utensils.

***Ductility** is the ability of metal due to which it can be drawn into wires. Copper, aluminium and iron can be drawn into wires. Silver, gold and platinum are highly ductile metals.

***Electrical conductance** is the property due to which electric current can pass through the metal. It is due to presence of free electrons or mobile electrons. Copper, silver, gold and aluminium are good conductors of electricity.

***Thermal conductivity** is the property due to which metals can conduct heat. e.g., Copper, silver, aluminium, gold and iron are good conductors of heat.

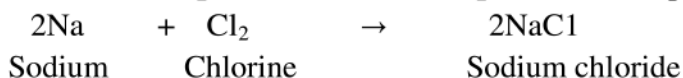
*The process of forming oxide layer on the surface of metal is called **anodising**, e.g., Aluminium forms an oxide layer on its surface when it is exposed to air. It is non- penetrating layer which protects it from corrosion.

*Metals in their pure state have bright shining surfaces. This property is called **metallic lustre**.

*When metals are struck with a hard substance, they produce sound. This property is called **sonority** and the metals are said to be **sonorous**.

*Those bases, which are soluble in water are called **alkalies**. Example, NaOH, KOH, Ca(OH)₂. The oxides which react with acids or acidic oxides to form salt and water are called Basic oxides. Example, Na₂O, CaO, K₂O, MgO. The oxides which react with bases or basic oxides to form salt and water are called **Acidic oxides**. Example, CO₂, SO₂, SO₃, P₂O₅ etc.

*The compounds in which metal loses electrons and non-metal gains electrons are called **electrovalent compounds or ionic compounds**. Example, NaCl, KCl etc.



*A stable group of eight electrons in the outermost orbit of the atom is known as **Octet**. The bond which is formed by loss and gain of electrons is called ionic or **electrovalent bond**.

***Ionic compounds or electrovalent compounds** are solid, hard and brittle due to strong force of attraction between them. They have high melting and boiling points. These compounds are soluble in water but insoluble in organic solvents.

***Corrosion** is a process in which metal reacts with substance present in the atmosphere to form surface compounds e.g., silver metal turns black due to formation of AgS, iron forms reddish brown coating of hydrated ferric oxide, Fe₂O₃.xH₂O, Green coating on copper.

*The process of coating iron articles with zinc which is more reactive than iron is called **Galvanisation**.

***Metallurgy:** All the processes involved in the extraction of metals from their ores and refining them for use, is called metallurgy.

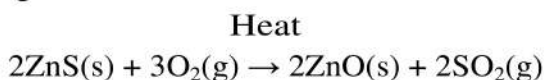
***Ore-dressing** is a process of removing unwanted substances from the ore. This is also known as concentration of the ore or enrichment of ore. It is usually done by hydraulic washing, magnetic separation or froth floatation process.

***Froth floatation** process is based on the principle that the mineral particles are more wetted by the oil, whereas the gangue particles are more wetted by water. Compressed air is bubbled through the mixture. As a result of agitation, oil froth is formed which contains minerals which float on the top of water and can be separated easily.

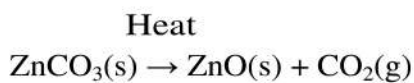
*The unwanted material present in the ores mined from earth is called Gangue. It needs to be removed prior to the extraction process.

***Anode mud** is the impurities collected below anode during electrolytic refining of metal.

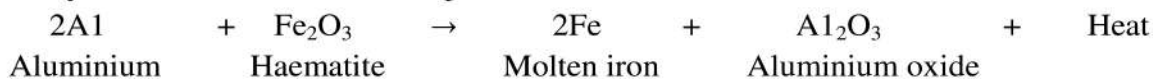
***Roasting** is the process in which ore is heated in the presence of air so as to obtain metal oxides, which can be reduced easily to get free metal. Sulphide ores are converted into oxides by roasting.



***Calcination** is the process of heating ore in absence of air so as to remove moisture and volatile impurities and to convert carbonate ores into oxides.



***Thermite Reaction** is a process in which molten metal oxides are treated with aluminium powder. It is highly exothermic reaction. The molten metal obtained is used for welding of railway tracks or cracked machine parts.



***Refining** is a process of converting impure metal into pure metal by different processes depending on the nature of metals. It is a process of purification of metal.

*The substance which reacts with gangue to form a fusible mass which can easily be removed is known as flux, e.g., CaO, (Calcium oxide) is used as **flux** so as to remove SiO₂(Silica) as gangue.

*The fusible mass formed by the reaction of flux and gangue is known as **slag**. Slag is lighter than molten metal, hence floats over molten metal and can be easily removed. It prevents metal from oxidation.

* **Amalgam** – If an alloy contains mercury as one of its components, it is called amalgam.
Ex; sodium – mercury amalgam.

* **Cinnabar** (HgS) is an ore of **mercury**

* **Amphoteric oxides** ; acts both acid and base Ex. Na₂O, ZnO, Al₂O₃

Important questions and answers

1. Aluminium is highly reactive metal, but it is used to make utensils for cooking.

Ans: Aluminium is a highly reactive metal, yet it is used to make utensils for cooking.

This is because aluminium reacts with oxygen present in air to form a thin layer of aluminium oxide. This oxide layer is very stable and prevents further reaction of aluminium with oxygen.

2. Magnesium when reacts with hot water, starts floating. Why?

Ans: It reacts with hot water to form magnesium hydroxide and hydrogen. Magnesium starts floating due to the bubbles of hydrogen gas sticking to its surface. As the Bubbles move up it pulls Mg with it.

3. Royal water is prepared by mixing two acids A and B. It can dissolve gold and platinum. It is highly corrosive and fuming liquid. Identify 'A' and 'B'. What is the ratio in which 'A' and 'B' are mixed.

Ans: HCl and HNO₃ (3:1)

4. Corrosion is a serious problem. Every year an enormous amount of money is spend to replace damaged iron. What steps can be taken to prevent this damage.

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

5. Non metals do not displace hydrogen from dilute acid.

Ans: Non metals can not loose electrons so that H⁺ ions become hydrogen gas.

6. On adding dilute HCl acid to copper oxide powder, the solution formed is blue-green. Predict the new compound formed which imparts a blue-green colour to the solution? Write its equation.

Ans: When HCl reacts with copper oxide, a blue green solution of copper (II) chloride is formed

$$2\text{HCl} + \text{CuO} \longrightarrow \text{CuCl}_2 + \text{H}_2\text{O}$$

This is a double replacement reaction. The soluble Copper (II) Chloride is blue-green in color and is responsible for the color of the solution formed.

7. I am homogenous and not a compound though my formation least to altering the properties of metals involved.

Ans: Alloy

8. I am a process associated with wasting away of metals by the action of atmospheric gases and moisture.

Ans: Corrosion

9. I am a property of metals which appears at lower temperatures.

Ans: Resistance, hardness, elasticity, etc.

10. Magnesium when reacts with hot water, starts floating. Why?

Ans: It reacts with hot water to form magnesium hydroxide and hydrogen. Magnesium starts floating due to the bubbles of hydrogen gas sticking to its surface. As the Bubbles move up it pulls Mg with it.

11. I am noble conductor of heat and electricity.

Ans: I am noble conductor of heat and electricity.

12. Though I get corroded in atmosphere but still find wide applications for making kitchen utensils.

Ans: Aluminium

13. I am a metal but very soft and cannot be kept in the open.

Ans: Sodium/Potassium.

14. A student was given Mg, Zn, Fe, and Cu metals. He put each of them in dil HCl contained in different test tubes. Identify which of them (i) will not displace H_2 from dil HCl, (ii) forms a pale green substance

(iii) will give H_2 with 5% HNO_3 , (iv) will be displaced from its salt solution by all other metals

Ans: (i) Cu (ii) Fe (iii) Cu (iv) Cu

15. A non-metal X exists in two different forms Y and Z. Y is hardest natural substance, whereas Z is a good conductor of electricity. Identify X, Y and Z.

Ans: a) A non-metal X is carbon (C).

b) Carbon exists in two different forms called the allotropes of carbon. These allotropes are diamond and graphite.

c) The Y is diamond because diamond is the hardest natural substance and Z 'is graphite which is a good conductor of electricity.

16. What is reactivity series? Write the order of reactivity series of metals.

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

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

17. Give reason for the following:

(i) School bells are made up of metals.

(ii) Electrical wires are made up of copper.

Ans: i) Metals are sonorous (produce sound on being hit), so school bells are made up of metals.

ii) Copper is a very good conductor of electricity. So, it is used for making electrical wires.

18. Why does calcium float in water?

Ans: Calcium reacts with water to form hydrogen gas. Although, calcium is heavier than water, but due to the sticking of the H_2 gas bubbles on calcium metal surface, it starts floating.

19. A green layer is gradually formed on a copper plate when left exposed to air for a week in a bathroom. What could this green substance be?

Ans : This green substance is basic copper carbonate $\text{CuCO}_3 \cdot \text{Cu(OH)}_2$.

20. I am a process to refine metals of high reactivity.

Ans: Reactive metals such as aluminium are extracted by electrolysis.

21. Why Aluminium extracted from Alumina by electrolytic reduction & not by reducing it with Carbon?

Ans: Aluminium is more reactive than carbon and it has more affinity for oxygen, therefore, alumina cannot be reduced with carbon but is extracted by electrolytic reduction.

22. I belong to the same category of elements but still combine to form molecules/compounds.

Ans: Carbon

23. Write 5 points of difference between Ionic compound and covalent compound.

Ans: a) Ionic compounds are formed by the transfer of electrons that are positively and negatively charged, whereas, covalent compounds are formed by sharing the electrons.

b) In an ionic compound, bonding involves a metal and nonmetal, whereas, in the covalent compound, bonding is between nonmetals.

c) Ionic compounds are more soluble in water than covalent compounds.

d) Ionic compounds have definite shape whereas, covalent has no shape.

e) Ionic compounds are the good conductor of electricity, whereas covalent compounds are the bad conductor of electricity.

24. Give reasons for the following:

(i) Ionic compounds have high melting point and boiling point.

(ii) Ionic compounds conduct electricity in molten state.

(iii) Ionic compounds are solids at room temperature and are somewhat hard.

Ans: (i) A large amount of energy is required to break the strong inter-ionic attraction.

(ii) When ionic compounds are present in molten state, crystal structure deforms and they can easily conduct electricity with the mobile ions.

(iii) Due to the strong force of attraction between the positive and negative ions.

25. Aluminium and zinc do not corrode easily even though they are reactive metals. Give reasons for your answer.

Ans: Aluminium and zinc react with moist air to form a thin protective layer of oxide on their surfaces. This layer prevents further corrosion of the metals.

26. Why is carbon not used for reducing aluminium from aluminium oxide?

Ans: Because aluminium has greater affinity for oxygen than for carbon, therefore carbon cannot reduce alumina (Al_2O_3) to aluminium.

CARBON AND ITS COMPOUNDS

KEY POINTS

*The element carbon is non-metal. Its symbol is C.

*Carbon is a versatile element the percentage of carbon present in earth crust in form of mineral is 0.02% and in atmosphere as CO₂ is 0.03%.

*All the living things, plants and animals are made up of carbon based compounds.

*The atomic number of carbon is 6 (C - 6).

Electronic configuration:

K	L
2	4

How carbon attain noble gas configuration?

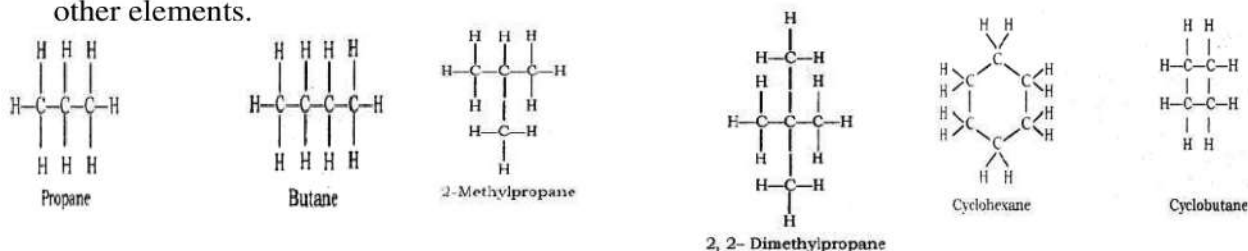
1. Carbon is tetravalent, it does not form ionic bond by either losing four electrons (C⁴⁺) or by gaining four electrons (C⁴⁻). It is because, it is difficult to hold four extra electrons and would require large amount of energy to remove four electrons. So, carbon can form bond by sharing of its electron with the electrons of other carbon atom or with other element and attain noble gas configuration.
2. The atoms of other elements like hydrogen, oxygen and nitrogen, chlorine also form bonds by sharing of electrons.
3. The bond formed by sharing of electrons between same or different atoms is covalent bond.

Versatile Nature of Carbon: The existence of such a large number of organic compounds is due to the following nature of carbon, Catenation and Tetravalent nature.

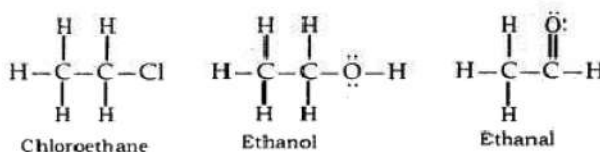
(i) **Catenation:** The self-linking property of an element mainly carbon atom through covalent bonds to form long straight, branched and rings of different sizes are called Catenation. This property is due to

- The small size of the carbon atom.
- The great strength of the carbon-carbon bond.

Carbon can also form stable multiple bonds (double or triple) with itself and with the atoms of other elements.



(ii) **Tetravalent Nature:** Carbon has valency of four. It is capable of bonding with four other atoms of carbon or some other heteroatoms with single covalent bond as well as double or triple bond.



***Covalent Bond:** A covalent bond is formed by sharing of electrons between atoms. In a covalent bond, the shared pair of electrons belongs to the valence shell of both the atoms.

***Carbon forms covalent bonds.**

***Conditions for Formation of a Covalent Bond:**

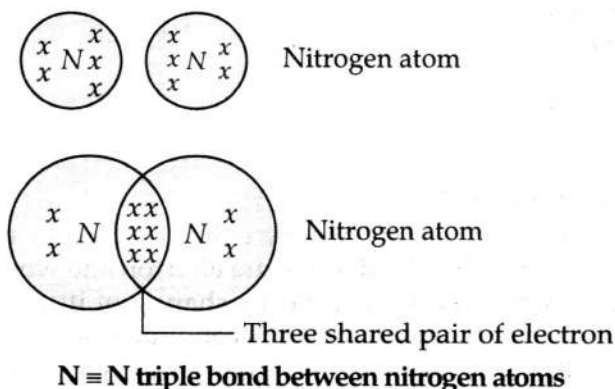
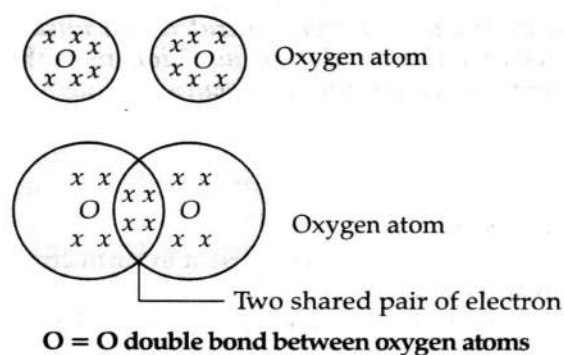
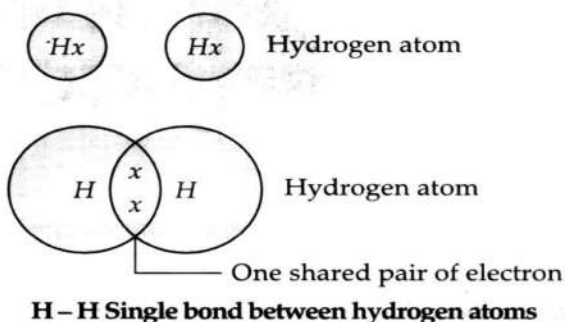
1. The combining atoms should have 4 to 7 electrons in their valenceshell.
2. The combining atoms should not lose electrons easily.
3. The combining atoms should gain electrons readily.
4. The difference in electro negativities of two bonded atoms should below.

***Properties of Covalent Compounds:**

1. **Physical states:** They are generally liquid or gases. Some covalent compounds may exist as solid.
2. **Solubility:** They are generally insoluble in water and other polar solvents but soluble in organic solvents such as benzene, toluene, etc.
3. **Melting and boiling points:** They generally have low melting and boiling points.
4. **Electrical conductivity:** They do not conduct electrical current.

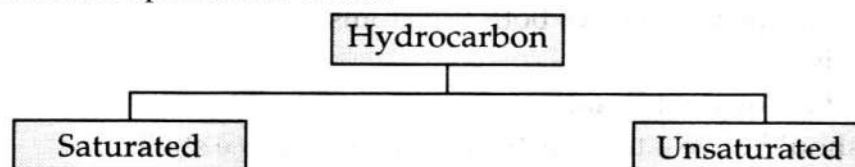
Steps for Writing the Lewis Dot Structures of a Covalent Compound:

1. Write the electronic configuration of all the atoms present in the molecule.
2. Identify how many electrons are needed by each atom to attain noble gas configuration.
3. Share the electrons between atoms in such a way that all the atoms in a molecule have noble gas configuration.
4. Keep in mind that the shared electrons are counted in the valence shell of both the atoms sharing it.



Saturated and Unsaturated Carbon Compounds

Compounds made up of hydrogen and carbon are called hydrocarbon. There are acyclic carbon compounds which form open carbon chains.



1. Single bond between carbon atoms. $-C-C-$

2. Alkanes

3. General formulae $C_n H_{2n+2}$

4. These are Strong compounds.

5. Examples: Methane, Ethane, etc.

1. Double or triple bond between carbon

$*-C=C--C=C-$

2. Alkenes and Alkynes

3. $C_n H_{2n}$ - Alkenes

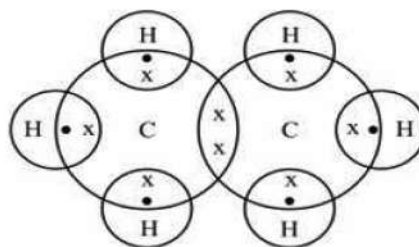
$C_n H_{2n-2}$ - Alkynes

4. These are weak compounds.

5. Examples; Ethene, Propene, Ethyne, etc.

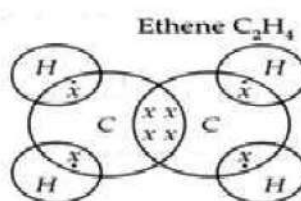
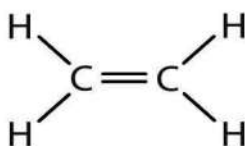
Electron Dot Structure of Saturated Hydrocarbons

Ethane C_2H_6

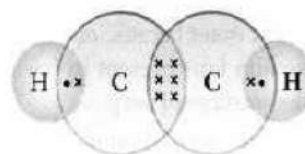


Electron Dot Structure of Unsaturated Hydrocarbons

$H-C=C-H$ = Ethene



Ethyne C_2H_2

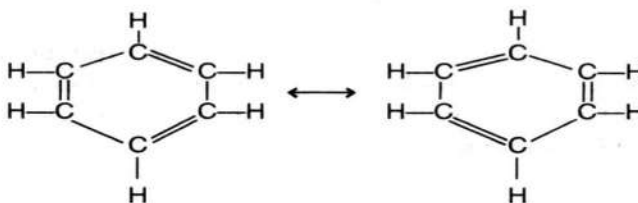


Cyclic or Closed Chain Hydrocarbons: These are the hydrocarbons which do not have carbon carbon closed chain.

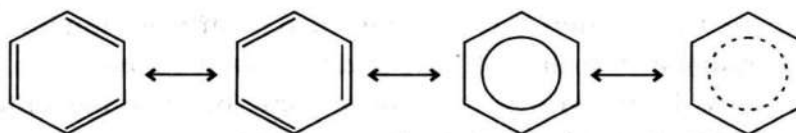
They are classified as:

- Alicyclic hydrocarbons:** These are the hydrocarbons which do not have benzene ring in their structures.
- Aromatic hydrocarbons:** These are the hydrocarbons which have benzene ring in their structures. When hydrogen bonded to carbon of benzene is substituted with halogens, radicals or other functional groups, the derivatives are called aromatic compounds.

***Benzene:** It is an aromatic hydrocarbon which has the molecular formula C_6H_6 . It has alternating carbon- carbon single and double bonds.



Benzene can also be represented as:



IUPAC name of hydrocarbon consists of two parts. It involves:

(i) **Word root:** Number of carbons in the longest carbon chain.

Number of carbon atoms	Word root (Greek name)
1	Meth
2	Eth
3	Prop
4	But
5	Pent
6	Hex
7	Hept
8	Oct
9	Non
10	Dec

(ii) **Suffix:** It depends on the type of carbon - carbon bond for single bond suffix is —ane, for double bond suffix is —ene and for triple bond suffix is —yne.

Types of Formula for Writing Hydrocarbons:

- (i) **Molecular formula:** It involves the actual number of each type of atom present in the compound.
- (ii) **Structural formula:** The actual arrangement of atoms is written in structural formula.
- (iii) **Condensed formula:** It is the shortened form of the structural formula.

Functional Groups

*In hydrocarbon chain, one or more hydrogen atom is replaced by other atoms in accordance with their valencies. These are hetero atom.

*These heteroatom or group of atoms which make carbon compound reactive and decides its properties are called functional groups.

Hetero atom	Functional group	Formula of functional group
DI/Br	Halo (Chloro/Bromo)	— Cl, — Br, — I
Oxygen	1. Alcohol	— OH
	2. Aldehyde	— CHO
	3. Ketone	$\begin{array}{c} \text{— C —} \\ \\ \text{O} \end{array}$
	4. Carboxylic acid	$\begin{array}{c} \text{O} \\ \\ \text{— C — OH} \end{array}$
Double bond	1. Alkene group	>C = C <
Triple bond	2. Alkyne group	— C \equiv C —

***Homologous Series:** A series of organic compounds in which every succeeding member differs from the previous one by — CH₂ or 14 a.m.u. is called homologous series. The molecular formula of all the members of a homologous series can be derived from a general formula.

***Properties of a homologous series:** As the molecular mass increases in a series, physical properties of the compounds show a variation, but chemical properties which are determined by a functional group remain the same within a series.

***Homologous series of alkanes:** General formula: C_nH_{2n+2}, where n = number of carbon atoms.
CH₄, C₂H₆, C₃H₈, etc.

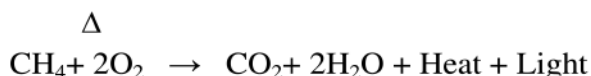
***Homologous series of alkenes:** General formula: C_nH_{2n}, where n = number of carbon atoms.
C₂H₄, C₃H₆, C₄H₈, etc.

***Homologous series of alkynes:** General formula: C_nH_{2n-2}, where n = number of carbon atoms.
C₂H₂, C₃H₄, C₄H₆, etc.

Chemical Properties of Carbon Compounds:

(a) Combustion:

*Carbon and its compounds are used as fuels because they burn in air releasing lot of heat energy.

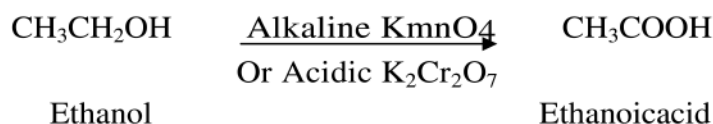


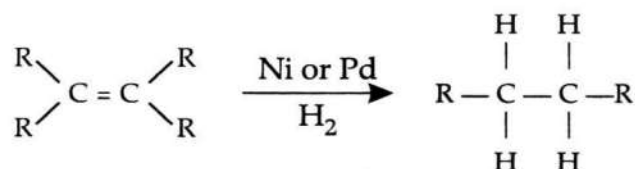
*Saturated hydrocarbon generally burn in air with blue and non-sooty flame.

*Unsaturated hydrocarbon burns in air with yellow sooty flame because percentage of carbon is higher than saturated hydrocarbon which does not get completely oxidized in air

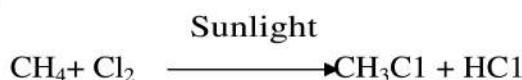
(b) Oxidation:

Alcohols can be converted to carboxylic acid in presence of oxidizing agent alkaline KMnO₄ (potassium permanganate) or acidic potassium dichromate.



(c) Addition Reaction:

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

(d) Substitution Reaction:**Soaps and Detergents:**

*Soap is sodium or potassium salt of long chain carboxylic acid. Ex; $\text{C}_{17}\text{H}_{35}\text{COONa}^+$

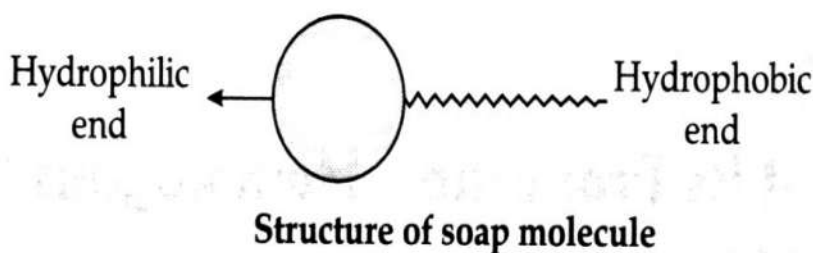
*Soaps are effective only in soft water.

*Detergents are ammonium or sulphonate salt of long chain of carboxylic acid.

*Detergents are effective in both hard and soft water.

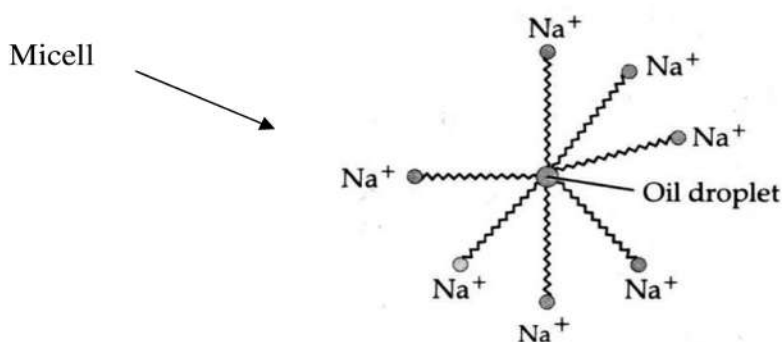
Soap molecule has:

1. Ionic (hydrophilic) part
2. Long hydrocarbon chain (hydrophobic) part

**Cleaning Action of Soap**

*Most dirt is oily in nature and hydrophobic end attaches itself with dirt and the ionic end is surrounded with molecule of water. This result in formation of a radial structure called **micelles**.

*Soap micelles help to dissolve dirt and grease in water and cloth gets cleaned.



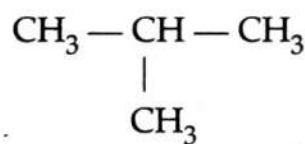
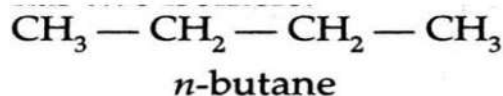
*The magnesium and calcium salt present in hard water react with soap molecule to form insoluble product called scum. This scum creates difficulty in cleansing action.

*By use of detergent, insoluble scum is not formed with hard water and cloths get cleaned effectively.

Know the terms

***Electronegativity:** It is the ability of an atom to attract a shared pairs of electrons towards itself. If the atoms forming a covalent bond have different electronegativities, the atom with higher electronegativity pulls the shared pair of electrons towards itself. Thus, the atom with the higher electronegativity develops a partial negative charge and the atom with the lower electronegativity develops a partial positive charge. This bond with some polarity is called **polar covalent bond**.

***Isomerism:** The compounds which possess the same molecular formula but different structural formulae are called isomers, and the phenomenon is known as isomerism. For example, butane with a molecular formula C_4H_{10} has two isomers.



Iso-butane

***Homologous Series:** It is a family of organic compounds having the same functional group in which the formulae of successive members differ by $-\text{CH}_2$ group. For example, CH_4 , C_2H_6 , C_3H_8 , C_4H_{10} etc. All the members of a homologous series have similar structures and same chemical properties.

***Oxidation:** Oxidation means controlled combustion. For example, when ethanol is heated with alkaline potassium permanganate solution or acidified potassium dichromate solution, it gets oxidised to ethanoic acid.

***Saponification Reaction:** Esters react in the presence of an acid or a base to give back the alcohol and the carboxylic acid. This reaction is known as saponification because it is used in the preparation of soap.



***Soaps and Detergents:** Soaps are sodium and potassium salts of long chain (higher) fatty acids such as stearic acid, palmitic acid etc. Detergents are ammonium or sulphonate salts of long chain hydrocarbons.

Important questions and answers

- 1) Suman always carried her tiffin box in a jute bag while most of her friends got it packed in a polythene bag.
 - (a) What type of bonding is present in polythene?
 - (b) Give one advantage of carrying jute and disadvantage of poly bag.
 - (c) Which value is reflected in Suman by using jute bag?

Ans. (a) In polythene, long chain of ethene is present – $C = C$ –.

(b) Jute bag is biodegradable and will not cause pollution. While polythene bag is a non-biodegradable and causes pollution.

(c) Suman shows the value of a responsible behaviour.

2. Geeta helps her mother in washing clothes, toilets, balconies every Sunday. She uses the left over detergent water of washing machine to clean toilets.

(a) Why is detergent used in washing clothes?

(b) Give one advantage of detergent over soap.

(c) What value of Geeta is reflected in the above task?

Ans.(a) Detergents have strong cleansing ability and can remove oil and dirt from clothes or other surfaces.

(b) Soap cannot be used in hard water but detergents can be used in hard water.

(c) Geeta is trying to reduce water pollution and water shortage problem. She also shows helpful to her mother and responsible behaviour.

3. How many covalent bonds are present in C_2H_6 ?

Ans: 7

4. What is hydrogenation? What is its industrial application?

Ans: Hydrogenation is the chemical reaction between hydrogen and other compounds in the presence of catalyst. Industrial application: Hydrogenation is used in many industrial applications. For example; in Petrochemical Industry, hydrogenation is used to convert alkenes into alkanes (paraffins) and cycloalkanes.

5. Give a test that can be used to differentiate between ghee and oil.

Ans: Hydrogenation or addition of hydrogen

6. What is functional group? Identify the functional group present in CH_3COOH & C_2H_5OH .

Ans: Functional group in a carbon compound may be defined as an atom or group of atoms or reactive part which is responsible for the characteristic properties of the compounds. CH_3COOH has functional group $-COOH$ i.e. carboxylic acid and C_2H_5OH has alcohol group $-OH$.

7. Explain the mechanism of cleaning action of soaps.

Ans: The dirt (oil and grease) present on clothes is organic in nature, and insoluble in water. Hence, it cannot be removed only by washing with water. When soap is dissolved in water, its hydrophobic ends attach themselves to the dirt and remove it from the clothes. Then, the molecules of soap arrange themselves in micelle formation and trap the dirt at the centre of the cluster. These micelles remain suspended in water like particles in a colloidal solution. The various micelles present in water do not come together to form a precipitate as each micelle repels the others because of ion-ion repulsion. Thus, the dust particles remain trapped in the micelles

(which remain suspended), and are easily rinsed away by water. Hence, soap micelles remove the dirt by dissolving it in water.

8. (a) Give a chemical test to distinguish between saturated and unsaturated hydrocarbons.

(b) Name the product formed when ethanol burns in air.

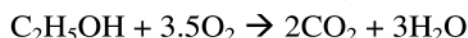
(c) Why is the reaction between methane and chlorine considered as substitution reaction?

Ans: (a) Bromine water test is used to distinguish between saturated and unsaturated hydrocarbons.

Saturated hydrocarbon + Br₂ water → No reaction

Unsaturated hydrocarbon + Br₂ water → Decolorization

(b) When ethanol is burnt in air, carbon dioxide and water are formed.



Products formed - Carbon dioxide and Water

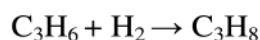
Energies involved - Heat energy and Light energy

(c) In a reaction of methane and chlorine, H is displaced by Cl. Hence, it is called substitution reaction.



9. Two carbon compounds X and Y have the molecular formula C₃H₆ and C₄H₁₀ respectively. Which one of the two is most likely to show addition reaction? Justify your answer. Also give the chemical equation to explain the process of addition reaction in this case.

Ans: C₃H₆ will show addition reaction as it is an unsaturated hydrocarbon. The C₃H₆ reacts with hydrogen in the presence of a catalyst to give ethane on adding one molecule of hydrogen across carbon-carbon bond.



Vegetable oil reacts with hydrogen in presence of Ni as a catalyst to form vegetable ghee which is a saturated compound.

10. Mrs. Anita observed that her cooking utensils are becoming black in colour and the flame of her gas stove is yellowish in colour what can be the reason for this sooty flame. How is this problem harmful for our environment? What steps should be taken to stop this process.

Ans a) The inlets for air in stove get blocked which leads to yellow flame.

b) This problem is harmful for our environment as incomplete combustion results in the formation of oxides which are major pollutants of our environment.

c) For preventing this situation gas or stove burners should be cleaned time to time.

11. You must have seen advertisements stating that some vegetable oils are healthy. Saturated fatty acids which are said to be harmful for health. Why vegetable oils are considered healthy than saturated fatty acids (ghee)? What precautions you would take in selecting cooking oil.

Ans: Vegetable oils contain unsaturated fatty acids which are healthy and decrease the cholesterol level in our blood. That is why we should use vegetable oils for cooking. Cooking oil should be with low cholesterol.

12. Give reason;

- Carbon form compounds mainly by covalent bonding?
- List any two reasons for carbon forming a very large number of compounds.
- An organic acid 'X' is a liquid which often freezes during winter time in cold countries, has the molecular formula, $C_2H_4O_2$. On warming it with ethanol in the presence of a few drops of concentrated sulphuric acid, a compound 'Y' with a sweet smell is formed.
 - Identify 'X' and 'Y'.
 - Write a chemical equation for the reaction involved.

Ans: a) Carbon has 4 electrons in its outermost shell and requires 4 more electrons to attain a noble gas electronic configuration. So, carbon achieves a noble gas electronic configuration only by sharing its 4 valence electrons with other elements. Thus, it forms compounds mainly by covalent bonds.

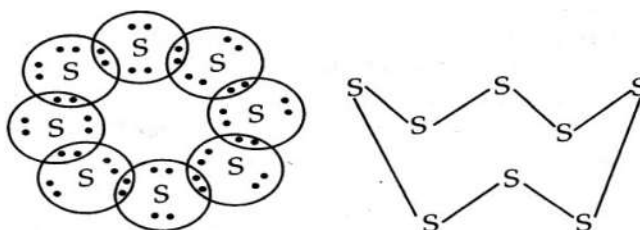
b) Catenation and tetravalency nature of carbon is the reason for the formation of a large number of compounds. The property of formation of bonds with other carbon atoms to form long chains of different compounds is called catenation. Carbon has 4 electrons in its outermost orbit so it can either gain 4 electrons or lose 4 electrons to form a bond.

c) i) X is $CH_3 - COOH$ Ethanoic Acid and Y is $C_2H_5COOCH_3$ Ethyl Acetate

ii) $CH_3COOH + C_2H_5OH \rightarrow C_2H_5COOCH_3 + H_2O$

13. Eight atoms of sulphur? What would be the electron dot structure of a molecule of sulphur which is made up of

Ans:



14. List any four differences between soaps and detergents.

Ans: Difference between soaps and detergents:

Sl.No	Soaps	Detergents
(i)	They are sodium salts of long chain fatty acids	These are sodium or potassium salts of sulphonic acids of hydrocarbons
(ii)	Soaps cannot be used with hard water	Detergents work well with hard and soft water
(iii)	They are fully biodegradable	They are non – biodegradable
(iv)	They take time to dissolve in water	They dissolve faster in water.

15. Write the four properties of ionic compounds.

Ans: 1. solids and are some what hard. 2. have high melting and boiling points. (strong attractive force between ions) 3. generally soluble in water. 4. conduct electricity only in the molten state. (movement of ions)

16. Write the electron dot structures of a) methane b) ethane c) ethene.

Ans: See page no 4, 6 & 7 of science text book part –II

17. Define Covalent bond.

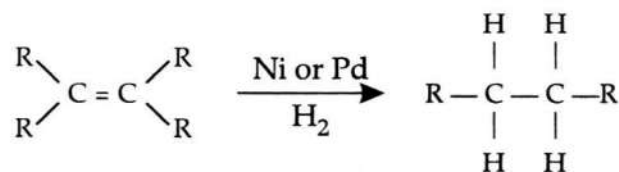
Ans : A chemical bond formed by the mutual sharing of one or more electron pairs.

18. Difference between the properties of Covalent and Ionic compounds:

Sl.No	Covalent Compounds	Ionic Compounds
(i)	They are readily soluble in organic solvent	They are not soluble in organic solvent
(ii)	They do not ionize	They ionize in organic medium
(iii)	They are bad conductor of heat and electricity	They are good conductors of heat and electricity

19. What is hydrogenation? What is its industrial application?

Ans : The process of converting unsaturated hydrocarbons into saturated hydrocarbons by passing hydrogen in the presence of palladium or nickel catalyst.



This reaction is used in the hydrogenation of vegetable oils.

20. Explain the mechanism of the cleaning action of soaps.

Ans: Cleansing Action of Soaps: A molecule of soap is made up of two parts:

- (i) an ionic part which is hydrophilic (water loving) and
- (ii) a hydrocarbon chain which is hydrophobic (water hating).

Most dirt is oily in nature and the hydrophobic end of soap attaches to dirt, while the ionic end is attracted by the water. This results in the formation of micelles. Soap molecule forms an emulsion. The cloth needs to be mechanically agitated to remove the dirt particles from the cloth.

22. What are isomers? Draw the structures of two isomers of butane (C₄H₁₀).

Ans. Organic compounds having the same molecular formula but different structural formulae, and hence, different physical and chemical properties are called isomers.

23. What is catenation?

Ans; The ability of carbon to form covalent bonds with other carbon atoms.

24. What is substitution reaction?

Ans: A chemical reaction in which hydrogen atoms in a saturated hydrocarbon are replaced by chlorine atoms one by one.

25. What is a homologous series? Give example.

Ans. A group of members of the same class of organic compounds, where successive members differ by a -CH₂ group.

Ex : a) CH₃OH, C₂H₅OH, C₃H₇OH, C₄H₉OH

b) CH₄, C₂H₆, C₃H₈, C₄H₁₀

PERIODIC CLASSIFICATION OF ELEMENTS

KEY POINTS

Need for Periodic Classification

*To make the study of these elements easy, these elements have been divided into few groups in such a way that elements in the same group have similar properties. Now study of a large number of elements is reduced to a few groups of elements.

***Dobereiner's Triads:** when elements were arranged in the order of increasing atomic masses, groups of three elements (known as triads), having similar chemical properties are obtained.

* States that "The atomic mass of the middle element of the triad was roughly the average of the atomic masses of the order two elements".

Elements	Atomic Mass
Ca	40.1
Sr	87.6
Ba	137.3

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

Li	Ca	Cl
Na	Sr	Br
K	Ba	I

*Dobereiner could identify only three triads. He was not able to prepare triads of all the known elements.

***Newlands Law of Octaves:** John Newlands arranged elements in order of increasing atomic mass. It states "when elements are arranged in increasing order of atomic mass, the properties of the eighth element are a kind of repetition of the first, just like notes of music".

***Table showing Newlands Octaves:**

Sa (do)	re (re)	ga (mi)	ma (fa)	pa (so)	dha (la)	ni (ti)
H	Li	Be	B	C	N	O
F	Na	Mg	Al	Si	P	S
Cl	K	Ca	Cr	Ti	Mn	Fe
Co & Ni	Cu	Zn	Y	In	A	Se
Br	Rb	Sr	Ce, La	Za		

Limitations of Newlands law of octaves:

1. The law was applicable to elements up to calcium (Ca) only.
2. It contained only 56 elements. Further it was assumed by Newlands that only 56 elements existed in nature and no more elements would be discovered in the future.
3. In order to fit elements into the table, Newlands adjusted two elements in the same column as F, Cl & Br which have very different properties than these elements. Iron, which resembles cobalt and nickel in properties, has been placed differently away from these elements.

Mendeleev's Periodic Table:

Dmitri Ivanovich Mendeleev, a Russian chemist, was the most important contributor to the early development of a periodic table of elements where in the elements were arranged on the basis of their atomic mass and chemical properties.

❖ Characteristics of Mendeleev's Periodic Table:

- (i) Mendeleev arranged all the 63 known elements in increasing order of their atomic masses.
- (ii) The table consists of vertical columns called 'groups' and horizontal rows called '**periods**'.
- (iii) The elements with similar physical and chemical properties came under same groups.

❖ **Mendeleev's Periodic Law:** The properties of elements are the periodic functions of their atomic masses.

❖ Merits of Mendeleev's Periodic Table

- (i) Mendeleev left some blank spaces for undiscovered elements.
- (ii) Mendeleev predicted the discovery of some elements and named them as eka-boron, eka aluminium and eka silicon.
- (iii) Noble gases discovered later could be placed without disturbing the existing order.

❖ Limitations of Mendeleev's periodic table:

- (i) **Position of Hydrogen:** Could not assign a correct position to hydrogen as hydrogen resembles alkali metals as well as halogens.
- (ii) **Position of Isotopes:** Isotopes are placed in same position though they have different atomic masses.
- (iii) Separation of chemically similar elements while dissimilar elements are placed in the same group.

***Modern Periodic Table:** Henry Moseley gave a new property of elements, 'atomic numbers' and this was adopted as the basis of Modern Periodic Table.

***Modern Periodic Law:** Properties of elements are the periodic functions of their atomic numbers.

***Position of elements in modern periodic table:**

- (i) The Modern Periodic Table consists of 18 groups and 7 periods.
- (ii) Elements present in any one group have the same number of valence electrons. Also, the number of shells increases as we go down the group.
- (iii) Elements present in any one period, contain the same number of shells. Also, with increase in atomic number by one unit on moving from left to right, the valence shell electron increases by one unit.
- (iv) Each period marks a new electronic shell getting filled.

***Trends in the Modern Periodic Table:**

- (i) **Periodicity in Properties:** The properties of elements depend upon the electronic configuration which changes along a period and down a group in the periodic table. The periodicity properties i.e. repetition of properties after a regular interval is due to similarity in electronic configuration.
- (ii) **Tendency to lose or gain electron:** Chemical reactivity of an element depends upon the ability of its atoms to donate or accept electrons.

(iii) **Variations of tendency to lose electron down the group:** Tendency to lose electron goes on increasing down the group.

Reason: It is due to the increase in the distance between the valence electrons and the nucleus as the atomic size increases down the group, the force of attraction between the nucleus and the valence electrons decreases, therefore, tendency to lose electron also increases down the group.

(iv) **Variation of tendency to lose electron along a period:** It goes on decreasing generally along a period from left to right with decrease in atomic size.

Reason: Due to decrease in the atomic size, the force of attraction between the valence electrons and the nucleus increases and, therefore, electrons cannot be removed easily.

(v) **Variation of tendency to gain electron down the group:** It goes on decreasing down the group in general. **Reason:** Due to increase in atomic size, the force of attraction between the nucleus and the electron to be added becomes less.

(vi) **Variation of tendency to gain electron along a period:** It increases left to right in a period.

Reason: It is due to decrease in the atomic size which leads to an increase in the force of attraction between the nucleus and the electron to be added.

***Metallic and non-metallic character:** Groups 1 to 12 are metals. Groups 13 to 18 comprises non-metals, metalloids and metals.

***Properties of Metals:**

- (i) They are malleable.
- (ii) They are ductile.
- (iii) They are good conductors of heat and electricity.
- (iv) They have generally 1 to 3 valence electrons.
- (v) They have the same or less number of electrons in their outermost shell than the number of shells.
- (vi) They are mostly solids.

***Properties of Non-metals:**

- (i) They exist in solid, liquid or gaseous state.
- (ii) Non-metals are generally brittle.
- (iii) They are non-conductors.
- (iv) They have 4 to 8 valence electrons.

Know the Terms

***Mendeleev's Periodic Law:** This law states that the properties of elements are the periodic function of their atomic masses.

*Anomalies in arrangement of elements based on increasing atomic mass could be removed when the elements were arranged in order of increasing atomic number, a fundamental property of the element discovered by Moseley in 1913.

***Modern Periodic Law:** According to this law, the properties of elements are periodic function of their atomic number.

*The 18 vertical columns in modern periodic table are known as groups whereas 7 horizontal rows in modern periodic table are called **periods**.

***Periodicity:** When the elements are arranged in order of increasing atomic numbers, elements

with similar chemical properties are repeated at definite intervals. This is known as **periodicity**.

***Atomic Radius:** Atomic radius is defined as the distance from the centre of the nucleus of an atom to the outermost shell of electrons.

***Covalent Radii:** It is defined as half of the distance between the centre of nuclei of two atoms (bond length) bonded by a single covalent bond e.g., bond length in case of H—H is 74 pm.

Covalent radius: $\frac{1}{2} \times 74 = 37$ pm

It can be measured in case of diatomic molecules of non-metals.

***Metallic Radii:** It is defined as half of the internuclear distance between the two metal ions in a metallic crystal.

***Metalloids:** Those elements which resemble both metals and non-metals are called metalloids. They are also called semi-metals. Eg., Boron, Silicon, Germanium, Arsenic, Antimony, Tellurium and Polonium.

***Isotopes:** Elements which have same atomic number but different mass number are called isotopes.

Ex; Chlorine isotopes are $_{17}\text{Cl}^{35.5}$ and $_{17}\text{Cl}^{37.5}$ and Hydrogen isotopes are ${}_1\text{H}^1$, ${}_1\text{H}^2$ and ${}_1\text{H}^3$.

Table: Trends in the modern periodic table.

	Periodic trends	Move from left to right in the periodic table →	Move from top bottom in the ↓ group of periodic table.
1	Atomic size	Decreases	increases
2	Ionization energy	Increases	Decreases
3	Metallic property	Decreases	Increases
4	Electro positivity	Decreases	Increases
5	Electronegativity	Increases	Decreases

Important questions and answers

1. Name: (a) Three elements that have a single electron in their outermost shells.

(b) Two elements that have two electrons in their outermost shells.

(c) Three elements with filled outermost shells.

Ans. (a) Li, (2, 1), Na, (2, 8, 1) and K (2, 8, 8, 1)

(b) Be, (2, 2) and Mg (2, 8, 2)

(c) He, (2), Ne, (2, 8) and Ar (2, 8, 8)

2. Mendeleev predicted the existence of two elements and named them as eka-silicon and eka-aluminium. Identify the elements which took their position at later stage

(a) Si and Ge

(b) Si and Ga

(c) Ge and Ga

(d) Si and Al

Ans: (c) Ge and Ga

3. An element 'X' is placed in group 13 and third period of the Periodic Table. It burns in oxygen to form an oxide which is amphoteric in nature. Identify the chemical formula of its chloride

(a) CCl_4

(b) BCl_2

(c) GaCl_3

(d) AlCl_3

Ans: (d) AlCl_3

4. The element with atomic number 3 to 10 belongs to the second period. Identify the most electropositive and most electronegative element.

- (a) F, Li (b) Li, F (c) Li, Ne (d) Ne, Li

Ans: (b) Li, F

5. An element X (2, 8, 2) combines separately with $(\text{SO}_4)^{2-}$ and $(\text{PO}_4)^{3-}$ radicals. The chemical formulae of the compounds are

- (a) $\text{X}_2\text{SO}_4 : \text{X}_3(\text{PO}_4)_2$ (b) $\text{XSO}_4 : \text{X}_3(\text{PO}_4)_2$ (c) $\text{X}(\text{SO}_4)_2 : \text{X}_2(\text{PO}_4)_3$ (d) $\text{XSO}_4 : \text{X}_3(\text{PO}_4)_3$

Ans: (b) $\text{XSO}_4 : \text{X}_3(\text{PO}_4)_2$

6. Two elements X and Y belong to group 1 and 2 respectively in the same period. The formulae of these oxides are,

- (a) XO, YO (b) X_2O , YO (c) X_2O , Y_2O (d) XO, YO_2

Ans: (b) X_2O , YO

7. An element 'X' belongs to II group and 2nd period. Write the atomic number and name of element.

Ans. K L 2, 2 \therefore Atomic Number = 4, Element = Beryllium

8. An element 'A' has atomic number 11, name the period and group number to which it belongs.

Ans. 'A' — atomic number = 11, Electronic configuration = K L M, 2, 8, 1

\therefore Period number = Shell No. = 3 Group number = Valence electron = 1

9. An element 'X' belongs to Group I and 3rd period.

- (i) Give its electronic configurations. (ii) Formula when it combines with oxygen.

- (iii) Formula when it combines with hydrogen. (iv) State its nature. v) Give its valency.

Ans: Name of the element is Sodium. i) 2, 8 1 ii) Na_2O , iii) NaH, iv) Alkaline metal, v) 1

10. An element belongs to 3rd period and 17th group of the Periodic Table, find out

- (i) The electronic configuration of element on its left side and right side.

- (ii) Its valence electrons. (iii) Its size with in comparison with its neighbouring elements.

Ans: An element to 3rd period and 17th group of the periodic table is Chlorine

- (i) The electronic configuration of elements on its left and right.

Left- 2,8,6 Sulphur & Right-2,8,8 Argon.

- (ii) It has 7 Valence electrons.

- (iii). Being on the right side of the periodic table its size is small and it is non metal.

11. An element X from group I combine with an element Y from group 17 to form a compound. Both X and Y belong to II period. (a) Give the formula of the compound formed.

- (b) Will the compound be ionic or covalent? (c) Give its electron dot structure.

Ans: Given X (Group 1) & (Period 2) so X is lithium (Li) Y(Group 17)& (Period 2) so Y is Fluorine(F).

- (a) So the formula of the compound formed by X & Y is LiF

- (b)The compound LiF is ionic because Fluorine (F) is electronegative and we know that when a electronegative atom present the compound is ionic.

- (c)Here is the electron dot structure of the LiF compound \longrightarrow

12. An element has electronic configuration. 2, 8, 7
 (i) What type of ion will it form? (ii) Name the unit to measure its atomic radius.
 (iii) Give the electronic configuration of an element that lies above this element.
 (iv) Give the electronic configuration of an element that belongs to 4th period but in 17th group.
Ans: i) Anion ii) angstrom (\AA) iii) 2, 2, 5 iv) 2, 8, 18, 7

13. Identify the following elements:

- (a) Element with 4 valence electrons in L shell. (b) Element with 2 valence K shell.
 (c) Element with 7 valence electrons in M shell. (d) Element with 1 valence electron in K shell.
Ans: a) Carbon b) Helium (Zero Valency) c) Chlorine d) Sodium

14. The atomic number of element X is 17. Predict its

- (a) Physical state. (b) Name of element. (c) Formulae of its compound with hydrogen.
 (d) Metal or Non-metal. (e) Formulae of its molecule.

Ans. Atomic number of X = 17. Electronic configuration = 2, 8, 7

- (a) Physical state \rightarrow Gas (b) Chlorine (c) HCl (d) Non-metal (e) Cl_2

15. An element 'X' belongs to II group & 2nd period. Write the atomic no. and name of element.

Ans: Beryllium, Atomic No. 4,

16. An element 'Y' belongs to group 2 & period 3. State the nature of oxide & type of element.

Ans: Basic oxide (Metallic oxide) and Magnesium-Metal

17. A part of the periodic table has been shown below.

Group \rightarrow Period \downarrow	1	2	13	14	15	16	17	18
1		C						
2	A						E	G
3	B			D			F	

Answer the following questions on the basis of position of elements in the above table.

- (i) Which element is a noble gas? Give reason.
 (ii) Which element is most electronegative? Give reason.
 (iii) Write the electronic configuration of (a) B and (b) E.

Ans: i. G is a noble gas, because it is present in group 18 and has zero valency.

ii. E is the most electronegative element due to its smallest atomic size and large tendency to gain electrons.

iii. (a) Electronic configuration of B = $1s^2 2s^2 2p^6 3s^1$

(b) Electronic configuration of E = $1s^2 2s^2 2p^6 3s^2 3p^5$

18. Write the formulae of chlorides of Eka-silicon and Eka-aluminium, the element predicted by Mendeleev.

Ans: Eka-silicon is germanium (Ge). It lies in group 4 of Mendeleev's periodic table and thus, has a valency of 4.

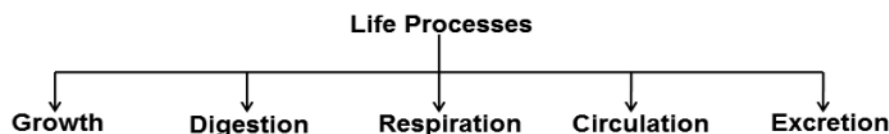
\therefore The formula of its chloride is GeCl_4 .

Eka-aluminium is gallium (Ga). It lies in group 3 of Mendeleev's periodic table and thus, has a valency of 3 \therefore The formula of its chloride is GaCl_3 .

LIFE PROCESSES

KEY POINTS

*All living things perform certain life processes like growth, excretion, respiration, circulation etc. All the processes like respiration, digestion, which together keep the living organisms alive and perform the job of body maintenance are called life processes.



*Human heart has 4 chambers –2 atria (right and left) and 2 ventricles (right and left).

Right half of the heart receives deoxygenated blood where as the left half receives oxygenated blood.

*Arteries carry blood from heart to different parts of the body whereas veins deliver the blood back to the heart. Arteries are connected to veins by thin capillaries, where materials are exchanged between blood and cells.

*Blood platelets are essential for clotting of blood at the place of injury and thus preventing blood loss.

*Lymphatic system consists of lymph, lymph nodes, lymphatic capillaries and lymph vessels which drain into larger veins. Lymph is also important in the process of transportation.

Double circulation

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

***Pulmonary Circulation:** Blood moves from the heart to the lungs and back to the heart.

***Systemic Circulation:** Blood moves from the heart to rest of the body and back to the heart

Blood Vessels (Differences between arteries and veins)

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

Transportation in plants

There are two main conducting pathways in plant.

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

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

*During excretion, the harmful metabolic nitrogenous wastes generated is removed from the body.

*Nephrons are the basic filtration units of kidneys. They carry out filtration, selective reabsorption and tubular secretion to form urine in kidney, which is then passed out through the urethra, via the ureters and urinary bladder.

Formation of Urine

*Each kidney contains many filtration units called as **nephrons**.

*Nephrons are made up of a cluster of thin walled capillaries called as glomerulus which is associated with a cup like structure called as Bowman's capsule and the long tube which terminates through this capsule.

*The renal artery brings oxygenated blood to the kidneys along with the nitrogenous wastes like urea and uric acid and many other substances.

*The blood gets filtered through the glomerulus and this filtrate enters the tubular part of nephron.

*As this filtrate moves down the tubular part, glucose, amino acids, salts and excess of water gets selectively reabsorbed by the blood vessels surrounding tubules.

*The amount of water reabsorbed depends upon:

- ✓ How much excess of water is there in the body and
- ✓ How much nitrogenous wastes need to be excreted out.

*So the fluid now flowing in the tubular part is urine which gets collected in collecting ducts of nephrons.

*These collecting ducts together leave the kidney at a common point by forming the ureter.

*Each ureter drains the urine in the urinary bladder where it is stored until the pressure of expanded bladder leads to an urge to pass it out through urethra.

*This bladder is a muscular structure which is under nervous control.

*180 litres of filtrate is formed daily but only 2 litres is excreted out as urine so the rest is reabsorbed in the body.

Know the Terms

***Transportation:** It is the movement of materials from one part to another, usually from the region of their availability to the region of their use, storage or elimination.

***Circulatory System:** It is a system of organs, tubes and a blood-like fluid that circulates various materials inside the body.

***Haemolysis:** It is the process of destruction of RBC's.

***Serum:** It is a whitish water fluid that is squeezed out from contracting blood clot.

***Diapedesis:** It is the crawling of white blood corpuscles out of blood capillaries into surrounding tissues.

***Pulse:** It is a repeated throb(vibrate) felt in a superficial artery of the body due to forceful pumping of the blood.

***Translocation:** It is the movement of materials in solution form within an organism especially in phloem of plants.

***Transpiration:** It is the loss of water in vapour form from the exposed parts of a plant.

***Ascent of Sap:** It is the upward movement of absorbed water or sap from root to the top of the plant.

***Excretion:** It is the process of throwing out of waste products and other harmful chemicals from the body.

***Nephric Filtrate:** It is the fluid passed out of glomerulus due to ultrafiltration in the Malpighian capsule of a nephron.

***Ultra filtration:** It is the filtration under pressure of small particles, solutes and solvents, through a finely porous membrane.

***Glomerulus:** It is a bunch of fine blood vessels or capillaries present in the depression of Bowman's capsule where ultrafiltration occurs.

***Bowman's Capsule:** It is a broad, blind cup-shaped, proximal end of a nephron in which glomerulus is located for ultra filtration.

***Osmoregulation:** It is the maintenance of a fixed osmotic concentration of body fluids by controlling the amount of water and salts.

Important questions and answers

1. What would be the consequences of deficiency of hemoglobin in your body?

Ans: The deficiency of hemoglobin in our body is called anemia. In anemia, the blood is unable to carry the sufficient amount of oxygen required by the body. So, respiration would be less and less energy will be available to the body. The hemoglobin deficient person will feel weak, pale, and lethargic and will be unable to perform heavy physical work.

2. Rahul wants to build up his body very quickly without following right exercise regime and balanced diet. Instead he started eating readymade food supplement.

i. In your opinion was the step taken by Rahul is right. Justify your answer.

ii. What are the harmful effects of taking artificial health supplement without consulting a physician.

Ans: i. No the steps taken by Rahul was not right.

ii. It can lead to addiction and can affect the health adversely.

3. Meena who is studying in Class-X gets tired very soon and her skin colour is turning pale, her hemoglobin content in the blood is also low she is really confused about this situation.

i. Which disease is she suffering from?

ii. What kind of diet should she take to overcome this problem?

Ans: i. Meena is suffering from Anemia.

ii. She should take fruits and vegetables (Spinach) which is rich in iron. Iron is an essential component of hemoglobin and is required for its proper functioning.

4. Why is it necessary to separate oxygenated & deoxygenated blood in mammals & birds?

Ans. The mammals and birds are warm-blooded animals which have high energy needs because they constantly require energy to maintain their body temperature. It is necessary to separate oxygenated blood and deoxygenated blood in mammals and birds because such a separation allows a highly efficient supply of oxygen to the body cells which is required for producing a lot of energy needed by them.

5. Write the important components and their functions of blood.

Ans: The components of blood are

- i) **Plasma** : It helps in the transport of nutrients, salt waste materials,. Hormones and antibodies.
- ii) **Red blood corpuscles** : helps in the transportation of oxygen and carbon dioxide.
- iii) **White blood corpuscles** : helps in protection by destroying disease causing micro organisms
- iv) **Blood platelets** : helps in the synthesis of thromboplastic for the clotting of blood.

6. Describe double circulation in human beings, Why is it necessary?

Ans: The human heart consists of two sides: right and left. The right side of the heart receives deoxygenated blood and sends it further for purification to lungs. The left side of heart receives oxygenated blood from the lungs which is pumped further and sent to all the parts of the body through blood vessels. This is called double circulation. The energy demands for human beings is too large and hence it is necessary for the separation of oxygenated and deoxygenated blood to meet this energy demand.

7. What are the consequences of deficiency of haemoglobin in our bodies?

Ans: The deficiency of haemoglobin causes anaemia. The symptoms of anaemia are breathlessness, tiredness pale skin, palpitations and poor resistance to infection.

8. What are the differences between the transport of materials in xylem and phloem?

Ans: (a) Xylem: It transports water and mineral and it involves upward movement (Unidirectional).

(b) Phloem: It transports food and hormones and it involves upward and downward movements (bidirectional).

9. List any four strategies used by the plants for excretion.

Ans: Strategies used by plants for excretion are:

- ✓ Many plant waste products are stored in cellular vacuoles.
- ✓ Waste products may be stored in leaves that fall off.
- ✓ Waste products are stored as resin and gums, especially in old xylem.
- ✓ They can get rid of excess water and oxygen through stomata.

10. Plants absorb water from the soil. Explain how does the water reach the tree top?

Ans: Xylem (vessels) of roots, stems and leaves are inter connected to form a continuous column. Roots also take up mineral salts actively, water moves in and as a result, it creates pressure which pushes the water up. Transpiration pull creates a suction force pulling up water.

11. (i) Draw a diagram of an excretory unit of a human kidney and label the following: Bowman's capsule, Glomerulus, Collecting duct, Renal artery.

(ii) Write the important function of the structural and functional unit of kidney.

(iii) Write any one function of an Artificial Kidney.

Ans: (I) Draw a nephron diagram

(ii) Function of nephron is filtration, reabsorption and secretion.

(iii) Function of Artificial Kidney: Helps to remove harmful wastes, extra salts and water, control blood pressure. Maintain the balance of sodium potassium salts in a patient whose kidneys have failed).

12. Define transpiration.

Ans: Loss of water in the form of vapour from the aerial parts of the plant.

13. How are water and minerals transported in plants?

Ans: In xylem tissue, vessels and tracheids of the roots, stems and leaves are interconnected to form a continuous system of water-conducting channels reaching all parts of the plant. At the roots, cells in contact with the soil actively take up ions. This creates a difference in the concentration of these ions between the root and the soil. Water, therefore, moves into the root from the soil to eliminate this difference. Evaporation of water molecules from the cells of a leaf creates a suction which pulls water from the xylem cells of roots.

14. How is food transported in plants?

Ans: Transport of soluble products of photosynthesis is called translocation. Phloem transports food materials from the leaves to different parts of the plant body. The transportation of food in phloem is achieved by utilizing energy from ATP. The translocation of food and other substances takes place in the sieve tubes with the help of adjacent companion cells both in upward and downward directions.

15. What are the methods used by plants to get rid of excretory products?

Ans: (i) Plants get rid of excess of water by transpiration.
 (ii) Waste products are stored in cellular vacuoles.
 (iii) Waste products may be stored in leaves that fall off.
 (iv) Resins and gums are stored in old xylem.
 (v) some waste substances excreted into the soil from roots.

16. What is double circulation? What are its importances?

Ans: Blood goes through the heart twice during each cycle. Importance-

- (i) keeps the oxygenated blood separated from de-oxygenated blood.
- (ii) allows more efficient supply of oxygen to the body cells.

17. What is 'translocation' in plants?

Ans: Transport of soluble products of photosynthesis.

18. a) What is lymph?

b) How is composition of lymph different from blood plasma?

c) List two functions of lymphatic system.

Ans: a) Lymph is a tissue fluid, that contain plasma, proteins and blood cells which escapes into intercellular spaces.

b) Lymph is colourless and contains less protein than plasma.

c) Functions: i) Carries digested food

(i) Drains excess fluid from extracellular space back into the blood.

19. Differentiate between an artery and a vein.

Artery	Vein
Carries blood away from the heart	Carries the blood to the heart
Thick walled	Thin walled
Valves are absent	Valves are present

CONTROL & CO-ORDINATION

KEY POINTS

- *All the living organisms respond and react to changes in the environment around them.
- *The changes in the environment to which the organisms respond and react are called stimuli such as light, heat, cold, smell, touch etc.
- *Both plants and animals respond to stimuli but in a different manner.

CONTROL AND COORDINATION IN ANIMALS

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

- (a) Nervous system
- (b) Endocrine system

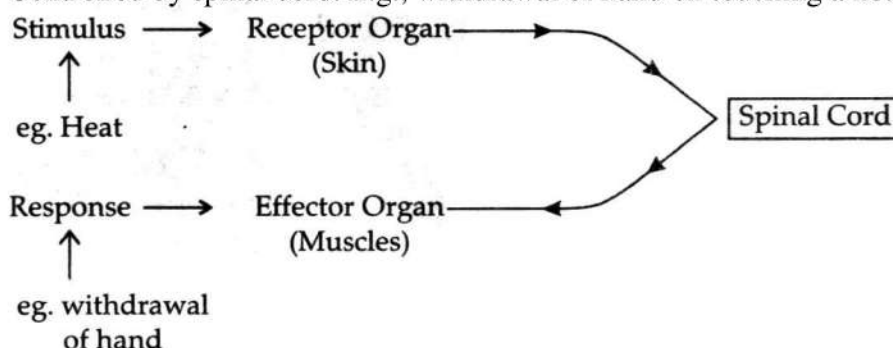
NERVOUS SYSTEM

- *Control and coordination are provided by nervous and muscular tissues.
- *Nervous tissue is made up of an organized network of nerve cells or neurons, and it specialized for conduction information via electrical impulses from one part of the body to another.
- ***Nervous system** is the system of conducting tissues that receives the stimulus and transmits it to other parts of the body forming a network of nerves.
- *The units which make up the nervous system are called nerve cells or neurons.
- *The **receptors** pass the information to the brain through a type of nerve cells called sensory neurons.
- ***Motor neurons** transmit the information from the brain to the effector organs, mainly muscles and glands.
- ***Nerve Impulse:** It is the information in the form of chemical and electrical signals passing through neurons. These impulses are carried by dendrites towards the cell body.
- ***Neuromuscular Junction:** It is the point where a muscle fibre comes in contact with a motor neuron carrying nerve impulses from the central nervous system. The impulses travel from the neuron to the muscle fibres by means of neurotransmitter in the same way as the transmission of impulses across a synapse between two neurons.
- ***Voluntary Action:** These are the actions which need thinking and are performed knowingly i.e. these are controlled by conscious thought.
Example: Speaking to a friend, writing a letter etc.
- ***Involuntary Action:** These are not under the control of the will of an individual and are automatic response to a stimulus which is not under the voluntary control of the brain. *Example:* Touching a hot plate unknowingly.

Reflex Action

- *Reflex action is quick, sudden and immediate response of the body to a stimulus.
E.g., Knee jerk, withdrawal of hand on touching hot object, etc.
- ***Reflex arc:** The pathway through which nerve impulse pass during reflex action is called reflex arc.
- ***Response:** Responses are of three main types:
 - a) Voluntary: Controlled by fore brain. E.g., talking, writing.
 - b) Involuntary: Controlled by mid and hind brain. E.g., heartbeat, vomiting, respiration.

c) Reflex action: Controlled by spinal cord. E.g., withdrawal of hand on touching a hot object.

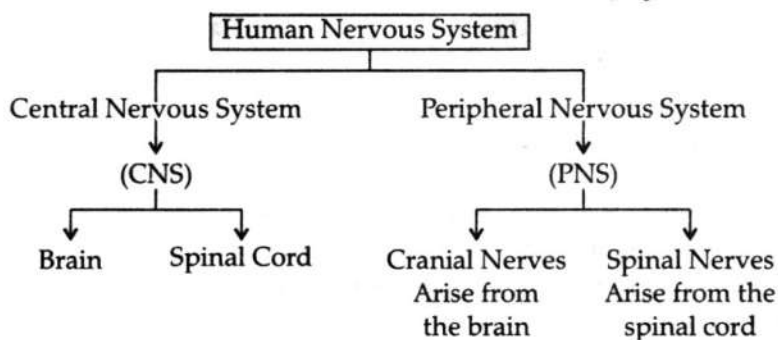


***Need of Reflex Actions:** In some situations such as touching a hot object, pinching etc. we need to act quickly; otherwise our body would be harmed. Here response is generated from spinal cord instead of brain.

HUMAN BRAIN

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

(a) Fore-brain [procencephalon] (b) Mid-brain [mesencephalon] (c) Hind-brain [rhombencephalon]



(a) **Fore-brain:** It is the most complex or specialized part of the brain. It consists of cerebrum and diencephalon. 1) cerebrum 2) Diencephalon

Functions:

1. Thinking part of the brain.
2. Control the voluntary actions.
3. Store information (Memory).
4. Receives sensory impulses from various parts of the body and integrates it.
5. Centre associated with hunger.

(b) **Mid-brain:** Controls involuntary actions, such as: vision, hearing, motor control, sleep, temperature regulation, etc.

(c) **Hind-brain:** It has three parts:

- i) Cerebellum:** Controls posture & balance. Precision of voluntary actions e.g., picking pen.
- ii) Medulla:** Controls involuntary actions e.g., blood pressure, salivation, vomiting.
- iii) Pons:** Involuntary actions, regulation of respiration.

*Autonomic Nervous System means 'Self governing nervous system', consists of a pair of chains of nerves and ganglia found on both sides of the vertebral column.

*Spinal cord is a cylindrical structure and a part of the central nervous system. It is made up of nerves which supply information to think.

***Plant Movements:** The movements of the individual plant parts or organs of a plant like shoot, root etc. are due to some external stimuli like light, force of gravity, chemical substance, water etc.

***Tropic Movement:** It is the directional growth or movement of a plant organ in response to an external stimulus. Growth towards the stimulus is positive tropism and growth away from the stimulus is negative tropism.

***Hormones** are the chemical substances which co-ordinate and control the activities of living organisms and also their growth.

I. Plant Hormones are chemical compounds which help to coordinate growth, development and responses to the environment. Main plant hormones are Auxins, Gibberellin, Cytokinins and Abscissic acid.

Functions of Plant Hormones:

Auxins: It helps in the elongation of cells.

It helps in the bending of stem towards light source.

Gibberellins: It helps in the growth of the stem and flower

Cytokinins: It promotes cell division

It helps in rapid cell division in fruits & seeds.

It helps in opening of stomata during day time

Abscissic acid: It inhibits the growth of plant.

It is responsible for wilting of leaves

It helps in the closing of stomata during night.

Know the following terms:

- 1) Phototropism 2) Geotropism 3) Hydrotropism 4) Chemotropism

1) **Phototropism:** The movement of plant parts in response to light is called phototropic movement. The phenomenon is called phototropism.

Ex : The shoot grows towards the light, while the growth of root is away from the light.

2) **Geotropism:** The movement of plant parts in response to gravity is called geotropic movement. The phenomenon is called geotropism.

Ex : Root always move towards the centre of gravity, while shoots usually grow away from the gravity.

3) **Hydrotropism:** The growth of the plant in response to water is called hydrotropic movement. The phenomenon is called hydrotropism;

4) **Chemotropism :**

The growth of plant in response to chemical stimulus is called chemotropic movement. This phenomenon is called chemotropism.

Ex : Growth of pollen tube towards ovules during fertilization

II. Animal Hormones

Endocrine Gland, Hormones and their Functions

No.	Gland	Hormones	Functions	Target Site
1.	Hypothalamus	(i) Releasing hormones(RH) (ii) Inhibiting hormones	Regulates secretion of pituitary hormones.	Pituitary gland
2.	Pituitary Gland	Pituitary hormone (Growth hormone)	Controls growth –Dwarfism (due to under secretion) & Gigantism(due to over secretion)	Most tissues
3.	Thyroid Gland	(i) Thyroxin	Regulate carbohydrate, protein and fat metabolism, Provide best balance for growth.	Body tissues
4.	Adrenal Gland	(i) Adrenaline	Helps to deal with scary situation. Increase heart beat rate,supply more oxygen to our muscles, contraction of muscles around arteries , increases breathing rate.	Body tissues
5.	Pancreas	(i) Insulin	Helps in Regulating glucose level in blood Converts excess of glucose to glycogen.	Tissues
		(ii) Glucagon	Maintains, glucose levels, stimulates gluconeogenesis. Release of sugar from liver.	
6.	Testis	(i) Testosterone (ii) Androgens	Develops male reproduction organs & accessory sexual characters. Influence male sexual behaviour.	Male body tissues
7.	Ovary	(i) Estrogen	Develops female reproductive organs, accessory sexual characters & female secondary behaviour.	Female body tissues
		(ii) Progesterone	Support pregnancy, stimulates milk secretion.	

Important questions and answers

1. What is the name of the neuron which remains between the sensory neuron and the motor neuron? Where is it located?

Ans: Relay neuron and located in spinal cord.

2. Mayank's father never bothered to check the brand/contents of the salt he had purchased from the market. Mayank noticed that her sister had developed swollen neck. The doctor advised her to eat iodized salt.

i. Name the disease from which Mayank's sister suffered.

ii. Why the doctor has advised her to eat Iodized Salt?

Ans: i. Goiter/Thyroid related disease.

ii. Iodine present in iodized salt is needed to produce thyroxin hormone.

3. Injections are given to the cattle for the production of milk.

- i. Do you think it is a right practice?
- ii. What harm is this practice causing us?

Ans: i. No.

- ii. Intake of such contaminated milk may cause various health disorders.

4. Often the road accidents victims faced really a tough time due to the shortage of blood in the hospital. Give suggestion to avoid shortage of blood in the blood bank.

Ans: a). Spread awareness that blood donation is a healthy social habit.

b). Sensitizing and encouraging the people with the help of Nukkad, Natak, Media etc. to participate in blood donation camp.

5. A person is taking the insulin injection every day.

i. Name the disease he is suffering from. ii. How does healthy life style help this patient to control this disease?

Ans: i. Diabetes (Type-II)

ii. Regular exercise, taking Balanced diet avoid sweet food (carbohydrates) item, cola etc.

6. Most of students suffer from exam stress and anxiety during exam days.

Suggest three good habits which students should adopt to tackle this problem.

Ans. Good habits to beat the exam stress:

- a. Regular study hours.
- b. Taking balanced /light diet.
- c.. Exercise /walk with good speed in the morning /evening.
- d. Regular breaks.

7. Generally some of teenagers readily come under bad influences under peer group pressure. Why does a teenager readily come under this influence? Suggest methods to overcome such problems.

Ans: a) Proper counseling of teenagers should be arranged from the counselor.

b) Healthy communication with parents.

c) Teenagers should be properly motivated to set realistic goals.

8. Rahul got a bike on his 18th Birthday from his parents. His father instructed him always to wear helmet while driving. He reluctantly obeys him but does not tie the straps of Helmet properly.

i. According to you, what danger Rahul can face in future while he is driving his bike.

ii. Which vital organ/organs gets protection by wearing the helmet while driving the two wheelers?

Ans. i. He may get head injury that may even prove fatal to him. ii. Brain, Eye.

9. Which hormone: a) prepares the body for action?

b) controls the amount of sugar (glucose) in blood?

c) brings about changes in boys at puberty?

d) brings about changes in girls at puberty?

Ans. a) Adrenaline b) Insulin c) Testosterone d) Oestrogen

10. i) Name the hormone produced by thyroid gland.

ii) Which mineral is necessary for the synthesis of the above hormone?

iii) Name the disease suffer from the deficiency of this mineral.

iv) Write the function of the above hormones?

Ans: i) Thyroxine

ii) Iodine

iii) Goiter

iv) Thyroxine is the main hormone secreted into the bloodstream by the thyroid gland. Thyroid hormones play vital roles in regulating the body's metabolic rate, heart and digestive functions, muscle control, brain development and maintenance of bones.

11. Name a female sex organ which produces gametes as well as female hormone.

Ans: Ovary

12. Which system of our body is made of organized network for conducting information in the body?

Ans: Nervous system

13. Which part of the neuron receives information?

Ans: Dendrites

14. What are two major types of muscles we have?

Ans: skeletal or striated and smooth muscles.

15. Which part of the brain helps us to do activities like riding cycle & walking in a straight line?

Ans: Cerebellum

16. Explain how the time and amount of secretion of this hormone is regulated in human system.

Ans: a) He is suffering from diabetes. Deficiency of insulin causes diabetes.

b) Pancreas secretes insulin. Insulin helps in regulating blood sugar.

c) When the sugar level in blood increases, it is detected by the beta-cells of the pancreas which responds by producing more insulin. As the blood sugar level falls, insulin secretion is reduced.

17. Differentiate between reflex action and waling.

Ans:

Reflex action	Walking
1) It is involuntary action	1) It is voluntary action
2) It is sudden and fast taking place in response to action	2) It is not spontaneous. It is a conscious effort
3) It is controlled by spinal card	3) It is controlled by brain
4) The connection between the neurons and spinal cord muscles forms the reflex arc form reflex action to take place	4) There is no reflex arc for it.

18. Why are some patients of diabetes treated by giving injections of insulin?

Ans: Patients of diabetes are given insulin injection to control the blood glucose level, because their pancreas cannot /does not produce the required amount of insulin in the body.

19. Why the use of iodized salt is advisable?

Ans: Iodine is required for the production of thyroxin hormone. Iodine is available in iodised salt.

- ✓When iodized salt used in diet /food, supplies the required amount to the body for maintenance and thyroxin formation.
- ✓The deficiency of iodine in diet leads to goiter.(a disorder of thyroid gland) and also development of brain is affected in developing babies. So used of iodized salt is advisable.

20. How does our body respond when adrenaline is secreted into the blood?

Ans: It speeds up the heartbeat and hence supplies more oxygen to the muscles. The breathing rate also increases due to contractions of diaphragm and rib muscles.

21. What is the role of the brain in reflex action?

- ✓Reflex action is an involuntary action i.e., an action that does not need a thought / thinking or will to control it. It is spontaneous and controlled by spinal cord.
- ✓Therefore brain does not play any role in it.

22. How are involuntary actions and reflex actions different from each other?

Involuntary actions	Reflex actions
i. cannot be consciously controlled.	i. are sudden, unconscious automatic response to some change in an environment.
ii. directly under the control of the brain.	ii. controlled by spinal cord.
iii. Takes place slowly.	iii. Takes place very rapidly

23. Name different type of tropisms exhibited by the plants and write their meaning.

Ans: A tropism is a growth toward or away from a stimulus.

Phototropism - the directional growth of an organism in response to light(controlled by auxin)

Thigmotropism - plant growth in response to touch or contact with a solid object.

Geotropism - growth in response to gravity.

Hydrotropism - directional growth in response to water.

chemotropism - growth in response to chemicals.

24. Write the functions of, a) Forebrain b)Cerebellum c) Mid brain d)Medulla

Ans: a) Forebrain :- * Control the voluntary actions.

* Stores information collected from sense organs (Memory)

* Receives sensory impulses from various body parts and integrates it.

* Sensation of hunger.

b)Cerebellum: - 1.Controls posture and balance 2.Control precision of voluntary actions

c) Mid brain : Controls involuntary activities.-

d)Medulla : Controls involuntary actions eg. blood pressure, salivation, vomiting

HOW DO ORGANISMS REPRODUCE ?

KEY POINTS

***Reproduction** is the process by which living organisms produce new individuals similar to themselves. It ensures continuity of life on earth.

*Nucleus of the cell contains DNA (Deoxyribose Nucleic Acid) which is the heredity material

*DNA replicates and forms new cells causing variation. So, these new cells will be similar but may not be identical to original cell.

*Variations are useful for the survival of the individual and species over time as well as basis for evolution.

Types of Reproduction

a) Asexual Reproduction

b) Sexual Reproduction

*Two individuals i.e., one male and one female are needed to give rise to new individual.

*Gametes are formed.

*New individual is genetically similar but not identical to parents.

*It is useful to generate more variations in species.

*Adopted by higher organisms

Sexual reproduction in flowering plants

It takes place in the plants **angiosperms**. The gametes are produced within the flowers and the ovules are enclosed in a carpel.

*The flowers are usually bisexual i.e., male and female reproductive parts are present in the same plant. The main parts of a flower are: sepals, petals, stamens and carpel.

*Stamens and carpels are the reproductive parts of a flower which contain the germ cells. The male organ of a flower called 'stamen' makes the male gamete which are present in the pollen grain. The female organ of a flower calls 'carpel' or 'pistil' makes the female gamete, which is present in ovules of the plant.

***Pollination** is the transfer of pollen grain from the anther of a stamen to the stigma of a carpel. Pollination is of two types: Self pollination and Cross pollination.

***Embryo:** It is the stage of development between the zygote or fertilized egg and the newly formed offspring

Reproduction in Human Beings:

*Humans use sexual mode of reproduction.

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

Changes at Puberty

1) Common in male and female

*Thick hair growth in armpits and genital area.

*Skin becomes oily, may result in pimples.

2) In girls

*Breast size begin to increase.

*Girls begin to menstruate.

3) In boys

*Thick hair growth on face.

*Voice begin to crack.

These changes signal that sexual maturity is taking place.

Male Reproductive System

1) **Testes:** A pair of testes are located inside scrotum which is present outside the abdominal cavity. Scrotum has a relatively lower temperature needed for the production of sperms.

*Male germ cell i.e., sperms are formed here.

*Testes release male sex hormone (testosterone). Its function is:

- Regulate production of sperms.
- Bring changes at puberty.

2) **Vas deferens:** It passes sperms from testes up to urethra.

3) **Urethra:** It is a common passage for both sperms and urine. Its outer covering is called penis

4) **Associated glands:** Seminal vesicles and prostate gland add their secretion to the sperms. This fluid provides nourishment to sperms and makes their transport easy. Sperm along with secretion of glands form semen.

Female Reproductive System

(a) **Ovary:** A pair of ovary is located in both sides of abdomen.

*Female germ cells i.e., eggs are produced here.

*At the time of birth of a girl, thousands of immature eggs are present in the ovary.

*At the onset of puberty, some of these eggs start maturing.

(b) Oviduct or Fallopian tube

*Receives the egg produced by the ovary and transfer it to the uterus.

*Fertilisation i.e., fusion of gametes takes place here.

(c) **Uterus:** It is a bag-like structure where development of the baby takes place.

*Uterus opens into vagina through cervix.

*The embryo moves down to reach the uterus. The embedding of the embryo in the thick inner lining of the uterus is called **implantation**.

*The time period from the development of foetus inside the uterus till birth is called **gestation period**. The act of giving birth to the fully developed foetus at the end of gestation period is termed as **parturition**.

*The breakdown and removal of the inner, thick and soft lining of the uterus along with its blood vessels in the form of vaginal bleeding is called **menstrual flow** or **menstruation**.

*Reproductive health is all those aspects of general health which help a person to lead a normal, safe and satisfying reproductive life.

***Sexually Transmitted Diseases (STDs)** are the diseases which are spread by sexual contact from an infected person to a healthy person. Some common STDs are Gonorrhoea, syphilis, trichomoniasis, AIDS.

*There are different methods which are developed to prevent and control pregnancy such as

mechanical methods, chemical methods, oral pills and surgical methods.

Contraception

*It is the avoidance of pregnancy, can be achieved by preventing the fertilisation of ova.

Methods of contraception

(a) Physical barrier

*To prevent union of egg and sperm.

*Use of condoms, cervical caps and diaphragm.

(b) Chemical methods

*Use of oral pills

*These change hormonal balance of body so that eggs are not released.

*May have side effects.

(c) Intrauterine contraceptive device(IUCD)

*Copper-T or loop is placed in uterus to prevent pregnancy.

(d) Surgical methods

*In males the vas deferens is blocked to prevent sperm transfer called **vasectomy**.

*In females, the fallopian tube are blocked to prevent egg transfer called **tubectomy**.

Know the Terms

***Reproduction:** It is the process of producing new individuals of the same species by existing organisms of a species i.e. parents.

***Sexual reproduction:** It is the process in which two sexes male and female are involved. The male sexual unit is known as male gamete or sperm while female sexual unit is termed as female gamete or ova.

***Pollination:** It is the transfer of pollen grain from the anther of a stamen to the stigma of a carpel. The pollen grains are transferred by many agents as insects, birds, man, wind and water.

***Fertilization:** It is defined as the fusion of a male gamete (sperm) with a female gamete (an ovum) to form a zygote during sexual reproduction.

***Zygote:** The cell which is formed by the fusion of a male gamete and female gamete is called Zygote, i.e. it is a 'fertilised ovum' or 'fertilized egg.'

***Sex ratio:** It is the ratio of the number of females to per thousand males in a population. The female-male sex ratio must be maintained for a healthy society.

***Population size:** Organisms increase their population with the help of reproduction. The rates of birth and death in a given population determine its size.

Important questions and answers

1. In male reproductive system identify the parts that you get as answer from (a)—(e).

(a) Where testes are located.

(b) Where the fluid is formed which helps sperms to swim.

(c) Where sperms are formed.

(d) Which is blocked to prevent pregnancy (surgically).

Ans: a) Pelvic region in scrotum b) Seminal vesicle c) testes d) vasa deference

2. Name the following parts of seed (germinating stage):

- (a) Part that will become shoots **Ans:** Plumule
(b) Part that will become roots. **Ans:** Radicle
(c) Part that contains food for the growth. **Ans:** Endosperm

3. “Variations that confer an advantage to an individual organism only will survive in a population.” Justify.

Ans: It is because the chances of survival depend on the nature of variations and different individuals have different kinds of advantages. For example, a bacteria that can withstand heat will survive better in a heat wave, i.e. the organisms that are fit in the competitive environment and with great variations will be able to survive and adapt. Thus, more offsprings and population with genetic variations will survive.

4. Why sexual mode of reproduction is essential in an organism?

- Variations ensure retaining of a species within the community. The variation is due to sexual mode of reproduction involves the combination of two different DNA of two organisms of same species.
- Sexual reproduction helps in crossing over, it is essential for variation, and it is essential for variation.
- The variation allows organisms to live in diverse habitat with the help of adaptation.
- During this type of reproduction fusion of gametes take place. It helps to maintain constant number of chromosomes throughout the species.

5. Why reproduction is essential?

- Ans:** a) Continuation of life on Earth
b) Replacement of dead organisms
c) To maintain the size of the population
d) Transfer of variation from one generation to another

6. “DNA copies generated during reproduction will be similar but may not be identical to the original.” Justify this statement.

Ans: DNA copies generated will be similar, but may not be identical to the original as some variations are so drastic that new DNA copy cannot work with the cellular apparatus it inherits. Such a newborn cell will simply die. Therefore, there could be many other variations in the DNA copies that would not lead to such a drastic outcome. Thus, the surviving cells are similar but slightly different from each other. This tendency of variation during reproduction is the basis for evolution.

7. We hear and read about female foeticide, which is really is a wrong practice. In some families, be it rural or urban, females are tortured for giving birth to a girl child. They do not seem to understand the scientific reason behind the birth of a boy or a girl. In your opinion, the approach of the society towards mother in this regard is correct or not? Explain the scientific reason.

Ans: Approach of society is baseless. Sex of child is determined by type of chromosome present in sperm (X or Y) that fuses with ovum at time of fertilization.

8. Mr. R. Sharma was suffering from various types of diseases presently. He went for thorough health checkups and was diagnosed as HIV⁺. Soon this news spread in his neighborhood and on account of this, he faced social isolation.

Comment upon:-

- i. Do you think people's indifference towards HIV⁺ people is justifiable? What kind of approach should we have towards the persons suffering from AIDS.
- ii. How can one protect one self from this disease?

Ans: i. absolutely not. Human approach/behavior

ii. One should be aware about the mode of transmission of disease, danger of sharing needles etc.

9. It is a well known fact that pregnant woman's health is a backbone of every family, society and thus nation,

- i. Which tissue is responsible for providing nutrition from mother to growing embryo?
- ii. According to you, what can be the likely measures to maintain woman health during pregnancy.

Ans. i. Placenta.

ii. Would be mother should eat healthy balanced nutritious diet, should be stress free. She should not take any medicine without proper doctor's advice.

10. How can one justify this statement that "Like physical mental and social fitness, human beings need fitness of reproductive life" i.e. "Reproductive Health".

Ans: This will prevent himself from contracting various STD's as well as spreading of diseases.

11. Arjun and Ram are students of Class-IX. Both were initially good in studies. After some time academic performance of Arjun started declining and he became irritable. This change was noticed by his class teacher, the teacher while interacting with Arjun found out that he had six siblings and whole family lived in a single room. Mother was not able to devote much attention to him and resources were not sufficient. After going through the situation, what are the factors, which you think, are responsible for change in behaviour and his poor performance in studies.

Ans: Big families can be one of the reasons/advantages of having short family

12. What is the importance of DNA copying in reproduction?

Ans: DNA copying (replication) mechanism is necessary for reproduction as copying of DNA helps in transfer of information or characters from parents to offspring. It also helps to generate variations during sexual reproduction. This variation leads to evolution.

13. Why is variation beneficial to the species but not necessary for the individual?

Ans: Importances of variations as follows

- ❖ Variation is a change in the body design of an individual.
- ❖ Variation allows organisms to exist in diverse habitat or niches.
- ❖ If this area is drastically altered due to various natural or man made causes, the species may be wiped out.
- ❖ However, if some variations are present in few individuals, it would help them to colonize in other habitats and survive.

❖ However, if variations were present in a single organism, there would be a very little chance of survival.

14. How DNA is responsible for changing of body structure of an organism?

Ans: DNA present in the nucleus of an organism contains information for the synthesis of protein. If the information present on DNA is altered the protein synthesized by the DNA is also altered ultimately it is responsible for change in body design of an organism.

15. What is the role of seminal vesicle and the prostate gland?

Ans: Secretion of Seminal vesicle and the prostate gland : i) Makes the transport of the sperms easier, ii) Provides nutrition to the sperms

16. What are the functions of placenta?

Ans: Functions of placenta;

- Provide nutrition to the developing embryo.
- Helps in the exchange of CO_2 and oxygen.
- It helps in the removal of waste substance formed in the developing foetus.
- It helps in the attachment of foetus to the wall of uterus.

17. Write the difference between male gametes and female gametes.

Ans:

Male gametes	Female gametes
1) Generally smaller in size	1) Generally larger in size
2) It contains small amount of reserve food	2) It contain large amount of reserve food
3) Male gametes are usually motile	3) Female gametes are usually

18. How is the process of pollination different from fertilisation?

Pollination	Fertilisation
transfer of pollen grains from anther to the stigma of a flower	fusion of male gamete with the female gamete

19. What are the changes seen in girls at the time of puberty?

Ans: (i) Skin becomes oily. Pimples often develop.

(ii) Breast size begins to increase, with darkening of the skin of the nipples at the tips of the breasts.

(iii) Beginning of menstruation cycle.

(iv) Growth of thick hairs in armpit and genital area between the thighs.

20. What are the advantages of sexual reproduction over asexual reproduction?

Ans: (i) The offspring's produced exhibit more diversity.

(ii) It plays a prominent role in the origin of new species.

21. What are the functions performed by the testis in human beings?

Ans: (i) Production of sperms. (ii) Secretion of testosterone hormone which induces secondary sexual characters at puberty.

22. What happens if egg is not fertilized in female?

Ans: The lining of the uterus breaks down along with blood vessels. The degenerated part of uterus along with the blood moves out of the vagina in the form of bleeding, called menstruation.

23. What are the different methods of contraception?

Ans: (i) Creation of mechanical Barrier : Condoms on the penis or similar coverings worn in the Vagina. Using loop or the copper-T inside vagina.

(ii) Changing the hormonal balance -by using drugs or pills.

(iii) Surgical methods : Blocking the vas deferens in male or the fallopian tube in female.

24. Why do testes located in scrotum outside the abdominal cavity?

Ans. Sperm formation requires lower temperature than the body temperature.

25. Differentiate between self pollination and cross pollination.

self pollination	cross pollination
i) transfer of pollen grains within the same flower	i) transfer of pollen grains from one flower to another.
ii) Does not require external agency	ii) Requires external agency.

26. Observe the following sectional view of human female reproductive system and label the part where

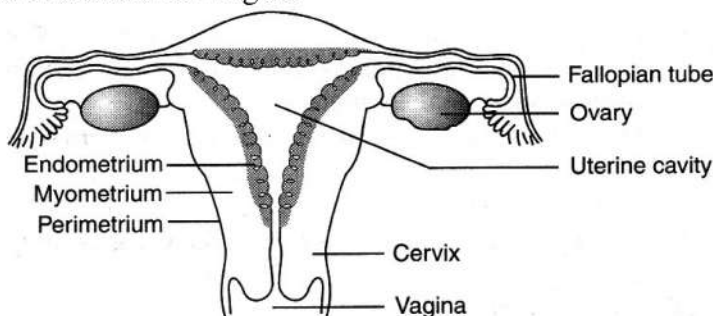
(1) (i) Eggs develop (ii) Fertilization takes place (iii) Fertilized egg gets implanted.

(2) Describe, in brief, the changes the uterus undergoes

(i) To receive the zygote.

(ii) If zygote is not formed.

Ans: (a) The human female reproductive system consists of a pair of ovaries, a pair of oviducts, the uterus and the vagina



Human Female Reproductive System

(1)

(i) The development of egg occurs in the ovary.

(ii) Fertilisation takes place in the fallopian tubes.

(iii) The fertilised egg gets implanted in the uterus.

(2) (i) The uterus prepares itself every month to receive a fertilized egg/zygote. The inner uterus lining (endometrium) becomes thick and is supplied with blood to nourish the embryo.

(ii) If the egg is not fertilised, then the uterus lining is not required. Hence, it breaks down and gets released in the form of blood and mucus through the vagina. This process lasts for 2 - 8 days. This cycle occurs every month and is known as **menstruation**.

HERIDITY AND EVOLUTION

KEY POINTS

*Variations arise during the process of reproduction. They may be few in asexual reproduction, but many in case of sexual reproduction.

*The minor variations arising during Sexual reproduction are caused by slight in accuracies in DNA copying. In sexual reproduction, variations are also caused by crossing over process of meiosis.

*Beneficial variations help the species to survive better in the environment.

*Nature selects the beneficial variations thereby leading to evolution.

*Reproduction produces offsprings with similar body design of the parents. However the offsprings are not identical, but show a great deal of variation from the parents.

Importance of Variation:

(i) Depending upon the nature of variations different individuals would have different kinds of advantages. Example, Bacteria that can withstand heat will survive better in a heat wave.

(ii) Main advantage of variation to species is that it increases the changes of its survival in a changing environment.

*Sexually reproducing organisms such as humans have two (or more) versions of genes for each trait, called alleles.

***Gregor Johann Mendel** carried out several experiments on pea plants. He carried out large number of monohybrid and dihybrid crosses using many contrasting characteristics and put forward several important conclusions.

Mendel and His Work on Inheritance

***Gregor Johann Mendel (1833 & 1884):** Started his experiments on plant breeding and hybridisation. He proposed the laws of inheritance in living organisms.

Mendel was known as **Father of Genetics**.

***Plant selected by Mendel:** *Pisum sativum* (garden pea). Mendel used a number of contrasting characters for garden pea.

❖ Seven pairs of contrasting characters in Garden Pea.

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

*In case of monohybrid cross with pure variety of plants, the phenotypic ratio obtained in F_2 generation is 3 : 1.

*In case of dihybrid cross involving two pairs of contrasting characters, the phenotypic ratio obtained in F_2 generation is 9 : 3 : 3 : 1.

*Mendel concluded that out of any pair of contrasting characters, one is dominant and the other is recessive.

*The homozygous dominant trait is denoted by two capital letters whereas the homozygous recessive trait is denoted by two small letters.

*The factors or genes controlling a particular trait separate from each other during gamete formation. Hence gamete is always pure as far as contrasting characters are considered. Each gamete will possess only one gene set.

*In crossing if two or more traits are involved, their genes assort independently, irrespective of the combinations present in the parents.

*Genes carry information for producing proteins, which in turn control the various body characteristics.

*For a particular trait, the offspring receives one allele from the father and one allele from the mother.

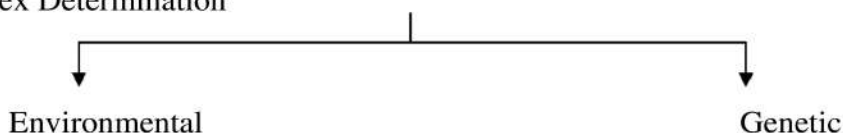
*The combination of the male and female germ cells gives a diploid zygote. Thus the normal diploid number of chromosomes in the offspring is restored.

*Different mechanisms are used for sex determination in different species.

Determination of sex of an offspring.

FACTORS

Responsible for sex Determination



In some animals, the temperature at which the fertilized eggs are kept, decides gender.

E.g., turtle

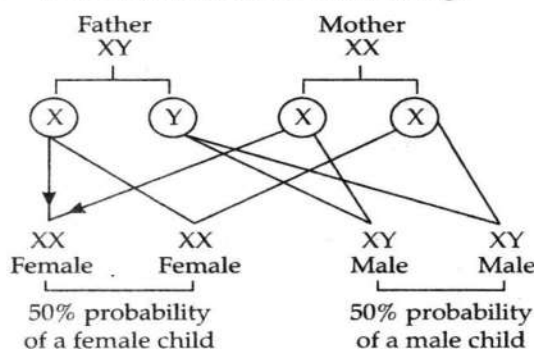
XX – Female XY – Male

In some animals like humans gender or individual is determined by a pair of chromosomes called sex chromosomes.

Sex Chromosomes: In human beings, there are 23 pairs of chromosome. Out of these 22 chromosomes pairs are called autosomes and the last pair of chromosome which helps in deciding gender of the individual is called sex chromosome.

SEX DETERMINATION IN HUMAN BEINGS

Sex determination in Human Beings



XX – Female XY – Male

Evolution

*Evolution is the sequence of gradual changes which takes place in the primitive organisms, over millions of years, in which new species are produced.

*Genetic drift can alter gene frequencies in small population and provide diversity without any survival benefits.

*Several factors such as environment, mutations, reproduction, etc can cause alterations in gene frequencies in a population over generations, leading to evolution. -

*Changes occurring in the DNA of germ cells are heritable whereas changes taking place in the non-reproductive tissues are not inherited.

*Charles Darwin proposed that evolution of species occurred by natural selection, but he did not know the underlying mechanism.

*Natural selection, genetic drift, variations and geographical isolation can lead to speciation in sexually reproducing organisms.

*Gene flow between the members of a population prevents speciation.

***The fundamental characteristics used to classify organisms are:**

1. Presence of prokaryotic or eukaryotic cells.
2. Whether the organism is unicellular or multicellular.
3. Ability to perform photosynthesis.
4. Presence of endoskeleton or exoskeleton in heterotrophic organisms.

*Classification of living organisms is closely related to their evolution.

Evolution and Classification

Both evolution and classification are interlinked.

1. Classification of species is reflection of their evolutionary relationship.
2. The more characteristics two species have in common the more closely they are related.
3. The more closely they are related, the more recently they have a common ancestor.
4. Similarities among organisms allow us to group them together and to study their characteristics.

I. **Homologous Organs:** (Morphological and anatomical evidences). These are the organs that have same structural plan and origin but different functions.

Homologous organs provides evidence for evolution by telling us that they are derived from the same ancestor.

Example:

Forelimb of horse	(Running)	–	Same basic structural plan, but perform different functions
wings of bat	(Flying)		
Paw of a cat	(Walk/scratch/attack)		

II. **Analogous Organs:** These are the organs that have different origin and structural plan but same function.

Example: Analogous organs provide mechanism for evolution.

Wings of bat →	Elongated fingers with skin folds	Different basic structure, but perform similar function i.e , flight
Wings of bird →	Feathery covering along the arm	

*Fossils help in tracing evolutionary pathways.

*The age of fossils can be determined by using the relative method or the isotope dating method.

*Evolution is not a one-step process, but a continuous process occurring in several stages.

*Complex organs are formed slowly over many generations, sometimes with intermediate forms playing an important role.

*Sometimes the use of certain features gets modified with time. For example: Feathers may have provided insulation initially, but later became associated with flight.

*Evolutionary studies have shown that birds are closely related to reptiles.

*Humans have carried out artificial selection for various features of cabbage and produced different vegetables.

Vegetable produced	Selected feature
Broccoli	Arrested flower development
Cauliflower	Sterile flowers
Kohirabi	Swollen parts
Kale	Larger leaves

*Molecular phylogeny can also be used to trace evolutionary relationships. Here the DNA of different species is compared. Greater the differences in DNA, more distantly related are the species.

*Disappearance of the existing species is not a requirement for formation of new species.

*The new species formed are better adapted to the environment but they need not be superior to the existing species.

*The common ancestor of humans and chimpanzees evolved in different ways to produce the present forms. Evolution produces more diverse and complex body forms over a period of time, but the newly formed species are not more progressive than the already existing ones. So it is wrong to say that evolution produces progressive higher forms from lower ones.

*All human beings, whether fair skinned or dark skinned, belong to the same species i.e., *Homo sapiens* that originated in Africa.

*The human ancestors gradually migrated from Africa to various parts of the world such as Asia, Europe, Australia and America. Thus they spread to different parts of the earth and adapted as best as they could to their environmental conditions.

Know the Terms

***F₁ generations:** The generations resulting immediately from a cross of the first set of parents (parental generation).

***F₂ generations:** Offsprings resulting from a cross of the members of F₁ generation.

***Dominant:** The gene which expresses itself if F₁ generation is known as dominant gene.

- ***Recessive:** The gene which is unable to express itself in presence of the dominant gene.
- ***Genotype:** It is the genetic constitution of an organism which determines the characters.
- ***Phenotype:** It is the appearance of an individual.
- ***Progeny:** The offspring produced as a result of reproduction of the parents.
- ***Dominant trait:** A genetic trait is considered dominant if it is expressed in a person who has only one copy of that gene.
- ***Recessive trait:** A genetic trait is considered recessive if it is expressed only when two copies of the gene are present.
- ***Homozygous:** Having two identical alleles of the same gene.
- ***Heterozygous:** Having dissimilar alleles at corresponding chromosomal loci.
- ***Monohybrid cross:** A type of cross in which only one pair of contrasting characters are considered.
- ***Dihybrid cross:** A type of cross that involves two sets of characteristics.
- ***Allele:** Either of a pair (or series) of alternative forms of a gene that can occupy the same locus on a particular chromosome and that control the same character.
- ***Somatic cells:** All cells forming the body of an organism, except the reproductive cells.
- ***Sex chromosomes:** Either of a pair of chromosomes, usually designated X or Y, in the germ cells of most animals, that combine to determine the sex and sex-linked characteristics of an individual.
- ***Gene:** A segment of DNA that is involved in producing a polypeptide chain and forms the basic unit of heredity.
- ***Trait:** A trait is a distinct variant of a phenotypic character of an organism that may be inherited or environmentally determined,
- ***Haploid cell:** Cell that has only one complete set of chromosomes.
- ***Diploid cell:** Cell that has two sets of chromosomes, one of paternal origin, the other of maternal origin.
- ***Micro-evolution:** Evolution resulting from small specific genetic changes that can lead to a new sub-species.
- ***Genetic drift:** It refers to the random change in gene frequencies in a small population, presumably owing to chance rather than natural selection, thereby providing diversity without any adaptations.
- ***Speciation:** The process of formation of a new species.
- ***Homologous organs:** Organs of different organisms which may be dissimilar externally and in function, but are similar in origin and in fundamental structural plan.
- ***Analogous organs:** Organs of different organisms which are similar in function and external appearance, but dissimilar in origin and structural plan.
- ***Fossils:** All preserved traces of living organisms.
- ***Molecular phylogeny:** The use of a gene's molecular characteristics to trace the evolutionary history of organisms.

Important questions and answers

1. There is an inbuilt tendency of variation during reproduction because of–

- (i) Errors in DNA copying (ii) Sexual reproduction
 (a) only (i) (b) only (ii) (c) both (i) and (ii) (d) none of them

Ans: (c) both (i) and (ii)

2. If we breed a group of squirrels and surgically remove their tails, then amongst the progeny of these tailless squirrels–

- (a) All have no tail (b) All have a tail (c) Some of them have tails (d) Cannot be determined

Ans: (b) All have a tail

3. Organism A recently came into existence while B was formed millions of years ago. What does this indicate?

- (i) A is more efficient than B (ii) A is more complex than B
 (a) Only (i) (b) Only (ii) (c) Both (i) and (ii) (d) Either (i) or (ii)

Ans: (c) Both (i) and (ii)

4. Why evolution should not be equated with progress?

Ans. Evolution cannot be equated with progress because it seems to have just given rise to more complex body designs. For example bacteria still flourish in spite of a very simple body design while dinosaurs did not survive in spite of complex design. Thus evolution is simply the generation of diversity and shaping of diversity by environmental selection.

5. A man with blood group A marries a woman with blood group O and their daughter has blood group O. Is this information enough to tell you which of the traits–blood group A or O is dominant? Why?

Ans: The given information is not enough to tell us which of the traits–blood group A or O – is dominant. In blood heredity, blood type A is always dominant and blood type O is always recessive. Here, father's Blood group can be $I^A I^A$ (homozygous) or $I^A i$ (heterozygous) genotypically, whereas that of mother is ii . For daughter to be born with blood group O, she must receive i type gene one each from father and mother. For this father must have heterozygous $I^A i$ blood group and mother must have homozygous blood group ii .

6. Variations that confer an advantage to an individual organism only will survive in population. Justify.

Ans. Variation is the difference in the characters or traits among the individuals of a species. Sexual reproduction of organisms produces variation. The variations produced in organisms during successive generations get accumulated in the organism. The significance of variations shows up only if it continues to be inherited by the offspring for several generations.

7. Green and red coloured seeds are recessive and dominant trait respectively. Out of F1 and F2, in which generations will the green seed appear, if both parents are not hybrid.

Ans. F2 generation.

8. Dead remains of two species A and B were buried. Later only A's body was found to be a fossil but not B's given reason. **Ans.** B's body did not have hard tissues, like bones.

9. Species A shares ten characteristics with species B, species C share fifteen characteristics with D which of the two pairs share closer relation.

Ans. C and D.

10. After the death of two insects, one of the insect was buried in hot mud and the other in usually found mud. Which of the two is more likely to be preserved better and why?

Ans. The insect buried in hot mud. The body will not get decomposed in hot mud and the impression of the body will remain.

11. A group of class X students prepared a street play to educate masses on gender disparity to stop sex determination of girl child and abort it.

(a) In human being, what is the chance of giving birth to a girl child?

(b) Who is responsible for the birth of a female child and why?

(c) What value is depicted among the group members of class X?

Ans. (a) The chance of giving birth to a girl child is 50%.

(b) Male (father) is responsible for the birth of a female child as only the male individual is a carrier both of X and Y chromosomes which will determine the sex of the foetus.

(c) The group members show team work, collaborative leadership, participating citizenship etc.

12. A blue colour flower plant denoted by BB is cross bred with that of white colour flower plant denoted by bb.

(a) State the colour of flower you would expect in their F1 generation plants.

(b) What must be the percentage of white flower plants in F2 generation if flowers of F1 plants are self-pollinated?

(c) State the expected ratio of the genotypes BB and Bb in the F2 progeny.

Ans: 1. The colour of flower in F1 progeny will be blue as it is dominant trait.

2. One fourth plants in F2 progeny will be white that means 25%.

3. Genotype ratio for every mono hybrid cross will be 1:2:1.

13. An individual cannot pass on to its progeny the experiences of its lifetime. Justify the statement with the help of an example and also give reason for the same.

Ans: Experience achieved during the lifetime of an individual does not make any change in the gene of the individual. For example, if a person reads a book on birds, the knowledge he earns by reading the book does not make any change in the gene, hence, this knowledge will not get automatically transmitted to his next generation. Such a trait is called acquired trait.

14. If a trait exists in 10% of a population of an asexually reproducing species and a trait B in 60% of the same population which trait is likely to have arisen earlier?

Ans: Trait B is likely to have arisen earlier. In asexual reproduction, cell divisions results in creation of similar cells with identical copies of DNA. Therefore, in such species, a trait may come into existence in some members due to sudden mutation induced by the environmental factors. This newly induced trait in some members of species is then inherited by future generations of such organism on replication over a period of time. So, it is but natural for trait B to exist earlier than trait A, as 60 % of population with trait B is likely to have been replicating that trait for a longer period than 10 % of population with trait A.

15. Which of the following is not the example of artificial selection?

- a. Colours of rose b. Flavors of mangoes c. colours of beetle d. Starch quality of wheat.

Ans: (d) similar function i.e., flight

Selection is a process in which a particular breed or a species reproduces more due to favorable characteristic. This can be of two types natural and artificial. Natural selection is one in which the breed or species which is more resistant to the environmental conditions will reproduce more and hence will be more in number. In artificial selection the breed which is better is grown more in number by human beings for their own use. Some examples are coloured rose, flavored mangoes etc.

16. Will geographical isolation be a major factor in the speciation of a self-pollinating plant species? Why or why not?

Ans: a) No, geographical isolation will not be a major factor in the formation of new species of self-pollinated plants.

b) This is because self-pollinated plants receive pollen grains from the same flower or another flower on the same plant and its distance from other plants hardly affects its reproduction. Moreover, self- pollinated plants rarely show variations in characters.

17. How are the areas of study of evolution and classification interlinked?

Ans: a) The study of classification of various organisms gives us an idea about the evolutionary history of the organisms. Organisms, which have certain similar characteristics, are placed in one group.

b) It can be thus concluded that the organisms placed in one group may have evolved from common ancestors and may have a common evolutionary history.

18. What are fossils? What do they tell us about the process of evolution?

Ans: Fossils are the remains or impressions of organisms that lived in the ancient times. Fossils provide the evidence that the present animals have originated from previously existing ones through the process of continuous evolution. Fossils can be used to reconstruct evolutionary history of an organism.

Ex: Fossils are helpful in the study of evolution as:

- i. They give us an idea of the time in history when different species were formed or became extinct.

- ii. Fossils also help us to trace the evolutionary history of some animals.
- iii. Fossils also indicate connecting links between two groups of organisms,
E.g. Archaeopteryx is a connecting link between reptiles and birds.

19. Why are human beings who look so different from each other in terms of size, colour and looks said to belong to the same species?

1. All human beings, even though they have different size, colour and looks belong to the same species (*Homo sapiens*) because they have similar DNA sequences and have descended from same ancestors. Also, they are capable of reproducing among themselves.
2. These variations may have arisen due to the environmental factors, mutation and mixing of characters during reproduction.

20. Why are traits acquired during the life-time of an individual not inherited?

Ans: Acquired traits cannot be passed on to DNA of germ cells.

21. How is the sex of the child determined in human beings?

Ans : Females have 44 + two X chromosomes and the males have 44+ one X and one Y chromosome. Therefore, the females are 44+ XX and the males are 44+XY. Male gametes(sperms) have either 22+ X or 22+Y chromosome. Female gametes (eggs) can only have 22+X chromosome. A child who inherits an X chromosome from her father will be a girl(44+XX), and one who inherits a Y chromosome from him will be a boy(44+XY)

22. What is Speciation? What factors could lead to the Speciation?

Ans : Formation of new and distinct species in the course of evolution from the existing species. The factors that could lead to the rise of a new species are :-

1. Natural selection, 2. Genetic drift, 3. Geographical isolation

23. Differentiate between acquired traits and inherited traits.

Sl.No	Acquired traits	Inherited traits
1	developed during the lifetime of an individual.	Characteristics transmitted from parent to offspring's.
2	Cannot be passed on to progeny	Can be passed on to progeny
3	Doesn't bring change in DNA of germ cells.	Bring changes in DNA of germ cells.
	Ex, Dancing ability in man	Skin color in man

24. Differentiate between homologous organs and analogous organs.

Homologous organs	Analogous organs
Organs that have same basic structural plan and origin but different functions.	Organs that have different origin and structural plan but same function.
Ex: hands of humans and the wings of birds	wings of bird and insects

LIGHT REFLECTION & REFRACTION

KEY POINTS

*When light fall on a body, it. may be absorbed, may be transmitted or light may get reflected back to the same medium.

*The phenomenon of change in the path of light from one medium to another is called **refraction of light**.

*The angle formed between the incident ray and the normal is called angle of incidence and the angle formed between the refracted ray and the normal is called **angle of refraction**.

*The cause of refraction is the change in the speed of light as it goes from one to another medium.

*Larger the difference in speed of light between the two media across the interface, the greater will be the angle of bending and vice-versa.

*When a ray of light passes from a rarer medium to a denser medium, it bends towards the normal. Also, the angle of incidence is greater than the angle of refraction.

*When a ray of light passes from a denser medium to a rarer medium, it bends away from the normal. Also, the angle of incidence is less than the angle of refraction.

❖ Laws of refraction:

First law: The incident ray, the refracted ray and the normal at the point of incidence all lie in the same plane. **Refractive index (n):** The ratio of speed of light in a given pair of media

$$n = \frac{\text{Velocity of light in medium 1}}{\text{Velocity of light in medium 2}}$$

n_{21} means refractive index of second medium with respect to first medium, and

$$n_{21} = \frac{v_1}{v_2}$$

n_{12} means refractive index of first medium with respect to second medium.

$$n_{12} = \frac{v_2}{v_1}$$

❖ **Absolute Refractive Index:** Refractive index of a medium with respect to vacuum or air.

$$n = \frac{c}{v} \quad c = 3 \times 10^8 \text{ ms}^{-1}$$

❖ Refractive index of one medium is reciprocal of others refractive index in a given pair.

$$n_{12} = 1/n_{21}$$

If refractive index of medium 1 with respect to air is given as ${}_1n^{\text{air}}$ air is given as ${}_1n^{\text{air}}$ and if refractive index of medium 2 with respect to air is given as ${}_2n^{\text{air}}$ then the refractive index of medium 1 with respect to media 2 = ${}_1n^{\text{air}} / {}_2n^{\text{air}}$

➤ Refractive index of diamond is the highest till date. It is 2.42. It means speed of light is 2.42 times less in diamond than in vacuum.

Snell's law; $n = \sin i / \sin r = \text{constant}$

Absolute refractive index = speed of light in air / speed of light in medium .

Power of a lens:

It is defined as the reciprocal of focal length in meter.

The degree of convergence or divergence of light rays is expressed in terms of **power**.

SI unit of Power = dioptre = D $1 \text{ D} = 1 \text{ m}^{-1}$

1 dioptre is the power of lens whose focal length is one meter.

	Lens
Lens	$\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$
focal length	$f = \frac{R}{2}$
Magnification	$m = \frac{h_1}{h} = \frac{v}{u}$
Power	$p = 1/f(\text{m}) \text{ or } 100/f(\text{m})$

Know the Terms

***Ray and beam:** Light travels in a straight line—Rectilinear propagation. The straight line indicating the path of the light (arrow—direction) is called a ray. A bundle of rays originating from the same source of light in a particular direction is called a beam of light.

***Parallel beam:** When the rays which constitute the beam are parallel to one—another, then it is called a parallel beam of light.

***Convergent beam:** When the rays actually meet or appear to meet at a point, then the beam containing such rays are called convergent beam and rays are called convergent rays.

***Divergent beam:** When the rays actually diverge or appear to diverge from a point, then the beam containing such rays are called divergent beam and rays are called divergent rays.

***Image:** The point of convergence or the point from where the light appears to diverge after reflection or refraction is called image.

***Aperture:** The width of the reflecting surface from which reflection takes place is called aperture.

***Pole:** The central point of the reflecting spherical surface is called pole (F). ***Centre of curvature:** The centre of the hollow sphere of which the spherical mirror is a part, is called centre of curvature (C).

***Radius of curvature:** The separation between the pole and the centre of curvature cut of the hollow sphere, of which the mirror is a part, is called radius of curvature (R).

***Principal axis:** The straight line joining the pole and the centre of curvature is called principal axis.

***Focus:** The point F on the principal axis, where a beam of light parallel to the principal axis actually meet after reflection or appear to come it from it is called its principal focus.

***Focal length:** The length or separation between the pole and the focus is called focal length.

Important questions and answers

1. You are given kerosene, turpentine and water. In which of these does the light travel fastest? Use the information given in table above.

Ans. Refractive index of kerosene = 1.44

Refractive index of turpentine = 1.47

Refractive index of water = 1.33

Lower the refractive index faster is the speed of light in that medium. Hence light will travel fastest in water.

2. The refractive index of diamond is 2.42. What is the meaning of this statement?

Ans. As refractive index = speed of light in air/ speed of light in diamond. This means the ratio of the speed of light in the air and the speed of light in diamond is equal to 2.42.

3. The power of a lens is – 40, what is its focal length?

Ans: $P=1/f$

4. On the rainy day, Ram reached his grandfather's place in village. On the way to house he saw a beautiful rainbow in the sky. In night, he saw lots of twinkling stars in the clear sky. He was very excited to see these beautiful natural phenomena, which he was not able to see in the city, where he lived with his father. Answer the following questions based on the situation given above.

(i) Do you think that pollution in atmosphere affects the formation of rainbow and twinkling of stars?

(ii) Do you agree with the fact that pollution-free environment will strengthen such natural phenomena in the cities as well?

(iii) What steps can be taken so that the natural phenomena can be enjoyed in cities as well?

Ans. (i) Yes. Though rainbow formation and twinkling of stars are the phenomena of light but these won't be visible if there is a lot of pollution in the stratosphere.

(ii) Yes.

(iii) Keeping the city clean and pollution-free, plant more trees.

5. When a ray of light entering from air is incident on the surface of a glass slab at an angle of 90° , what will be the measure of angle of refraction? Why does a ray change its path when it passes from one medium to another medium?

Ans. The angle of refraction will be zero. A light ray changes its path when it passes from one medium to another medium.

6. Which of the 2 has a great power a lens of short focal length or a lens of large focal length?

Ans: Lens of short focal length.

7. What will happen to a ray of light when it falls normally on a surface?

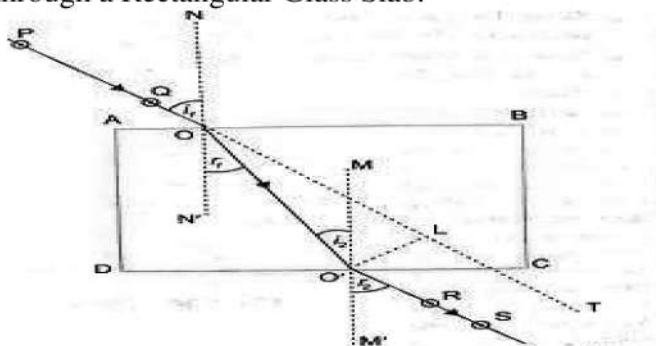
Ans: No bending of light ray occurs. It means light rays goes straight from one medium to another.

8. Printed letters appears diminished, when viewed through a lens. What is the nature of lens?

Ans: The lens is concave lens because the concave lens forms virtual erect and diminished letters

9. Explain the experiment of Refraction through a Rectangular Glass Slab.

MM'	perpendicular drawn
NN'	perpendicular drawn
ABCD	Glass Slab
PO	Incident ray
O'S	Emergent ray
OO'	Refracted ray



10. The focal length of a concave lens is 30 cm. At what distance should the object be placed from the lens so that it forms an image at 20 cm from the lens ?

Ans; $\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$ or $\frac{1}{u} = \frac{1}{v} - \frac{1}{f}$
 $\frac{1}{u} = \frac{1}{-20} - \frac{1}{(-30)}$
 $= -\frac{1}{20} + \frac{1}{30}$
 $\frac{1}{u} = -\frac{3}{60} + \frac{2}{60}$
 $\frac{1}{u} = -\frac{1}{60}$ so **$u = -60$ cm**

11. A doctor prescribes a correction lens of power -0.5 D to a person. Find the focal length of the lens. Is this lens diverging or converging? Give reason. How does the property of this lens can be used to correct eye defects?

Ans ; $p = \frac{1}{f}$, here $p = -0.5$ D
 $f = \frac{1}{p}$
 $f = -\frac{1}{0.5}$
 $f = -2$ m

- This lens is **diverging** ('-' minus sign indicates concave lens or diverging lens)
- Because power of a lens is **negative** means the given lens is **concave**.
- The diverging property of the lens is used to correct **myopia**. In myopic eye the image of a distance object is formed in front of the retina and not on the retina.
- A concave lens of suitable power diverges the light rays and brings the image back on the retina.

12. A person needs a lens of power -5.5 dioptres for correcting his distant vision. For correcting his near vision he needs a lens of power $+1.5$ dioptre. What is the focal length of the lens required for correcting (i) distant vision, and (ii) nearvision? (Formula $P = 1/f$)

Ans: For distant vision $p = -5.5$ D
 $f = \frac{1}{p}$
 $= \frac{1}{-5.5}$
 $f = 0.182$ m

13. For the same angle of incidence in media A, B and C the angles of refraction are 200° , 300° and 400° respectively. In which medium the velocity of light will be maximum? Give reason in support of your answer.

Ans: We know that ratio of sine of angle of incidence to the sine of refraction gives refractive index. Increases in the refractive index increases the range of bending. Here angle of incidence is same in every case. The angle of refraction is greater in c. It has less refractive index and hence, light suffer less bending, which increases its speed.

14. List out the differences between Real image and Virtual image

Real Image	Virtual Image
1.It can be taken on a screen.	1. It can't be taken on a screen.
2. convex lens forms real image	2. concave lenses forms virtual image
3. It is always inverted	3. It is always erect
4. The rays of light actually meet at a point after reflection or refraction.	4. The ray of light appear to diverge from a point after reflection or refraction.

15. Define absolute Refractive index .

Ans: The ratio of the velocity of light in a vacuum to its velocity in a specified medium.

16. Define Principal Focus of concave lens .

Ans: Parallel rays of light pass through the concave lens the refracted rays appear to come from one point called the principal focus of concave lens.

17. Define Principal Focus of convex lens

Ans: Parallel rays of light pass through convex lens the refracted rays converge at one point called the principal focus of convex lens.

18. Define 1 diopetre(D) of power of a lens.

Ans: 1 diopetre is defined as the power of a lens of focal length 1 metre.[$D = \frac{1}{f}$]

19.Red coloured light is used in traffic signals to indicate the vehicles to stop, because compared to other colours red light

- (a) Has high frequency
- (b) Has less wavelength
- (c) Scatters more
- (d) Scatters less

Ans: (d) scatters less

ELECTRICITY

KEY POINTS

*Electric charge is the property of matter due to which it produces and experience electrical and magnetic effects. There exist two types of charge in nature:

- (i) Positive charge (ii) Negative charge SI unit of charge is coulomb(C).

***Fundamental law of electrostatics:** Like charges repel and unlike charges attract each other.

Coulomb's Law: The force of attraction or repulsion between two point charges is

(a) directly proportional to the product (q_1q_2) of the two charges and

(b) Inversely proportional to the square of the distance (r) between them.

Mathematically,

$$F = k \frac{q_1 q_2}{r^2}$$

The value of K depends on the nature of the medium between the two charges and the system of units chosen. For charges in vacuum, $K = 9 \times 10^9 \text{ Nm}^2/\text{C}^2$.

***Law of Conservation of Charge:** Electric charges can neither be created nor destroyed; they can only be transferred from one body to another.

***Static and Current Electricity:** Static electricity deals with the electric charges at rest while the current electricity deals with the electric charges in motion.

Electric Current: The electric current is defined as the rate of flow of electric charge through any section of a conductor.

$$\text{Electric current} = \frac{\text{charge}}{\text{time}} \quad \text{or} \quad I = \frac{Q}{t}$$

***Ampere:** It is the SI unit of current. If one coulomb of charge flows through any section of a conductor in one second, then current through is said to be of one ampere.

***Electric circuit:** The closed path along which an electric current flows is called an 'electric circuit'.

***Conventional direction of current:** Conventionally, the direction of motion of positive charges through the conductor is taken as the direction of current. The direction of conventional current is opposite to that of the negatively charged electrons.

***Electric field:** It is the region around a charged body within which its influence can be experienced.

***Potential Difference (V):** Work done to move a unit charge from one point to another.

$$V = \frac{W}{Q}$$

***1 Volt:** When 1 joule work is done in carrying one Coulomb charge then potential difference is called 1 volt. S. I. unit of Potential difference = Volt (V)

$$1 \text{ V} = 1 \text{ JC}$$

*Voltmeter has high resistance and always connected in parallel. Symbol is



***Potential difference between two points:** The potential difference between two points in an electric field is the amount of work done in bringing a unit positive charge from one point to another.

$$\text{Potential difference} = \frac{\text{Work done}}{\text{charge}} \quad \text{or} \quad I = \frac{Q}{t} \quad \text{or} \quad V = \frac{W}{Q}$$

❖ **One volt potential difference:** The potential difference between two points in an electric field is said to be one volt if one joule of work has to be done in bringing a positive charge of one coulomb from one point to another. $1 \text{ Volt} = 1 \text{ joule} / 1 \text{ coulomb}$ or $1 \text{ V} = 1 \text{ J} / 1 \text{ C}$

➤ **Electrochemical or voltaic cell:** It is a device which converts chemical energy into electrical energy.

➤ **Galvanometer:** It is a device to detect current in an electric circuit.

➤ **Ammeter:** It is a device to measure current in a circuit. It is a low resistance galvanometer and is always connected in series in a circuit.

➤ **Voltmeter:** It is a device to measure the potential difference. It is a high resistance galvanometer and is always connected in parallel to the component across which the potential difference is to be measured.

➤ **Ohm's Law:** Potential difference across the two points of a metallic conductor is directly proportional to current through the circuit provided that temperature remains constant.

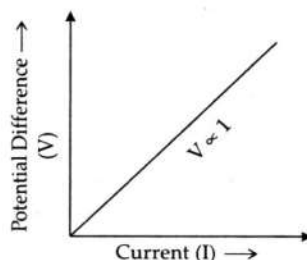
(i) **Mathematical expression for Ohm's law**

$$V \propto I$$

$$V = IR$$

R is a constant called resistance for a given metal.

(ii) **V–I graph for Ohm's law:**



➤ **Resistance (R):** It is the property of a conductor to resist the flow of charges through it.

• **Ohm (Ω):** S. I. unit of resistance.

• **Ohm = $\frac{1 \text{ volt}}{\text{ampere}}$**

➤ When potential difference is 1 V & current through the circuit is 1 A, then resistance is 1 ohm.

➤ **Rheostat:** Variable resistance is a component used to regulate current without changing the source of voltage.

➤ **Factors on which the Resistance of a Conductor depends:** Resistance of a uniform metallic conductor is

- 1) Directly proportional to the length of conductor,
- 2) Inversely proportional to the area of cross-section,
- 3) Directly proportional to the temperature and
- 4) Depend on nature of the material.

➤ **Resistivity (P):** It is defined as the resistance offered by a cube of a material of side 1 m when current flows perpendicular to its opposite faces.

a) Its S.I. unit is ohm-metre (Ωm).

b) Resistivity does not change with change in length or area of cross-section but it changes with change in temperature.

- ❖ Range of resistivity of metals and alloys is 10^{-8} to $10^{-6} \Omega \text{m}$.
- ❖ Range of resistivity of insulators is 10^{12} to $10^{17} \Omega \text{m}$.
- ❖ Resistivity of alloy is generally higher than that of its constituent metals.
- ❖ Alloys do not oxidize (burn) readily at high temperature, so they are commonly used in electrical heating devices.
- ❖ Copper and aluminium are used for electrical transmission lines as they have low resistivity.

➤ **Resistances in series:** When two or more resistances are joined end to end so that same current flows through each one of them in turn, they are said to be connected in series. Here, the total resistance is equal to the sum of the individual resistances.

$$R_s = R_1 + R_2 + R_3 + \dots$$

➤ **Resistances in parallel:** When two or more resistances are connected across two points so that each one of them provides a separate path for current, they are said to be connected in parallel. Here the reciprocal of their combined resistance is equal to the sum of the reciprocals of the individual resistances.

$$1/R_p = 1/R_1 + 1/R_2 + 1/R_3 + \dots$$

- **Heating effect of current:** When an electric current is passed through a conductor, heat is produced in it. This is known as heating effect of current.
- **Joule's law of heating:** It states that "the heat produced in a conductor is directly proportional to
- (i) The square of the current **I** through it,
 - (ii) Its resistance **R** and
 - (iii) The time **t**, for which current is passed.

Mathematically, it can be expressed as $H = I^2 R t$ Joule

Practical application of the heating effect of electric current:

It is utilised in the electrical heating appliances such as electric iron, room heaters, water heaters etc. The electric heating is also used to produce light as in an electric bulb.

❖ **Electric energy:** It is the total work done in maintaining an electric current in an electric circuit for a given time.

Electric energy, $W = VIt = I^2 R t$ Joule

❖ **Electric Fuse:** It is a safety device that protects our electrical appliances in case of short circuit or overloading.

- Fuse is made up of pure tin or alloy of copper and tin.
- Fuse is always connected in series with live wire.
- Fuse has low melting point.
- Current capacity of fuse is slightly higher than of the appliance.

- ❖ **Electric Power:** The rate at which electric energy is consumed or dissipated in an electric circuit.

$$P = VI \text{ or } P = I^2 R = V^2/R$$

S.I. unit of power = Watt (W)

1 Watt = 1 Volt x 1 ampere

- ❖ Commercial unit of electric energy = Kilo Watt hour(KWh) $1 \text{ KWh} = 3.6 \times 10^6 \text{ J}$
1 KWh = 1 unit of electric energy
- ❖ **Electrical power:** Electrical power is the rate at which electric energy is consumed by an appliance.

$$P = V/t = VI = I^2 R = V^2/R$$

- ❖ **Watt:** It is the SI unit of power. The power of an appliance is 1 watt if one ampere of current flows through it on applying a potential difference of 1 volt across it sends.

$$1 \text{ WATT} = 1 \text{ joule} / 1 \text{ second} = 1 \text{ volt} \times 1 \text{ ampere}$$

or

$$1 \text{ W} = \text{Js}^{-1} = 1 \text{ VA}$$

$$1 \text{ kilowatt} = 1000$$

- ❖ **Kilowatt hour:** It is the commercial unit of electrical energy. One kilo watt hour is the electrical energy consumed by an appliance of 1000 watts when used for one hour.

$$1 \text{ kilowatt hour (kWh)} = 36 \times 10^6 \text{ J}$$

- ❖ **Power rating:** The power rating of an appliance is the electric energy consumed per second by the appliance when connected across the marked voltage of the mains
- ❖ **Efficiency of an electrical device:** It is the ratio of the output power to the input power
Efficiency, $\eta = \text{Out put power} / \text{input power}$
- ❖ **Frictional Electricity:** It is the electricity produced by rubbing two suitable bodies and flow of electrons from one body to other.
- ❖ **Electricity:** A fundamental form of energy observable in positive and negative forms that occurs naturally (as in lightning) or is produced (as in a generator) and that is expressed in terms of the movement and interaction of electrons.
- ❖ **Positive and Negative Charges:** The charge acquired by a glass rod when rubbed with silk is called positive charge and the charge acquired by an ebonite rod when rubbed with wool is called negative charge.
- ❖ **Charge Conservation:** When a glass rod is rubbed on silk, the glass rod acquires positive charge. But it is not created. The negative charges from glass rod are shifted to silk leaving a net positive charge on glass rod. The net charge in them remains the same. So, charges are not created or destroyed but can be transferred from one place to another or remain conserved.
- ❖ **Coulomb:** It is the SI unit of charge. One coulomb is defined as that amount of charge which repels an equal and similar charge with a force of $9 \times 10^9 \text{ N}$ when placed in vacuum at a distance of 1 meter from it. Charge on an electron = $1.6 \times 10^{-19} \text{ coulomb}$.

❖ **Conductor:** A substance which allows passage of electric charges through it easily is called a conductor. A conductor offers very low resistance to the flow of current. For example, Copper, Silver, Aluminium etc.

❖ **Insulator:** A substance that has infinitely high resistance does not allow electric current to flow through it. It is called insulator.

❖ **Electric Potential Energy:** It is defined as the work required to be done to bring the charges to their respective location against the electric field with the help of a source of energy. This work done gets stored in the form of potential energy of charge.

❖ **Ohm:** It is the SI unit of **resistance**. A conductor has a resistance of one ohm if a current of one ampere flows through it on applying a potential difference of 1 volt across its ends. $V = IR$

$$1 \text{ ohm} = 1 \text{ volt} / 1 \text{ ampere}$$

❖ **Resistor:** A conductor which has some appreciable resistance is called a resistor.

❖ **Resistivity:** It is defined as the resistance offered by a cube of a material of side 1m when current flows perpendicular to its opposite faces. Its SI unit is ohm-metre (Ωm).

$$\text{Resistivity, } 1 \Omega = RA / L$$

❖ For a material irrespective of length and area, the resistivity is constant. It is otherwise called specific resistance of the material. It is also defined as the resistance offered by a cube of a material of side 1m when current flows perpendicular to the opposite faces.

❖ Rheostat is a device which changes the magnitude of current in the circuit, by changing the resistance. It is connected in series in the circuit. It is also used as a potential divider in the circuit.

❖ **Semiconductors:** Materials having resistivity between that of an insulator and a conductor are called semiconductors. They are used in making integrated circuits.

❖ **Superconductors:** These are certain materials that lose their resistivity at low temperature. Such materials are called as superconductors. The phenomenon of complete loss of resistivity by substances below a certain temperature is called super conductivity.

❖ **Fuse Wire:** The wire which melts, breaks the circuit and prevents the damage of various appliances in the household connections. It is connected in series and its thickness determines the maximum current that can be drawn. It is made of an alloy of Aluminium, Copper, Iron and Lead.

Important questions and answers

1. Suddenly the news spread in the school that the fire had broke out in examination room. All the important papers and office documents were burnt. The reason for this mishap was short circuiting. What is short circuiting and what precautions can be taken to avoid such tragic incidents.

Ans. Short-circuiting takes place if live wire and neutral wire come into direct contact due to damage of insulation of live wire. Use fuse, connecting wire should be of good quality, wire should be properly insulated externally.

2. We generally use a device in an electrical circuit, which is essential for safety of appliance as well as life. (i) What is that safety device called?

(ii) How it works and helps us to live happily?

(iii) Do you think it is necessary for every place where electricity is used?

Ans: (i) Fuse

(ii) Yes, Fuse protects circuit and appliances by stopping the flow of any unduly high electric current.

(iii) Yes

3. Mr. Sharma a property dealer, had many expensive appliances at his home like fridge 3 air conditioners, geyser etc but he forgot to put earth wire connections to these appliances. One day his younger daughter opened the fridge and suffered a severe electric shock though, she was saved electrical appliances. Why it happened and how can one save himself or herself from this electric shock by?

Answer the following questions based on the situation given above. (i) Why did it happen? (ii) How can one save himself/herself from electric shocks by these electrical appliances? (iii) What values are being neglected by Mr. Sharma?

Ans: (i) This happened because earth wire was not used in the electric appliances. The purpose of earthing is that in case of an insulation failure in some appliance, this wire connected to the metal body will provide a path for the current to flow in the ground.

(ii) By providing proper earthing in all electrical appliances, connecting electric fuse in circuits, never touch an electric switch or appliance with wet hands.

(iii) Carefulness and vigilance while handling electric gadgets.

4. 28. The current flows through the $10\ \Omega$ resistor in the following circuit

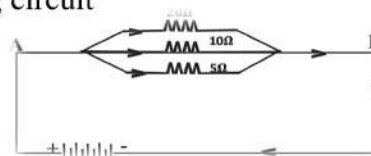
A] 1.2 A

B] 0.2 V

C] 2.0V

D] 0.6 V

Ans: A] 1.2 A



5. In the figure, the device labelled as 'A' is _____.

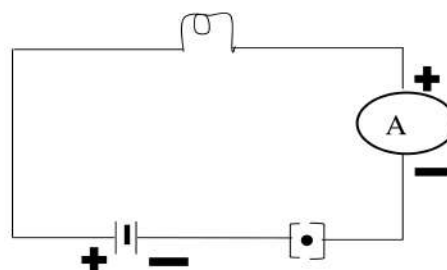
A. bulb

B. Key

C. Ammeter

D. Battery

Ans: C. Ammeter



6. Why is the tungsten metal more coiled in the bulb and not installed in straight parallel wire form?

Ans. The coiled wire of tungsten increases the surface area of the wire in very less space so as to emits more light and helps in glowing with more intensity.

7. Why are fairy decorative lights always connected in parallel?

Ans. When the fairy lights are connected in series the resistance offered will be greater and brightness of the bulbs will be affected. But in parallel connection all the bulbs will glow with same intensity and if any more bulbs gets fused the other bulbs will continue to glow.

8. What will happen when: a)Voltmeter is connected in series? b)Ammeter is connected in parallel?

Ans. a) Negligible current will pass through the circuit because the voltmeter has a very high resistance.

b) Ammeter will get damaged due to flow of large amount of current through it, because it has low resistance.

9. I am equal to the charge carried by 6.25×10^{18} electrons.

Ans: Coulomb

10. I am the rate of flow of charge through any section of a conductor.

Ans: electric current

11. I am same as coulomb/second.

Ans: Ampere

12. I am closed path along which electric charges can flow.

Ans: Electric circuit

13. I am equal to the work done per unit charge from point to another.

Ans: Electric Potential and Potential Difference

14. I am same as joule/coulomb.

Ans: Volt

15. I oppose the flow of charges through any conductor.

Ans: Resistance

16. I am same as volt/ampere.

Ans: ohm

17. I relate potential difference with current for a given resistance.

Ans: Ohm's Law. Ohm's Law states that, potential difference and electric current are directly proportional and they will increase or decrease in same order. Here, R is proportional constant which is called Resistance. This means that if potential difference will be halved then electric current will be halved

18. I am used to measure potential difference between two points of a circuit.

Ans: Voltmeter

19. An electric heater having resistance equal to 5Ω is connected to electric source. If it produces 180 J of heat in one second, find the potential difference across the electric heater.

Ans: Solution: Given,

Resistance (R) = 5Ω ,

Heat (H) produced per second by heater = 180 J,

time 't' = 1 s,

Potential difference (V) = ?

To calculate the potential difference, we need to calculate electric current (I) first.

We know that $H = I^2 R t$

Or, $180\text{J} = I^2 \times 5\Omega \times 1\text{s}$

Or, $I^2 = 180 \div 5 = 36$

Or, $I = 6\text{A}$

Now, potential difference $V = IR$

Or, $V = 6\text{A} \times 5\Omega$

$V = 30\text{V}$

Result: The potential difference across the electric heater is 30V.

20. How much heat is produced by 2 kW electric heater when it is operated for 30 minutes.

Ans: Heat Produced,

$H = \text{Rating in kW} \times \text{times of operation}$

$H = 2\text{ kW} \times 0.5\text{ hour} = 1\text{ kWh}$

$H = 36 \times 10^5 \text{ joules}$

$H = 860\text{ k cal}$

Explanation: According to formula we know that power = heat/ time. Here we need to calculate heat so we can this equation as follows-

Heat = power x time.

Here power is given $P = 2\text{kW}$ and time is also given which is 30 mint.

First convert kilo watt into watt. 1 kw = 1000 watt so 2kw will be equal to 2000watt

Convert 30 minute into second = 30 minute = $30 \times 60 = 1800\text{ sec.}$

Heat = power x time

$2000 \times 1800 = 36,00000\text{ joules}$ or $36 \times 10^5\text{J}$ or 860 kcal

21. An electric heater of resistance 500 ohm is connected to a mains supply for 30min. If 15A current flows through the filament of the heater, then calculate the heat energy produced in the heater.

Ans: $H = I^2 R t$

$H = 15^2 \times 500 \times 30 \times 60$ (time in seconds)

$H = 202500000\text{ Joules of heat}$

22. What will be the resistivity of a metal wire of 2 m length and 0.6 mm in diameter, if the resistance of the wire is 50Ω .

Solution: Given, Resistance (R) = 50Ω , Length (l) = 2 m

Diameter = 0.6 mm

Hence, radius = $0.3\text{ mm} = 3 \times 10^{-4}\text{ m}$

Resistivity (ρ) = ?

Now, area of cross section of wire $A = \pi r^2$

$$A = 3.14 \times (3 \times 10^{-4} \text{ m})^2$$

$$A = 3.14 \times 9 \times 10^{-8} \text{ m}^2$$

$$A = 28.26 \times 10^{-8} \text{ m}^2$$

$$A = 2.826 \times 10^{-9} \text{ m}^2$$

We know that, $\rho = RA/l$

$$\rho = 50 \Omega \times 2.826 \times 10^{-9} \text{ m}^2 / 2 \text{ m}$$

$$\rho = 25 \times 2.826 \times 10^{-9} \Omega \text{ m} = 70.65 \times 10^{-9} \Omega \text{ m}$$

$$\rho = 7.065 \times 10^{-8} \Omega \text{ m}$$

23. The resistance of an electric wire of an alloy is 10Ω . If the thickness of wire is 0.001 meter, and length is 1 m, find its resistivity.

Solution: Given, Resistance (R) = 10Ω , Length (l) = 1 m

Diameter = 0.001 m

Therefore, radius = 0.0005 m

Resistivity (ρ) = ?

Now, area of cross section of wire $= \pi r^2$

$$\text{Or, } A = 3.14 \times (0.0005)^2 \text{ m}^2$$

$$\text{Or, } A = 0.00007850 \text{ m}^2$$

We know that

$$\rho = RA/l$$

$$\rho = 10 \Omega \times 0.0000785 \text{ m}^2 / 1 \text{ m} = 10 \Omega \times 0.0000785 \text{ m}$$

$$= 0.000785 \Omega \text{ m} = 7.85 \times 10^{-4} \Omega \text{ m}$$

24. The resistivity of a metal wire is $10 \times 10^{-8} \Omega \text{ m}$ at 20°C . Find the resistance of the same wire of 2 meter length and 0.3 mm thickness.

Ans: Solution: Given, Resistivity (ρ) = $10 \times 10^{-8} \Omega \text{ m}$, Length (l) = 2 m, Diameter = 0.3 mm

Resistance (R) = ?

Now, Radius of wire = Diameter/2 = $0.3 \text{ mm} / 2 = 0.15 \text{ mm} = 0.00015 \text{ m} = 1.5 \times 10^{-4} \text{ m}$

Now, area of cross section of wire $= \pi r^2$

$$A = 3.14 \times (1.5 \times 10^{-4} \text{ m})^2$$

$$A = 3.14 \times 1.5 \times 1.5 \times 10^{-8} \text{ m}^2 = 7.065 \times 10^{-8} \text{ m}^2$$

We know that

$$R = \rho l / A = 10 \times 10^{-8} \Omega \text{ m} \times 2 \text{ m} / 7.065 \times 10^{-8} \text{ m}^2 = 10 \Omega \times 2 / 7.065$$

$$R = 2.83 \Omega$$

25. The area of cross section of wire becomes half when its length is stretched to double. How the resistance of wire is affected in new condition?

Ans: Solution: Let the area of cross section of wire = A

Let length of wire before stretching = L

Let Resistance of wire = R

After stretching of wire, let

Area of cross section = A / 2

Length = 2L

Resistance = R₁

Thus, ratio of resistance before stretching to resistance after stretching can be given as follows:

$$\text{Or, } R:R_1 = \rho LA : \rho 2L / A2$$

$$\text{Or, } R:R_1 = \rho LA:4\rho L/A$$

$$\text{Or, } R:R_1 = 1:4$$

This means $R = 1$ and $R_1 = 4$

Thus, resistance increases four times after stretching of wire.

26. (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?

Ans: (i) Resistivity will not change as it depends on the nature of the material of the conductor.

(ii) The length of each part becomes $L/4$. ρ, A constant. $R = \rho L/A$.

$$\text{Resistance of each part} = R_{\text{part}} = (\rho L/4)/A = R/4.$$

(a) In parallel the $1/R_{\text{eqv}} = 1/R_{\text{eqv}} + 1/R_{\text{eqv}} + 1/R_{\text{eqv}} + 1/R_{\text{eqv}} = 4/R_{\text{eqv}} = 16R \rightarrow R_{\text{eqv}} = R/16 \Omega$

(b) In series the $R_{\text{eqv}} = R/4 + R/4 + R/4 + R/4 = R \Omega$

(iii) $P = V^2/R$. If R_{eqv} is less, power consumed will be more. In the given case, R_{eqv} is lesser in the parallel and power consumed will be more.

27. List in a tabular form two differences between a voltmeter and an ammeter.

Voltmeter		Ammeter	
(i)	Used to measure the potential difference,	(i)	Used to measure the current.
(ii)	Connected in parallel in the electric circuit.	(ii)	Connected in series in the electric circuit.
(iii)	Has high resistance.	(iii)	Has low resistance.

28. Explain the following:

(i) The elements of electric heating devices such as bread-toasters and electric iron are made of an alloy rather than of a pure metal.

(ii) Series arrangement is not used for domestic circuits. Copper and aluminium wires are usually employed for electricity transmission

Ans: (i) Resistivity of an alloy is generally higher and it does not oxidize easily.

(ii) In series arrangement, same current will flow through all the appliances which is not required and the equivalent resistance becomes higher, hence the current drawn becomes less. They are extremely good conductors having a low value of resistivity

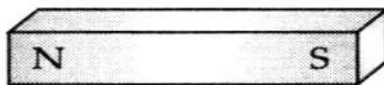
MAGNETIC EFFECTS OF ELECTRIC CURRENT

KEY POINTS

- The black ore of iron (Fe_3O_4) called magnetite; capable of attracting similar pieces of iron is called lodestone. They are naturally existing magnets used by man to find the directions.
- There are two basic laws of magnetism. There are two poles of a magnet namely North pole and South pole. Like poles repel each other, while unlike poles attract each other.
- H.C. Oersted, a Danish physicist first noticed the magnetic effect of electric current. According to him, a needle kept near the wire carrying current will deflect due to the magnetic field produced. Any change in the direction of current will show variation in the deflection.
- Magnet is any substance that attracts iron or iron-like substances.

❖ Properties of magnet

- Every magnet has two poles i.e., North and South.
- Like poles repel each other.
- Unlike poles attract each other.
- A freely suspended bar magnet aligns itself in nearly north-south direction, with its north pole towards north direction.



- The substances which are attracted by a magnet are called magnetic substances. Examples: Iron, nickel, cobalt, steel. The substances which are not attracted by a magnet are called non-magnetic substances. Examples wood, glass, copper, aluminium, brass, paper etc.

❖ Magnetic Field: The area around a magnet in which its magnetic force can be experienced

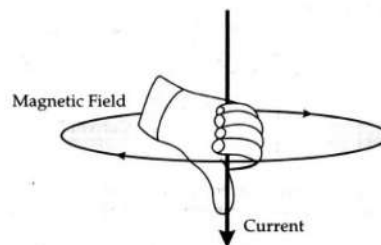
- Its SI unit is tesla (T).
- Magnetic field has both magnitude and direction.
- Magnetic field can be described with help of a magnetic compass.
- The needle of a magnetic compass is a freely suspended bar magnet.

➤ Characteristics of Field Lines

- Field lines arise from North pole and end into South pole of the magnet.
- Field lines are closed curves.
- Field lines are closer in stronger magnetic field.
- 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.
- Direction of field lines inside a magnet is from South to North.
- The relative strength of magnetic field is shown by degree of closeness of field lines.

❖ Right Hand Thumb Rule

- Imagine you are holding a current carrying straight conductor in your right hand such that the thumb is pointing towards the direction of current. Then the fingers wrapped around the conductor give the direction of magnetic field.



❖ Magnetic Field Due to Current Through a Straight Conductor

- It can be represented by concentric circles at every point on conductor.
- Direction can be given by right hand thumb rule or compass.
- Circles are closer near the conductor.
- Magnetic field \propto Strength of current
- Magnetic field inversely proportional to Distance from conductor

❖ Magnetic Field Due to Current Through a Circular Loop

- It can be represented by concentric circle at every point.
- Circles become larger and larger as we move away.
- Every point on wire carrying current would give rise to magnetic field appearing as straight line at centre of the loop.
- The direction of magnetic field inside the loop is same.

❖ Factors affecting magnetic field of a circular current carrying conductor

- Magnetic field \propto Current passing through the conductor
 - Magnetic field $\propto 1 /$ Distance from conductor
 - Magnetic field \propto No. of turns in the coil
 - Magnetic field is additive in nature i.e., magnetic field of one loop adds up to magnetic field to another loop. This is because the current in each circular turn has some direction.
- A coil of large number of turns closely wound on a hollow cylinder of insulated material or otherwise is called a **solenoid**. The end of the solenoid having clockwise current will act as south pole-field enters into, while on the other hand having anti-clockwise current will act as north pole-field comes out. Thus, a solenoid acts as a normal magnet.

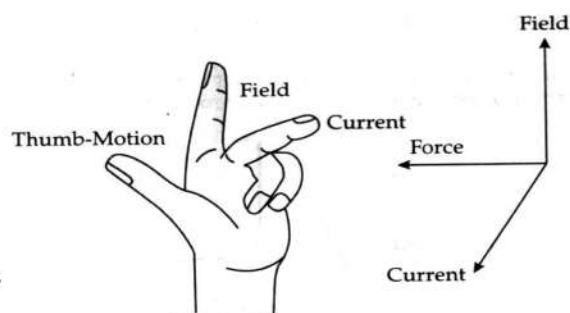
❖ **Per manent magnets** are made of carbon steel, chromium steel, tungsten steel and some alloys like Alnico and Nipermag. Alnico is an alloy of aluminium, nickel and cobalt.

➤ When a material is placed inside a coil carrying current, it will get magnetised. A bunch of nails or an iron rod placed along the axis of the coil can be magnetised by the current allowed to pass through the coil. Such magnets are called electromagnets.

➤ Ampere suggested that when a current I passes through a conductor of length l placed in a perpendicular magnetic field B , then the force experienced is given by $F = IBl \sin\theta$, where θ is the angle between the length of the conductor and magnetic field.

❖ Fleming's Left Hand Rule

Stretch the thumb, fore finger and middle finger of your left hand such that they are mutually perpendicular. If fore finger points in the direction of magnetic field, middle finger in the direction of current then thumb will point in the direction of motion or force.



❖ **Electric motor** is a device used to convert electrical energy to mechanical energy. It works on the principle of force experienced by a current carrying conductor in a magnetic field. The two forces in the opposite sides are equal and opposite.

❖ **Faraday's Law:** The rate at which the magnetic flux linked with a coil changes, produces the induced emf or current. More the rate, more the current and vice-versa.

$$I = \frac{e}{R} = \frac{\text{Change in flux}}{\text{Resistance} \times \text{Time}}$$

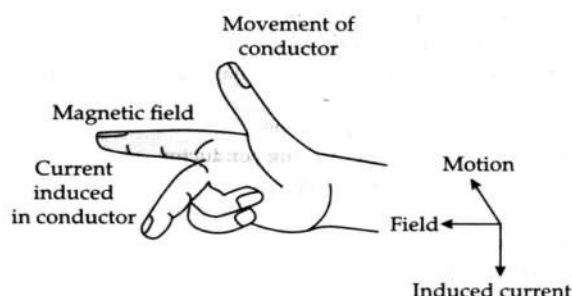
❖ **Fleming's Right Hand Rule**

$R \times t$

Resistance x Time

➤ Hold the thumb, the fore finger and the middle finger of right hand at right angles to each other. If the fore finger is in the direction of magnetic field and thumb points in the direction of motion of conductor, then the direction of induced current is indicated by middlefinger

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



➤ Generator works on the principle of Electromagnetic Induction. It converts the mechanical energy available into electrical energy. A.C. Generator produces potential which reverses after every 1800 rotation of the coil. D.C. Generator means the generator which produces unidirectional current.

❖ **Domestic Electric Circuits**

- An electric circuit consist of three main wiring components:
 - Live wire (positive) with red insulation cover.
 - Neutral wire (negative) with black insulation cover.
 - Earth wire with green insulation cover.
- The potential difference between live and neutral wire in India is 220V.
- Pole → Mainsupply → Fuse → Electricitymeter → Distributionbox → To separate circuits.

Know the Terms

- When a bar magnet is placed on a cardboard and iron-filings are sprinkled, they will arrange themselves in a pattern of lines known as **magnetic field lines**.
- The area around a magnet in which its effect can be experienced is called **magnetic field**.
- When electric current flows through a conductor, a magnetic field is produced around it. This is called magnetic **effect of current**.
- An **electromagnet** is a solenoid coil that attains magnetism due to the flow of current. It works on the principle of magnetic effect of current.
- The production of electric current due to relative motion between a conductor and a magnetic

field is called **electromagnetic induction**. Electric current produced due to this phenomenon is called **induced current**.

➤ When the current flowing through a coil changes, then the current is induced in the coil itself. This phenomenon is called **self induction**.

❖ **Magnetic flux** is defined as the product of the magnetic field and the area through which magnetic field passes perpendicularly. $\phi = NBA$, when field passes perpendicular to the plane of the coil. It is measured in weber. If B and A are at angle θ $\phi = NBA \cos \theta$, where N is the number of turns.

➤ If the current always flows in the same direction, it is called **direct current**. DC can be obtained from a cell or a battery. The positive and negative polarities of DC are fixed.

➤ If the current changes direction after equal intervals of time it is called **alternating current**. The positive and negative polarities of AC are not fixed.

➤ Connecting the outer frame of an appliance to earth to avoid any shock caused by fault or current leakage is called **earthing**.

➤ The coil having many turns used in electric motor or generator is called armature.

➤ **Fuse** is a safety device commonly used in electric circuits. It is connected in the live wire.

Important questions and answers

1. Positively charged particle (alpha-particle) projected towards west is deflected towards north by a magnetic field. The direction of magnetic field is

(a) towards north (b) towards east

Ans. (d) Upward (Apply Fleming's left hand rule).

2. Meena draws magnetic field lines of field close to the axis of a current carrying circular loop. As she moves away from the centre of the circular loop she observes that the lines keep on diverging. How will you explain her observation?

Ans: Meena draws magnetic field lines of field close to the axis of a current carrying circular loop as she moves away from the centre of the circular loop she observes that the lines keep on diverging. Strength of the magnetic field falls as distance increases. This is indicated by the decrease in degree of closeness of the lines of field.

3. Why does a magnetic compass needle pointing North and South in the absence of a nearby magnet get deflected when a bar magnet or a current carrying loop is brought near it. Describe some salient features of magnetic lines of field concept.

Ans: Current-carrying loops behave like a bar magnet. Both a bar magnet and current-carrying loop have a magnetic field around them. It is due to this magnetic field that the magnetic compass placed nearby gets deflected.

Characteristic properties of magnetic field lines:-

a) Magnetic field lines start at a north pole and end at south pole.

b) Magnetic field lines do not intersect each other because there can't be two directions of the magnetic field at any one point.

c) The degree of closeness of the field lines depends upon the strength of the magnetic field. Stronger the field, closer are the field lines. Since, the magnetic field is stronger near the poles, the magnetic field lines are closer near the poles.

4. With the help of a labelled circuit diagram wire describe an activity to illustrate the pattern of the magnetic field lines around a straight current carrying long conducting wire.

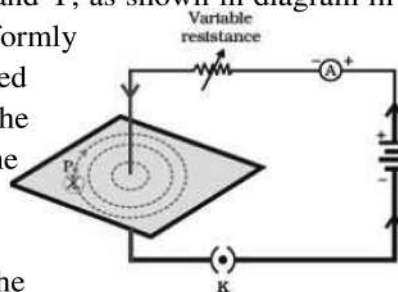
A. Name the rule that is used to find the direction of magnetic field associated with a current carrying conductor.

B. Is there a similar magnetic field produced around a thin beam of moving (a) alpha particles and (b) neutrons? Justify your answer.

Ans: Take a battery (12 V), a variable resistance (or a rheostat), an ammeter (0–5 A), a plug key, and a long straight thick copper wire. Insert the thick wire through the centre, normal to the plane of a rectangular cardboard. Take care that the cardboard is fixed and does not slide up or down.

Connect the copper wire vertically between the points X and Y, as shown in diagram in series with the battery, a plug and key. Sprinkle some iron filings uniformly

on the cardboard. Keep the variable of the rheostat at a fixed position and note the current through the ammeter. Close the key so that a current flows through the wire. Ensure that the copper wire placed between the points X and Y remains vertically straight. Gently tap the cardboard a few times. Observe the pattern of the iron filings. It is observed that the iron filings align themselves showing a pattern of concentric circles around the copper wire. These represent the magnetic field lines.

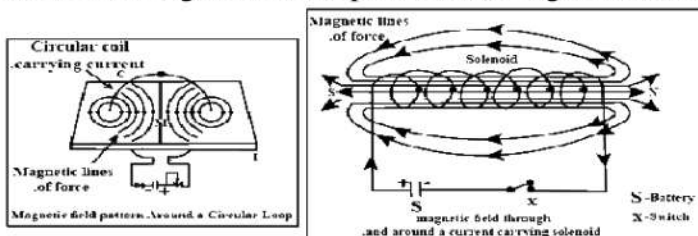


A) Right hand thumb rule

B) Yes, Alpha particles being, positively charged constitutes a current in the direction of motion. No, Neutron being electrically neutral constitutes no current.

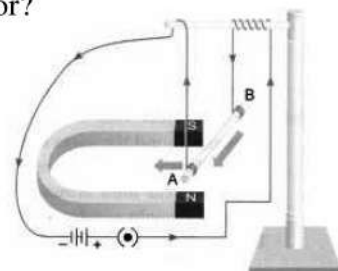
5. Explain with the help of a labelled diagram the distribution of magnetic field due to a current through a circular loop. Why is it that if a current carrying coil has n turns the field produced at any point is n times as large as that produced by a single turn?

Ans: Electric current in a circular loop creates a magnetic field which is more concentrated in the center of the loop than outside the loop. Concentric circles are formed, which are centered at the point on both sides of the loop as shown in figure A. The lines near the center of the loop are almost straight. The magnetic field at the center of the loop is perpendicular to the plane of the loop. The concentric circles become larger as we move away from the wire because as the distance increases from the current carrying conductor the strength of the magnetic field fades away. In same way, when we consider an electric current passing through a circular coil with n number of turns, say a solenoid, the strength of the magnetic field is directly proportional to the number of turns of the solenoid. That is, as the number of turns increases in the coil, the strength of the solenoid also increases. The diagrammatic representation is given above in figure B.



6. Describe the activity that shows that a current-carrying conductor experiences a force perpendicular to its length and the external magnetic field. How does Fleming's left-hand rule help us to find the direction of the force acting on the current carrying conductor?

Ans: According to Fleming's left hand rule, stretch the thumb, forefinger and central finger of your left hand such that they are mutually perpendicular. If the fore finger points in the direction of magnetic field and the central in the direction of current, then the thumb will point in the direction of motion or force acting on the conductor.



A small aluminium rod suspended horizontally from a stand using two connecting wires. Place a strong horseshoe magnet in such a way that the rod lies between the two poles with the magnetic field directed upwards. For this, put the north pole of the magnet vertically below and south pole vertically above the aluminium rod. Connect the aluminium rod in series with a battery, a key and a rheostat. Pass a current through the aluminium rod from one end to other (B to A). The rod is displaced towards left. When the direction of current flowing through the rod is reversed, the displacement of rod across towards right.

7. On what effect of an electric current does an electromagnet work?

Ans. Magnetic effect of electric current

8. What is the frequency of AC (Alternating Current) in India?

Ans. 50Hz

9. On what effect of an electric current does a fuse work?

Ans. Heating effect of electric current

10. Name the sources of direct current.

Ans: Dry cell, dry cell battery, car battery and DC generator, radio and television works only with D.C they have a device in them which convert A.C supplied to them into D.C.

11. Why don't two magnetic lines intersect each other?

Ans: The two magnetic field lines do not intersect each other because if they do it means at the point of intersect the compass needle is showing two different directions which is not possible.

12. What is the role of split ring in an electric motor?

Ans: Split ring is used for reversing the direction of current in the coil. ... Therefore, after every half rotation of the coil the direction of the couple rotating the coil remains the same and the coil continues its rotation in the same direction.

13. What is an earth wire?

Ans: An earth wire is literally a wire that goes down into the earth - also known as an "earth ground." It's meant to be the electrical path that unwanted electricity (such as lightning or a short-circuit) finds easiest to take.

14. What important observation did Oersted make in his experiments with current carrying conductors?

Ans: Oersted found out that for a straight wire carrying Dc current or steady current

- 1) The magnetic field line surrounds the current carrying wire.
- 2) The magnetic field line exists in the plane perpendicular to the wire.
- 3) If the direction of the current is reversed, the direction of the magnetic force reverses.
- 4) The strength of the field is directly proportional to the magnitude of the current.
- 5) The strength of the field at any point is inversely proportional to the distance of the point from the wire.

15. How can you locate a current – carrying wire concealed in a wall?

Ans: We just have to move magnetic compass on the wall since there will be magnetic field produced by a current carrying conductor and because of that magnetic field the needle of compass get deflected from its N S position

16. A freely suspended magnet always points along north – south direction. Why?

Ans: The earth behaves as a magnetic dipole. Therefore a freely suspended magnet always points towards in the north-south direction because the north pole of the suspended magnet attracts the south pole of the earth's magnet which is the geographical north pole of the earth.

17. What type of core should be used inside a solenoid to make an electromagnet?

Ans: A soft iron core is placed inside a solenoid to make an electromagnet. When a soft iron core is placed inside a solenoid, then the strength of the magnetic field becomes very large because the iron core gets magnetized by induction. This combination of a solenoid and a soft iron core is called an electromagnet.

18. Name the SI unit of magnetic field.

Ans: Tesla is the SI unit of magnetic field. $1 \text{ Tesla} = 1 \text{ Weber per square meter}$. Gauss is CGS unit. $1 \text{ Gauss} = 1 \text{ Maxwell per square cm}$. Weber and Maxwell are the corresponding MKS and CGS units for magnetic flux.

19. One day science teacher was teaching in her class, one of her student was very sad. The teacher asked her the reason, the way she responded amaze the students in the class room. She told the teacher of the mishap which took place in her locality where four members of a family died, as they were trying to theft electricity by connecting the conducting wire with the live wire on the street. Now do you think is this practice of electricity theft good, how does one's conscience allows it. What advice would you like to give to improve such mind set?

Ans: No, electricity theft is not good. The proper connection, billing, safety measure can save both property and the life which is more precious.

20. One day Sohan went to his friend's house. He was surprised to see that most of the electrical appliances at his house were functional. For example tube light and fan in all room, two TV's, computer, light of toilet & kitchen were switched on sohan told his friend that this is not the way to use electricity. Now the question arises whether this habit of consuming electrical energy is acceptable or not. Will it not effect like economical condition of family as well as the nation how?

Ans: No, Yes it will affect the economical condition of family as well as the nation because both renewable and mostly non-renewable sources of energy are used to generate large amount of electricity. We should conserve the energy.

21. Are different appliances connected in series or parallel in a house?

Ans: When appliances are connected in a parallel arrangement, each of them can be put on and off independently. This is a feature that is essential in a house's wiring. Also, if the appliances were wired in series, the potential difference across each appliance would vary depending on the resistance of the appliance.

22. Give scientific reasons:-

1. Why copper wire cannot be used as a fuse wire.

Ans: Because it has low resistance and high melting point..

23. Why parallel circuit arrangement best for domestic wiring?

- Parallel arrangement in domestic wiring provides equal amount of energy to all appliances.
- This reduces the equivalent resistance and results in consumption of energy,
- All the appliances can be operate separately.
- Why is the series arrangement not used for domestic circuit?

Ans: In series circuit.....

- All electrical switches will have common switch due to which they cannot be turn on or off separately.
- Overall resistance of circuit will increase due to which the current from power supply will be less

24. Give scientific reasons, why the voltmeter needs to be connected in parallel with resistor?

Ans: Voltmeter is s device which measures the voltage across a resistor. If it is connected in series then it will change the value of potential difference which will minimise the current in the circuit as it has very large resistance and you will get faulty readings.

25. What connection is used in domestic appliances and why?

Ans: Parallel connection is used in domestic appliances. Because parallel connection

- In domestic wiring provides equal amount of energy to all appliances.
- This reduces the equivalent resistance and results in consumption of energy,
- All the appliances can be operates separately.

26. Why an ammeter is always connected in series in a circuit.

Ans: Ammeter measures the current flowing in the circuit. It has low resistance. If it is connected in parallel across any load then all current in circuit will choose lower resistive path (i.e ammeter) to cause its circuit to be damaged. Hence it is used in series.

27. Why does the cord of an electric heater not glow while the heating element does?

Ans: The cord of the electric heater is a good conductor so it does not get heated up and also does not glow. But the heating element of the heater is made up of alloy which has very high resistance, so when current flows through it gets heated up and glows.

28. Why are coils of electric toasters and electric irons made of an alloy rather than a pure metal.

Ans: The resistivity of an alloy is higher than the pure metal and also at high temperatures the alloys do not melt easily.

29. What determines the rate at which energy is delivered by a current?

Ans: The rate at which energy is delivered by a current is determined by

- ❖ Magnitude of current
- ❖ Resistance of the device

30. Distinguish between alternating current and direct current. Explain why alternating current is preferred over direct current for transmission over long distances.

Ans: Alternating Current: If the current changes direction after equal intervals of time, it is called alternating current. The positive and negative polarities of AC are not fixed.

Direct Current: If the current always flows in the same direction, it is called direct current. It can be obtained from a cell or a battery.

The positive and negative polarities of DC are fixed for long distance transmission. AC is preferred as it causes minimum loss of energy during transmission.

31. Why don't two magnetic lines of force intersect each other?

Ans: Magnetic field lines do not intersect each other because there can't be two directions of magnetic field at any one point.

32. Name and state the rule which determines the direction of magnetic field around a straight current carrying conductor.

Ans: Right Hand Thumb Rule: Imagine holding the current carrying straight conductor in your right hand such that the thumb points towards the direction of current. Then the fingers of right hand wrap around the conductor in the direction of field lines of the magnetic field.

SOURCES OF ENERGY

KEY POINTS

- Any system from where energy can be trapped is called a source of energy. Source of energy is capable of providing adequate amount of energy. It should be convenient to use and easy to store and transport.
- **Law of conservation of energy:** Energy can neither be created nor be destroyed, but can be transformed from one form to another.
- ❖ **Qualities of a Good Source of Energy:**
 1. This would do a large amount of work unit mass.
 2. Cheap and easily available.
 3. Easy to store and transport.
 4. Safe to handle and use.
 5. Does not cause environmental pollution.

Fuel: The materials which are burnt to produce heat energy are known as fuels. E.g., wood, coal, LPG, kerosene.

❖ **Characteristics of a Good Fuel:**

High calorific value (give more heat per unit mass).

1. Burn without giving out any smoke or harmful gases.
2. Proper ignition temperature.
3. Easy to handle, safe to transport.
4. Convenient to store.
5. Burn smoothly.

❖ **Sources of Energy**

S. No.	Conventional Sources of Energy	Non-conventional Sources of Energy
(a)	Fossil fuels (Coal, Petroleum)	Solar energy (e.g, solar cooker, solar cell panel)
(b)	Thermal power plant	Energy from the sea (tidal wave, OT energy)
(c)	Hydro power plants	Biomass-plant
(d)	Geothermal energy	Nuclear energy

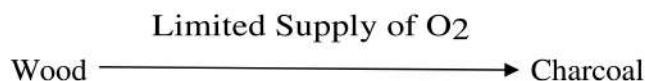
❖ **Conventional Sources of Energy**

- Sources of energy which are known to most of the people e.g., fossil fuels, biomass etc.
- The energy of water flowing through rivers or stored in dam is another potential source of energy. It is also indirect source of solar energy. It is the solar energy which recycles water in nature from oceans and the earth's surface through rain and snow. The energy of water flowing through rivers has been used for rotating the wheels of watermills which are still operating in remote hilly areas.
- The material contained in the bodies of plants and animals is called biomass. It acts as a fuel. It includes waste from tree and grass crops, forestry agricultural and urban wastes. The excreta of living organisms and their bodies after death also contribute to the biomass.
- The dead part of plants and trees and the waste materials of animals and man are called Biomass.

(1) Wood: It is a biomass and used as a fuel for a longtime. Disadvantages:

- Produces a lot of smoke on burning.
- Do not produce much heat.

(2) Charcoal: When wood is burnt in limited supply of air, then water and other volatile materials get removed and charcoal is formed.



Charcoal is better fuel than wood because:

1. It has higher calorific value than wood.
2. Does not produce smoke while burning.
3. It is a compact fuel, easy to handle and convenient to use.

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

- It produces a lot of smoke.
- Cowdung does not burn completely, produces a lot of ash as residue.
- Low calorific value.
- By making bio gas (or gobar gas) from cow dung, we get a smokeless fuel.

(4) Bio gas: It is produced in a biogas plant. Anaerobic micro organisms decompose the complex compound of the cow dung + water slurry. It takes a few days for the decomposition process and generate gases like methane, CO₂, hydrogen and hydrogen sulphide. Bio gas is stored in the gas tank above the digester from which they are drawn through pipes of use.

❖ Alternate or Non-conventional Sources of Energy

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

❖ Reasons for alternate source of energy

- (i) The fossil fuel reserves in the earth are limited which may get exhausted soon if we use them at the current rate.
- (ii) To reduce the pressure on fossil fuels making them last for a much longer time.
- (iii) To reduce the pollution level and to save the environment.

Know the Terms

- The fuels which are obtained from the remains of plants and animals are called fossil fuels, e.g., coal, petroleum and natural gas.
- The material contained in the bodies of plants and animals is called biomass. It acts as a fuel.
- **Bagasse** is the residue of sugarcane after extracting (taking out) juice from them. It is used as fuel in industries.
- **Conventional or Non-Renewable Sources:** Energy sources which are used traditionally for many years and are to deplete over a period of time are called conventional or non-renewable sources. e.g., coal, petroleum, natural gas etc.
- ❖ **Semiconductors** are those substances which have very low electrical conductivity. They are between the good conductors and insulators. If certain impurities are added, their electrical conductivity is increased when sunlight falls on semi-conducting material, their conductance increases.
- An electric motor is a rotating device that converts electrical energy to mechanical energy.

- A generator is the machine that converts mechanical energy into electrical energy. It works on the basis of electro magnetic induction.
- The concentration of salts in water of different seas is different. The difference in concentration of salts in the water of two different seas is called '**salinity gradient**'.

Important questions and answers

1. In a school, there are seventy teachers most of them come by their personal vehicle. Whereas there are many teachers who come from the same place? Is this practice of commuting to school will help nature. Justify it?

Ans: No, excessive use of fossil fuel, pollute the environment, and fossil fuels are non renewable source of energy. We can use car pool.

2. During the natural disaster (Tsunami) at Japan, the nuclear reactors were damaged, due to which hazardous radiation affected the large area.

- i. What will be the reason for this damage?
- ii. How it affected the people and environment?
- iii. Do you think that nuclear energy is good for nature?

Ans: i) Heat evolved during nuclear fission

ii) a. Damage to property & life b. Genetically Disorder c. Infertile soil

iii) Pros & cons of nuclear energy.

3. In a village people burn wood and cow dung as a fuel for basic necessity. In other nearby village, they have bio gas plant in which bio waste is used to prepare bio gas. If we compare the situation of both villages, which practice you will prefer the best and why?

Ans: Second village Qualities of Bio gas fuel.

4. You would have seen at the roofs of the minister's house, hospital, hotels etc, solar panel for electricity and solar heater for hot water is placed. Now a day's most of the people prefer these methods. Why they prefer these types of method? What kind of source of energy is used here? How it will affect our environment?

Ans: Saving of electrical energy, money and Non-polluting.

5. Conserving the energy has become the need of the society & nature, be it in the transport house hold or industries. Energy conservation has been recognized as a national issue for long time. As a responsible citizen of India, what steps would you take to conserve energy?

Ans. i. Use of renewable sources of energy

ii. Population control

iii. Planning trees (afforestation)

6. Why biogas is called a clean fuel?

Ans: Because it- (i) leaves no ash (ii) does not cause pollution (iii) does not produce any poisonous gas.

7. Why are biogas plants considered to be boon to the farmers? Give reason.

Ans: Biogas is considered to be a boon to the farmers because: Farmers can produce clean domestic fuel from the wastes like animal dung, dry leaves, dry plants, etc. Biogas can be used to generate electricity which can be utilized to run modern machines used in the fields to save time and energy.

8. Hydroelectricity generated at a dam may be considered another form of solar energy. Why?

Ans: In Hydro Power, the electricity is harvested from the kinetic energy of water flowing through a turbine. The sun provided the heat energy to cause the evaporation. In considering most form of energy currently known today, almost all can be traced back to the sun as the source of their energy.

9. How is the slurry left over after the generation of biogas in biogas plant used?

Ans: The slurry obtained as a byproduct, left in the biogas plant after the biogas is used up can be used as a manure, which is rich in nitrogen and phosphorous

10. Why is charcoal considered to be a better fuel than wood?

Ans: Charcoal is better fuel than wood because: When the same amount of charcoal and wood are burnt, charcoal produces almost twice the heat produced by wood. Charcoal produces much less smoke than wood. Charcoal is a compact fuel that is more convenient to handle than wood.

11. Modern chulahs are more efficient than traditional chulahs. Why?

Ans: Traditional chulhas emit a lot of smoke. With modifications to design, modern chulhas emit less smoke and sometimes even no smoke. This is attained by complete combustion.

12. I am a force that cannot be created but my form may be changed.

Ans: Energy

13. I am an important part of the system that transforms K.E. / P.E. into electrical energy.

Ans: Generators

14. I am the lightest fuel with a large potential as a source of energy.

Ans: Hydrogen fuel

15. The cost of production of electricity in a thermal power station located in Bihar/Jharkhand/Orissa is less than in Gujarat/Maharashtra. Do you agree? Justify your answer.

Ans: It is because coal is available in Bihar/Jharkhand/Orissa locally, whereas it has to be transported for any thermal power plant in Gujarat/Maharashtra.

16. Why is there so much emphasis on changing over from petrol/diesel driven automobiles to CNG-driven vehicles?

Ans: CNG on burning produces only carbon dioxide and water. It does not produce smoke. It does not leave un-burnt hydrocarbons, lead particulates etc.

17. H_2 has been used as a rocket fuel. Would you consider it as a cleaner fuel than CNG? Why or why not?

Ans. H_2 when burnt in presence of O_2 produces H_2O as the only product with release of lot of heat energy. Water does not cause any damage to environment while CNG during burning produces CO_2 and water. CO_2 is not a pollutant yet it leads to rise in the temperature (global warming), this rise is called green house effect and this will affect polar ice, and life on the earth is at risk. Thus, H_2 is a cleaner fuel than CNG.

18. How is the supply of electricity maintained in a windmill when there is no wind? In a solar panel when there is no sun?

Ans. In both the cases, the electricity generated is stored in a battery. This battery provides electricity when there is no wind in the case of a windmill and no sun in the case of a solar panel.

19. Why do you think that nuclear energy is bound to play an increasingly important role in India?

Ans: Nuclear energy is expected to play an increasingly important role in India due to following reasons,

(i) India has limited reserves of coal and petroleum. Nuclear energy minerals like Thorium are found in plenty in India.

(ii) Hence, nuclear energy can compensate for deficiency of fossil fuels.

(iii) Nuclear power stations can be established easily and conveniently in those areas where other sources are not available. It is very economical too.

(iv) Nuclear power releases tremendous amounts of energy. India can utilize this energy for peaceful purposes such as generation of electricity that can be used to run machines and industries.

20. What is wind energy? List out the merits and demerits

Ans: The kinetic energy of the moving wind is used to rotate blades to produce electrical energy

Merits	Demerits
1. Doesn't cause pollution	1. Setting up of wind energy farms is expensive.
2. It is renewable source of energy	2. Cannot be established in all places and requires more land.
	3. Minimum speed of wind is 15km/h

21. Name the major constituents of Bio-gas. List out the merits of Bio mass

Ans: The major constituents of Bio-gas is Methane (about 75%) and hydrogen.

Merits of bio mass:

1. Causes less pollution
2. Improves fertility of soil

OUR ENVIRONMENT

KEY POINTS

- Everything that surrounds us is environment. It includes both living (biotic) and non-living (abiotic) components.
- Interaction between these biotic and abiotic components forms an ecosystem.
- Human activities lead to environment problems such as depletion of ozone layer and production of huge amount of garbage.

❖ The flow of energy through different steps in the food chain is unidirectional. This means that energy captured by autotroph does not revert back to the solar input and it passes to the herbivores.

Flow of energy between trophic levels

- ❖ Flow of energy in a food chain is unidirectional.
- ❖ Green plants capture 1% of sunlight and convert it into food energy.
- ❖ **10 percent law:** Only 10% of energy is transferred to the next trophic level. The remaining 90% energy is used in life processes (digestion, growth, reproduction etc.) by present trophic level.
- ❖ Due to this gradual decrease in energy, food chains contain 3–4 trophic levels.

Biological magnification: The concentration of harmful chemicals increases with every next trophic level in a food chain. This is called biological magnification.

- ❖ Maximum concentration of such chemicals get accumulated in human bodies as humans occupy the top level in any food chain.

Ozone Depletion

Ozone (O₃) is an isotope of oxygen i.e., it is a molecule formed by three atoms of oxygen. Ozone performs an essential function of shielding the surface of the earth from ultraviolet radiation of the sun.



- ❖ Ozone layer is a layer of the earth's atmosphere in which most of the atmospheric Ozone is concentrated.
- ❖ Ozone layer protects the earth from harmful radiations.
- ❖ There are several reasons for depletion of ozone layer.
- ❖ The foremost is the use of chlorofluorocarbons (CFCs). The other factor responsible for ozone destruction is the pollutant nitrogen monoxide (NO).
- ❖ When the harmful chemicals like chlorofluorocarbons (CFCs) are released into the air, it accumulates in the upper atmosphere and reacts with ozone resulting in reduction in thickness of the ozone layer.
- ❖ Thus, the ozone layer in the atmosphere becomes thinner and gets depleted allowing more ultraviolet rays to pass through it.
- ❖ The Antarctic hole in ozone layer is caused due to chlorine molecules present in chlorofluorocarbons (CFCs) that are used by human beings.

Garbage disposal

- ❖ Improvements in lifestyle have resulted in accumulation of large amounts of waste materials.
- ❖ Garbage contains following type of materials:

Some methods of waste disposal

- a **Biogas plant:** Biodegradable waste can be used in biogas plant to produce biogas and manure.
- b **Sewage treatment plant:** The drain water can be cleaned in sewage treatment plant before adding it to rivers.
- c **Land fillings:** The wastes are buried in low lying areas and are compacted by rolling with bulldozers.
- d **Composting:** Organic wastes are filled in a compost pit and covered with a layer of soil, after about three months garbage changes to manure.
- e **Recycling :** Non-biodegradable waste are recycled to make new items.
- f **Reuse:** It is a conventional technique to use an item again e.g., newspaper for making envelopes.

Know the Terms

- ❖ **Flow of Energy:** The flow of energy through different steps in the food chain is unidirectional. This means that energy captured by autotroph does not revert back to the solar input and it passes to the herbivores. It moves progressively through various trophic level.

Important questions and answers

1. Which of the following is the full form of UNEP?

- (a) United Kingdom of Africa (b) United State of America
(c) United Nations Environment programme (d) Union English programme

Ans: (c) United Nations Environment programme

2. Why is the ozone layer getting depleted at the higher levels of the atmosphere?

Ans: Ozone is present at higher levels of the atmosphere where CFC – Chlorofluorocarbons reach, chlorine separates and acts on O_3 to split it into O_2 and (O). The conditions required to do this are available at higher levels i.e., clouds and sunlight.

3. Write any three informations which are obtained from the energy flow diagrams.

Ans: The information we get are:

- (i) The energy flow is unidirectional, it flows from sun → Autotrophs → herbivores → carnivores → decomposers
- (ii) The flow of energy is 10% i.e., 90% of the energy is used by a given level of food chain for metabolic activities.
- (iii) The unwanted chemicals like pesticides get accumulated in the highest organism in the food chain.

4. "Damage to the ozone layer is a cause of concern". Justify this statement suggest any 2 steps to limit this damage.

Ans: Ozone is a molecule of oxygen with 3 atoms i.e., O_3 . It is formed due to sunlight at higher levels with higher wavelength. Ozone is found in stratosphere shielding the earth by protecting it and by not allowing UV rays to reach the earth. If these rays will reach the earth then many harmful diseases are caused like skin cancer, cataract, it also affects the growth of plants and vegetation.

Two steps to limit the damage of this layer are:

- (i) Do not use aerosols, or any products which will release CFC (chlorofluorocarbon) in the atmosphere.
- (ii) Ban on use of CFC as refrigerant and in fire extinguishers.

5. All eco-club students collect the vegetable peels from canteen and use them in compost pit made in their school.

- (a) Name items that can be added in compost pit other than vegetable peels.
- (b) What type of reaction is seen in the pit?
- (c) State the values seen among eco-club members.

Ans: (a) Students can use leftover food and fruit peels, dried leaves.

(b) Fermentation i.e., anaerobic decomposition.

(c) The eco-club students show team work, collaborative work and good behavior.

6. Why is sun considered to be the ultimate source of energy?

Ans: The sun is called the ultimate source of energy because it is the source of almost all energies of the earth. -> Plants make food using sunlight; the food that we get from plants and animals also has its prime source as sunlight.

7. Explain why, when energy flows in a food chain the maximum energy is found in the lowest trophic level and the least energy is found in the top most trophic level?

Ans: Energy decreases as it moves up trophic levels because energy is lost as metabolic heat when the organisms from one trophic level are consumed by organisms from the next level. Trophic level transfer efficiency (TLTE) measures the amount of energy that is transferred between trophic levels.

8. Vultures feed on dead animals. It was found that vultures when laid eggs it could not hatch the young ones as some chemical interfered in the food chain. What is this process called?

Ans: Bio-magnification

9. It is often advised to stop our vehicles engine at red light and also to drive car / vehicles at constant speed. Based on the above statement, answer the following question.

- i. Which type of fuel is used in vehicles? Is it renewable or non renewable?
- ii. How can you contribute towards saving these fuels at your level?

Ans. Fossil fuel – non renewable i. travelling in Metro (MRTS) / Public transport

ii. Opting for CNG as a motor fuel instead of petrol & diesel.

10. Number of vultures is decreasing remarkably. Now a day which is a matter of concern?

- i. Vultures belong to which category of animal.
- ii. What is their role in nature to maintain ecological balance?

Ans. i. Scavenger ii. Help in recycling in nature by eating dead animals,

11. Newspaper reports about the alarming increase in pesticides level in packed food items Some of states have even banned these food items.

1. What are the sources of these pesticides in these food items?
2. Name the biological phenomenon associated with accumulation of pesticide in the food chain.

Ans. 1. Chemicals (Pesticides, Fertilizers) used in agricultural practices.

2. Biological magnification.

12. Ozone depletion / Ozone hole is a cause of concern now a days.

1. What are the causes of ozone depletion?
2. As students what steps will you advise to reduce ozone depletion?

Ans. 1. Chlorofluoro carbon (CFCs) released into atmosphere disintegrate the ozone molecule.

2. Stop using devices that release CFCs.

13. Acid rain is causing damage to monuments / Buildings etc. and also harms the flora and fauna.

- a.. What is the cause of acid rain?
- b.. What essential changes in our daily life can lie done to prevent acid rain / damage caused by acid rain?

Ans: a.. Oxides of Nitrogen & sulphur released from vehicular & industrial emissions on mixing with rain water produces acid rain.

b.. Traveling in metro (MRTS) instead of fossil fuel driven vehicles.

14. Plastic production is increasing day by day in spite of the fact that plastic is harmful for the environment. Based on the above statement answer the following,

- i. What are the harmful effects of plastic usage?
- ii. In our day to day situation what are the alternatives that we can use instead of plastics.

Ans: i. Environmental pollution, Burning plastics can cause pollution, Plastic cause harm to the cattle / animals if enter inside their alimentary canal.

ii. Paper bags / jute bags can be used instead of plastic bag.

15. Why some substances are degraded and others not?

Ans: Different components of food are changed to simpler substances by digestive enzymes and these enzymes are very much specific in nature and action. Similarly, substances are broken down by bacteria and saprophytes. They are also very specific in action and break down of the particular substance. Therefore, some substances are biodegradable and others are non-degradable.

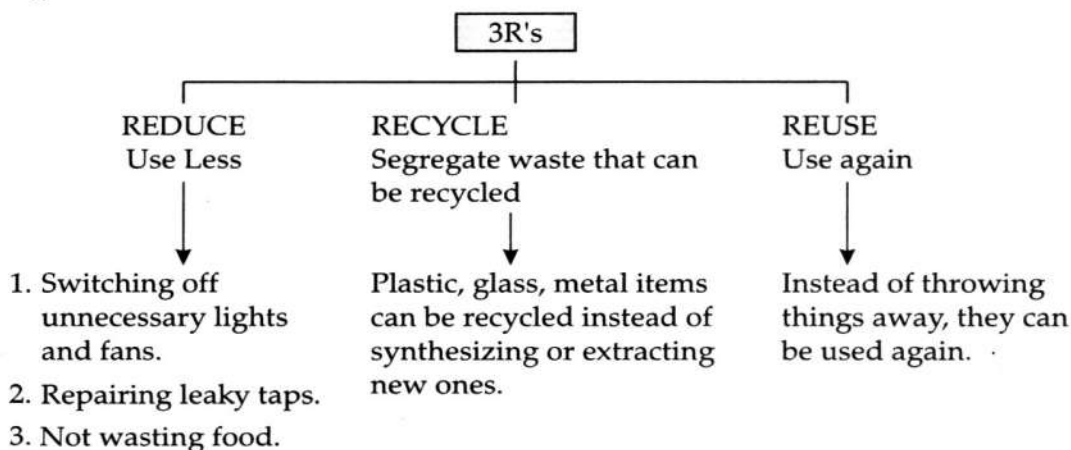
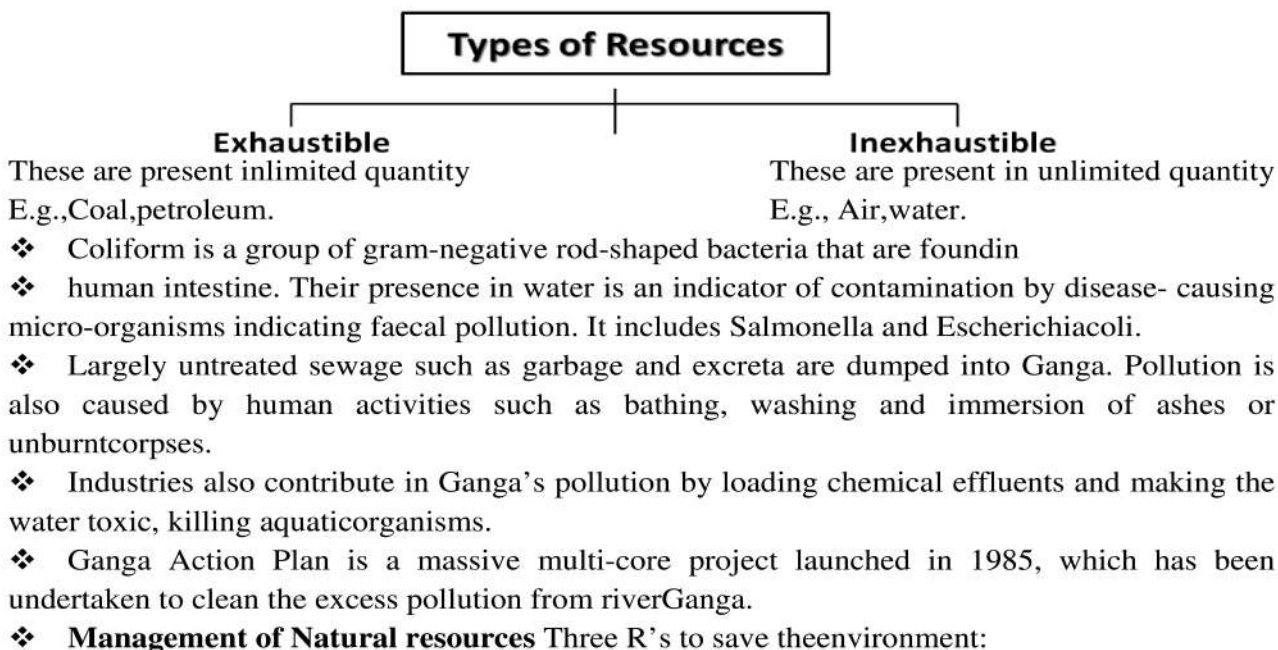
16. How can you help in reducing the problem of waste disposal? Give any three methods.

Ans: By minimizing the use of disposable items and promoting the use of recycled articles, separating the biodegradable and non-biodegradable wastes before dumping them and recycling the non-biodegradable wastes material.

MANAGEMENT OF NATURAL RESOURCES

KEY POINTS

Natural Resources: Anything in the environment 'which can be used' is called natural resource. For example, soil, air, water, forests, wildlife, coal and petroleum.



❖ Sustainable Management

Management of resource wisely so they meet current basic human needs while preserving them for the needs of future generations.

❖ The management of natural resources require:

1. Long term perspective so that these will last for generations to come.
2. Ensure equitable distribution of resources so that all economic sections benefit from these resources.
3. Safe disposal of waste.

- ❖ The objective of sustainable development is to provide the economic well being to the present and the future generations and to maintain a healthy environment and life support system.
- ❖ pH stands for 'Potential of Hydrogen'. It is negative logarithm (base 10) of the hydrogen ion concentration in moles per litre.
- ❖ The acidic and basic character of aqueous solutions can be described in terms of hydrogen ion and hydroxide ion concentration.
- ❖ Pollutant is the substance that causes a harmful change in the environment, thereby producing adverse effects on living organisms. Some of the common pollutants include pesticides, industrial wastes and emissions, exhaust fumes from vehicles and sewage.
- ❖ Biodiversity is the existence of a wide variety of species of plants, animals and micro-organisms in a natural habitat within a particular environment or of genetic variation within a species.
- ❖ Forest is a 'biodiversity hotspot' because it is an area where number of species or range of different life forms exists.
- ❖ Wildlife means all those naturally occurring animals, plants and their species which are not cultivated, domesticated and tamed.
- ❖ Conservation is the sensible use of the earth's natural resources in order to avoid excessive degradation and betterment of the environment.
- ❖ Afforestation is the practice of transforming an area into forest, usually when trees have not grown there, and involves three types of forestry programmes.
- ❖ Social and environmental forestry involves raising of trees for firewood, fodder, agricultural implements for the benefits of rural and tribal community.
- ❖ Agro-Forestry is an absolute commercial forestry developed to fulfil the need of various forest-based industries.
- ❖ It is done on the fallow land or free-grazing lands.
- ❖ Urban forestry involves growing of ornamental trees along roads, vacant lands and common parts of urban areas.
- ❖ Large reservoirs of petroleum have been preserved by nature for millions of years between porous rocks beneath the earth.
- ❖ Non-renewable energy sources are energy sources which cannot be replaced easily when they get exhausted and are also called conventional sources of energy. They are used traditionally for many years and take millions of years to form fossil fuels.
- ❖ The fossil fuels, coal and petroleum get exhausted and their combustion pollutes our environment, so a judicious use of these resources is necessary.
- ❖ Necessity of judicious use of coal and petroleum: The fossil fuels, coal and petroleum will get exhausted and their combustion pollutes our environment, so a judicious use of these resources is necessary.
- ❖ When combustion takes place, oxides of carbon, hydrogen, nitrogen and sulphur are formed.
- ❖ Carbon monoxide is formed instead of carbon dioxide if there is insufficient air.
- ❖ The oxides of sulphur, nitrogen and carbon monoxide are poisonous at high concentrations.
- ❖ Carbon dioxide is a greenhouse gas which leads to global warming.

❖ **Water for all**

- a) Water is the basic necessity for all terrestrial forms of life.
- b) Rain is an important source of water.
- c) Irrigation methods like dams, tanks and canals have been used in various parts of India.

❖ **Dams**

Dams ensure the storage of adequate water for irrigation and are also used for generating electricity. Various dams have been built on rivers to regulate the flow of water.

- E.g., a) Tehri Dam — On river Ganga
 b) Sardar Sarovar Dam — On river Narmada
 c) Bhakra Nangal Dam — On river Satluj

❖ **Advantages of Dams**

- a) Ensures adequate water for irrigation.
- b) To generate electricity.
- c) Continuous supply of water to cities and towns.

❖ **Disadvantages of Dams****a) Social problems:**

- (i) Many tribals and peasants are displaced and rendered homeless.
- (ii) They do not get adequate compensation or rehabilitation.

b) Environmental problems:

- (i) Deforestation
- (ii) Loss of biodiversity
- (iii) Disturb ecological balance

c) Economic problems:

- (i) Huge amount of public money is used.
- (ii) No proportionate benefit to people.
- (iii) No equitable distribution of water.

❖ **Rain Water Harvesting**

Rain water harvesting is to make rain water percolate under the ground so as to recharge 'groundwater'.

Know the Terms

- ❖ **Natural resources:** They are the stock of the nature such as air, water, soil, minerals, coal, petroleum, forest and wildlife that are useful to mankind in many ways.
- ❖ **Pollution:** It is defined as the undesirable change in physical, chemical or biological characteristics of our soil, air or water, which harmfully affect human lives or the lives of other species.
- ❖ **Pollutant:** It is the substance that causes a harmful change in the environment, thereby producing adverse effects on living organisms. Some of the common pollutants include pesticides, industrial wastes and emissions, exhaust fumes from vehicles and sewage.
- ❖ **Sustainable Development:** It is the development which can be maintained for a long time without undue damage to the environment.
- ❖ **Biodiversity:** It is the existence of a wide variety of species of plants, animals and micro-

organisms in a natural habitat with in a particular environment or of genetic variation with in aspecies.

- ❖ **Wildlife:** It means all those naturally occurring animals, plants and their species that are not cultivated, domesticated and tamed.
- ❖ **Conservation:** It is the sensible use of the earth's natural resources in order to avoid excessive degradation and betterment of the environment.

Important questions and answers

1. In spite of plenty rainfall in monsoon in some areas of India, there is failure to sustain water availability. Give reasons.

- Ans.** (i) Loss of forest cover prevents rainwater from seeping down the ground.
(ii) Underground water is not recharged.

2. An environmentalist on visit to your school suggested the use of three R's to save the environment. Explain what he meant by three R's and how you would follow his advice at home.

Ans. The 3R's to save the environment means:

- (i) Reduce—It means we should use less resources. The demand of exploiting resources should be reduced by switching off lights, fans when not required, by not wasting paper, pencil etc.
- (ii) Recycle—It means, to make new products from the old, used ones, e.g., recycle used paper, plastic bags, glass material and metals like tins, cans, foils etc.
- (iii) Reuse—It is the best option i.e., use the things, materials again and again. e.g., use the envelope which was already used, make use of plastic bottles, jam and pickle containers etc.

3. Pritam stays in a village near a forest. He plays the best role of being a stakeholder of the forest by taking care of it, reporting on illegal cutting down of trees and forest fire etc.

- (a) Name two industries based on forest produce.
- (b) Give two causes of forest depletion in India.
- (c) What values are reflected in Pritam?

Ans. (a) Paper, timber. (b) Deforestation and forest fires.

- (a) Pritam shows the values of personal responsibility and participating citizenship.

4. Arjun's father dropped him to school every day in his car but when he learnt about the pollution he started using school transport thereafter.

- (a) Give two disadvantages of using fossil fuel.
- (b) Why should we use these resources wisely and judiciously?
- (c) What value of Arjun is reflected?

Ans. (a) The two disadvantages of using fossil fuels are: It causes pollution and it is expensive resource which cannot be replenished.

- (b) These resources are limited and take long time in formation.
- (c) Arjun is showing responsible behavior and self-discipline.

5. Today we encounter the problem of water shortage, although it rains well in rainy season. 'Khushi society' has made a provision of rainwater harvesting.

- Suggest two methods of rain water harvesting.
- How can you store water without any water-borne diseases and germs multiplying in it?
- What values are seen in the members of society?

Ans. (a) Roof top and underground rain water harvesting.

(b) In close tanks and underground tanks.

(c) Members show responsible behavior, socially just interaction and team work.

6. The forest is located in a place where villages and tribals are dependent on it. Industrialist is the stakeholder of the forest who is cutting down the trees for profits. What could be the harmful effect of this on forest, local people and environment?

Ans: Conservation of forests and wildlife is necessary to protect the biodiversity. This is important because loss of biodiversity leads to ecological imbalance.

7. Human actions are leading to environmental problems. But we need not feel powerful or helpless as there are many things we can do to make a difference. Keeping in view the above statement answer the following questions:-

- What are the three R's which can make a difference in our environment?
- How can you contribute at your own level to save the environment?

Ans. 1. Reduce, reuse and recycle

2. By becoming Eco-friendly

3. By planting trees, by not throwing garbage etc.

8. An environmentalist on visit to your school suggested the use of three R's to save the environment. Explain what he meant by three R's and how you would follow his advice at home.

Ans: Three R's to save the environment: We can reduce pressure on the environment by applying the maxim of 'Reduce, Recycle and Reuse' in our lives.

Reduce means 'to use less' by switching off unnecessary lights and fans to save electricity, by repairing leaky taps to save water and by not wasting food.

Recycle means to collect plastic, paper, glass and metal items and recycle these materials to make required things. In order to recycle, firstly segregation of waste is necessary so that materials that can be recycled are not dumped along with other wastes. Reuse means 'to use things again and again'. The used envelopes can be reversed and used again instead of being thrown away. The plastic bottles of food items like jam or pickle can be used for storing things in the kitchen.

9. Chipko movement was started in 1970s in a small village of Garhwal high up in Himalayas villagers stood against greedy contractors. Women folk hugged the trees. The chipko – movement spread slowly to all nearby areas under the leadership of Shri Sunder Lal Bahuguna.

- Do you feel inspired by this movement which prevented felling of trees?
- Do you think that local people are real stake holders?
- Which old belief has been challenged by chipko movement?

Ans: 1. Yes

2. Yes

3. Chipko movement has challenged the old belief that forests are meant only for timber. Gift of trees to us is soil, water, oxygen.

10. There are certain N.G.Os which motivates the general public to donate clothes books toys, stationary items, utensils etc to them. There N.G.O.s further segregate and distribute these items to the needy. In your opinion what objective / objectives are fulfilled by this initiative?

Ans: 1. Good initiative approach of reuse
2. Sensitizing general public towards community

11. Reena is a student of class X of a Govt. School she is a member of Eco club“ of her school. What suggestions would like to give Reena to improve the environment in her school?

Ans: 1. Growing plants and trees in the open area in the school.
2. Arrangement for water harvesting
3. Reporting any kind of water leakage in the school.

12. Human population was less in early days. Men used to live in harmony with nature however, in present time tremendous growth of population and science & technology is resulting in fast depletion of natural resources.

1. Don't you think, it is high time that humans should realize that their own survival is in danger if they do not follow the path of sustainable development?
2. What are the ill effects of unsustainable development?
Ans: 1. Yes 2. Global warming, degradation of environment health hazards.

13. My sister is in habit of keeping the tap open while brushing her teeth. She loves to bathe under shower. My neighbor uses hosepipe attached to drinking water supply pipe for washing his scooter & car. According to me their way of handling the most precious source water is absolutely wrong.

1. Do you agree with me or not?
2. What changes in the above situation can be done to conserve water.

Ans: 1. Agreed
2. One should minimize use of water, should not keep the taps open when not in use, should use bucket of water for cleaning purpose for taking bath, as these practices consume less water.

14. Govt. of India has recently instituted an Amrita Devi Bishnoi National Award for wildlife conservation in the memory of Amrita Devi Bishnoi. Who sacrificed her life along with 363 others for the protection of khejri trees near Jodhpur in Rajasthan?

Based on the above statement answer the following question.

1. How trees are important to us?
2. How can you protect trees?
3. What is the significance of Van Mahotsava?

Ans: 1. Trees are the basis of human and animal life; no life can exist without them. We are directly or indirectly dependent on the trees for all our requirements.

2. We can protect trees by taking care of these and by reducing our needs and by not wasting the paper.

3. Mahotsava is the festival celebrated to enhance the plantation of trees

15. Sneha and Sugandha are friends. Sneha belongs to a rich family and she believes in throwing and discarding the things after use while Sugandha does not like wastage and she reused the things. Based on above information answer the following questions :-

1. How reusing the things avoid wastage.

2. List any two examples where you can reuse the things.

3. What change can you make in your habits to become more Eco-friendly.

Ans.1. Reusing means using the things again and again thus without wastage of any energy we can use the things.

2. Old envelop and old news papers can be used to make cards, pots, decorative pieces etc.

3. By adopting the principles of three 'R's we can make ourselves Eco-Friendly.

16. Business is not only about accumulating wealth and glory. It is not about growth for the sake of size. It is about being a good corporate citizen and the admirer of the environment. How can you say that being a good citizen is more important than becoming a successful businessman? How can you become a good and responsible citizen?

Ans. Being a good citizen is more important than becoming a successful business man because if we are not good citizen our action will take our country towards destruction.

17. Water is one of our most precious commodities and no life can survive without it. It has been predicted that water scarcity will become the subject of "Wars" in the near future.

1. Write any two ways in which water is getting polluted?

2. Write any two measures to stop water pollution at your level?

Ans: 1. By industrial waste.

2. By human activities.

3. By not throwing waste materials and garbage into water.

4. By sensitizing people about harmful effects of water pollution. Or any other methods.

18. Tourism sector is a major source of income for Govt. To obtain more income the hills are being converted into tourist places where rest houses and resorts are made and millions of tourists visit those hills. They throw plastic covers, bottles and other litter there and destroy them. As a responsible citizen of the country what two precautions you would take while visiting tourist place.

Ans: While visiting to tourist places we should not throw garbage and waste materials. We should not try to temper with the natural beauty of that place.

19. Give any four reasons to stop the usage of fire wood as a source of fuel.

- Ans:** 1. It leads to cause deforestation
2. It has low calorific value
3. It requires in large quantity
4. It leads to cause high pollution.

20. What are “biodiversity hot spots”? What is the measure of the biodiversity?

Ans: Forests are “biodiversity hot spots”. One measure of the biodiversity of an area is the number of species found here.

21. Why is dependence of man on nature greater than that of any other organism?

Ans: Man’s dependence on the environment is greater than that of other organisms because man:

- (a) Develops curiosity for more comforts and security.
- (b) Consumes large amount of material and energy.
- (c) Develops a new kind of socio-economic environment which consists of things developed by man through his tools and techniques.

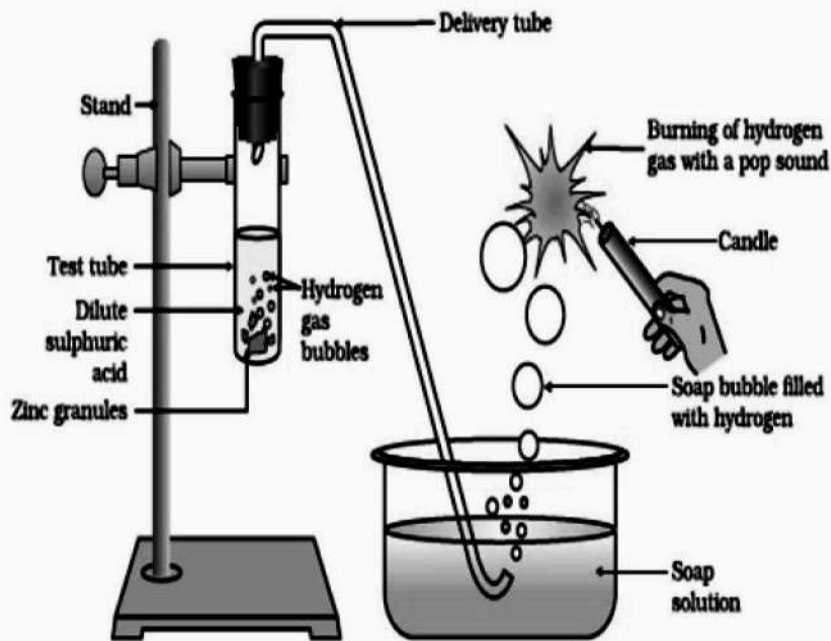
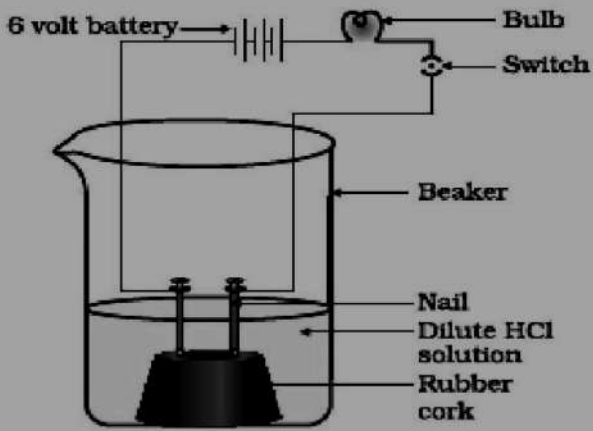
22. In addition to low rainfall, what are the other reasons for non-availability of water in arid and semi-arid zones of our country?

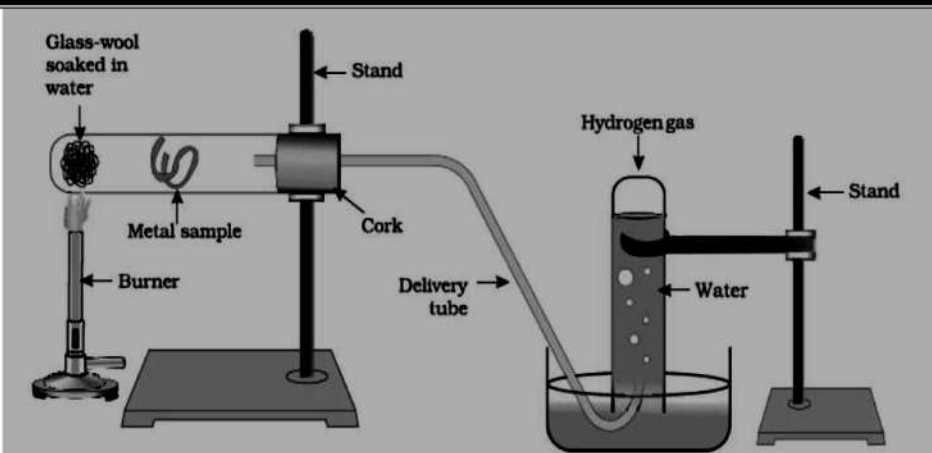
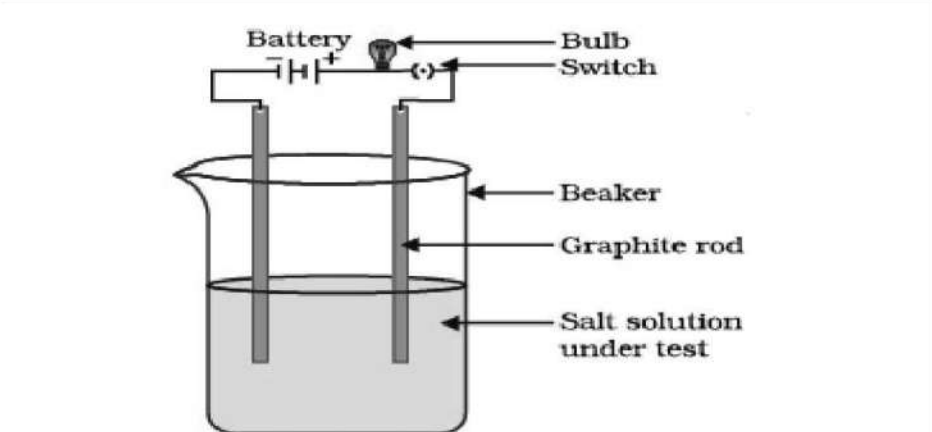
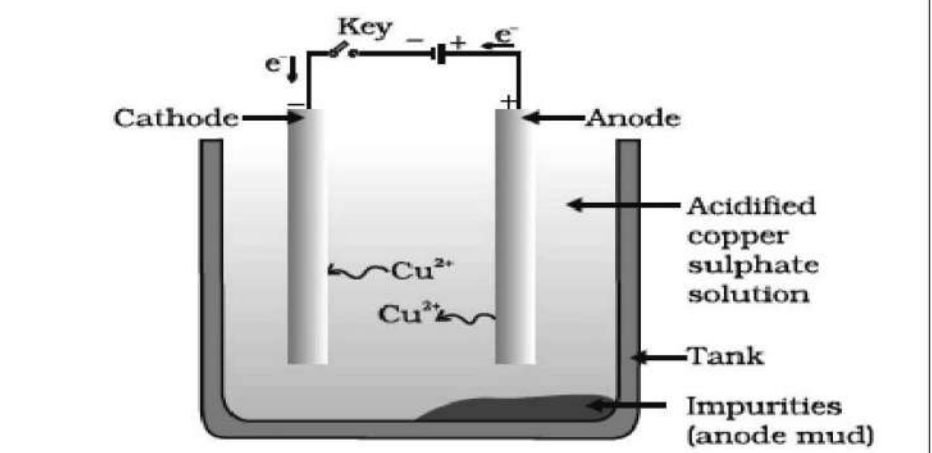
Ans: (a) Flowing of rain water and lack of management to harvest it.

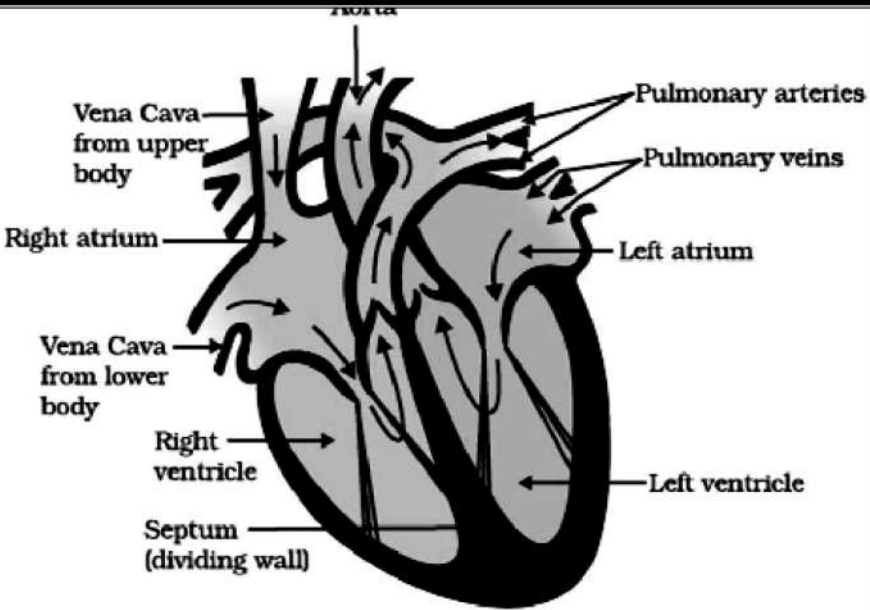
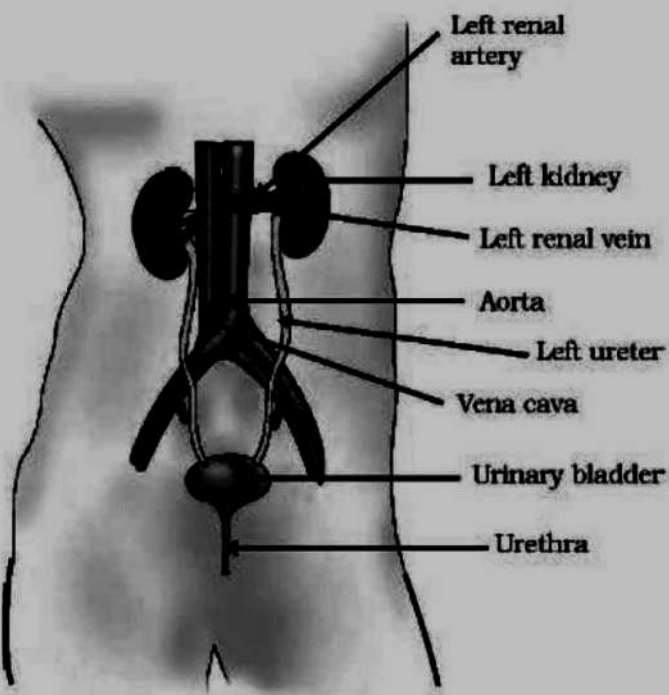
(b) Ground water is pumped out for high water demanding crops.

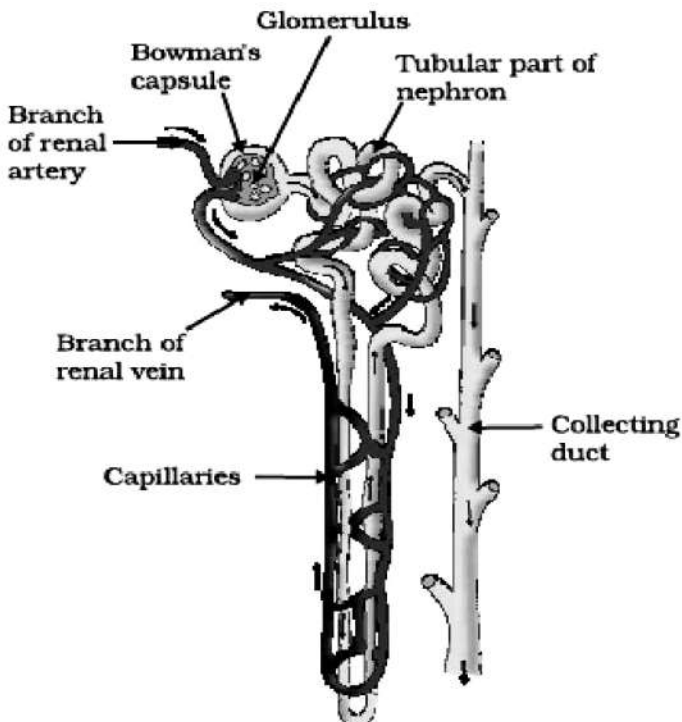
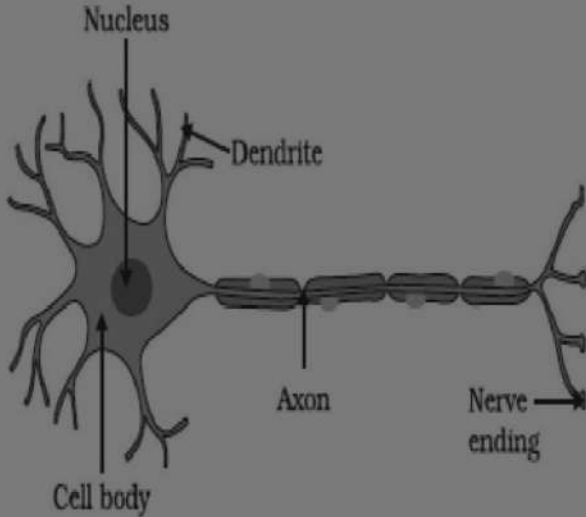
(c) Water becomes unsafe and unusable due to mixing of urban wastes and effluents from the industries.

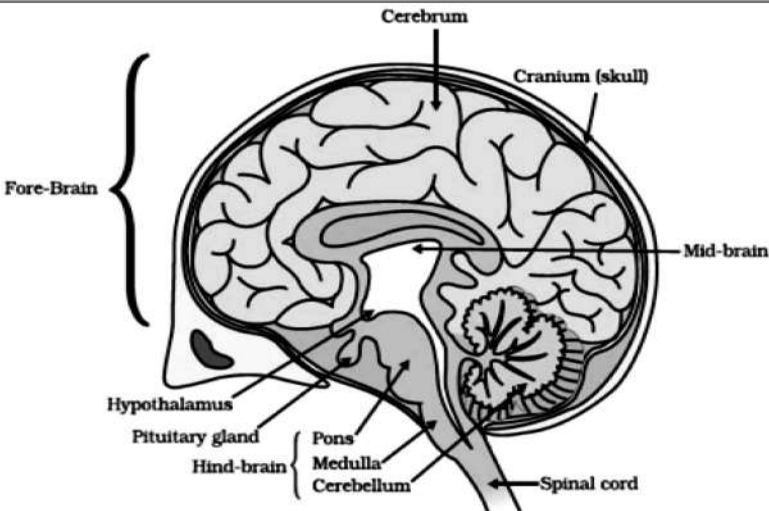
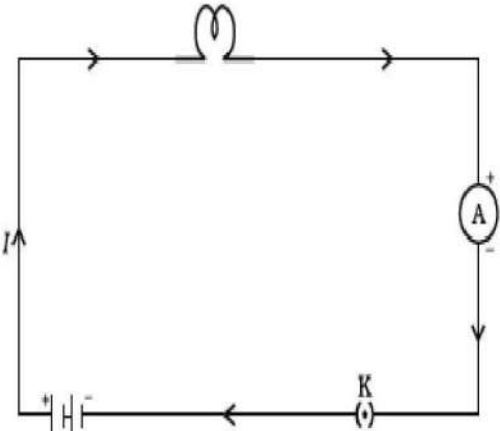
IMPORTANT DIAGRAMS

SL NO	CHAPTER	NO	DIAGRAM
1	Chapter 2 Acids, Bases & salts	2.1	 <p>The diagram illustrates the reaction of zinc granules with dilute sulphuric acid. A test tube containing zinc granules and dilute sulphuric acid is held by a stand. Bubbles of hydrogen gas are shown rising from the granules. A delivery tube leads from the test tube into a beaker of soap solution. Bubbles of hydrogen gas are shown rising from the delivery tube into the soap solution. A hand is shown holding a candle, lighting a soap bubble filled with hydrogen gas, which is shown burning with a pop sound.</p> <p>Reaction of zinc granules with dilute sulphuric acid and testing hydrogen gas by burning</p>
2	Chapter 2 Acids, Bases & salts	2.3	 <p>The diagram shows an electrical circuit used to test the conductivity of an acid solution. A 6 volt battery is connected to a bulb and a switch. The circuit is completed by a nail submerged in a beaker containing dilute HCl solution. The beaker is sealed with a rubber cork. The bulb glows, indicating that the acid solution in water conducts electricity.</p> <p>Acid solution in water conducts electricity</p>

3	Chapter 3 Metals & Non-Metals	3.3	 <p>Action of steam on a metal</p>
4	Chapter 3 Metals & Non-Metals	3.8	 <p>Testing the conductivity of a salt solution</p>
5	Chapter 3 Metals & Non-Metals	3.12	 <p>Electrolytic refining of copper</p>

6	Chapter 6 Life Processes	6.10	 <p>A schematic sectional view of the human heart. The diagram shows the four chambers: the right atrium and right ventricle on the left side of the image, and the left atrium and left ventricle on the right side. The septum, a dividing wall, separates the right and left sides. Arrows indicate the flow of blood: deoxygenated blood enters the right atrium from the vena cava (upper and lower body), moves to the right ventricle, and is pumped out through the pulmonary arteries. Oxygenated blood enters the left atrium from the pulmonary veins, moves to the left ventricle, and is pumped out through the aorta. Labels include: Vena Cava from upper body, Vena Cava from lower body, Right atrium, Right ventricle, Septum (dividing wall), Pulmonary arteries, Pulmonary veins, Left atrium, and Left ventricle.</p> <p>Schematic sectional view of the human heart</p>
7	Chapter 6 Life Processes	6.13	 <p>A diagram of the human excretory system. It shows the left kidney connected to the left renal artery and left renal vein. The left ureter carries urine from the kidney to the urinary bladder. The vena cava is shown as a large blood vessel. The urethra leads from the bladder. Labels include: Left renal artery, Left kidney, Left renal vein, Aorta, Left ureter, Vena cava, Urinary bladder, and Urethra.</p> <p>Excretory system in human beings</p>

8	Chapter 6 Life Processes	6.14	 <p>Structure of a nephron</p>
9	Chapter-7 Control & co-ordination	7.1(a)	 <p>Structure of neuron</p>

10	Chapter-7 Control & co-ordination	7.3	 <p style="text-align: center;">Human brain</p>
11	Chapter-12 Electricity	12.1	 <p style="text-align: center;">Schematic diagram of an electric circuit comprising – cell, electric bulb, ammeter and plug key</p>

12 Chapter-
12
Electricity

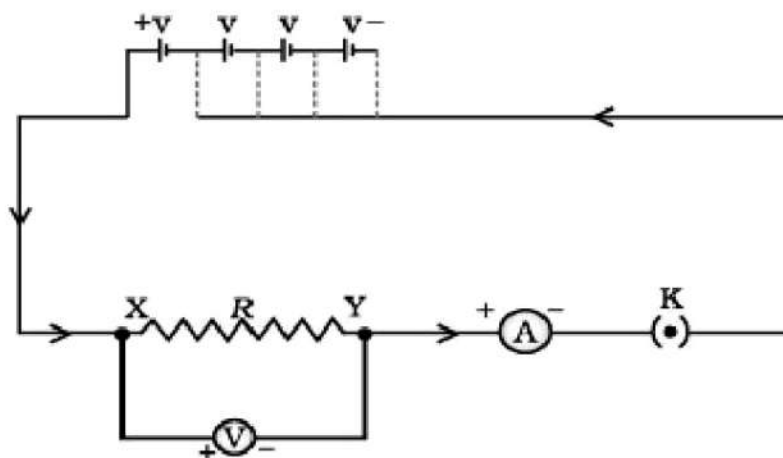
12.1

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	

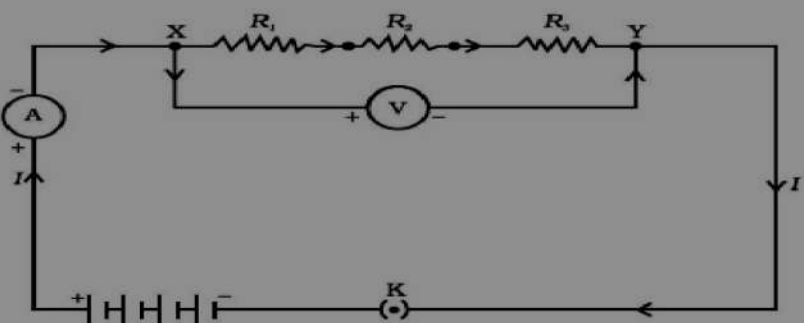
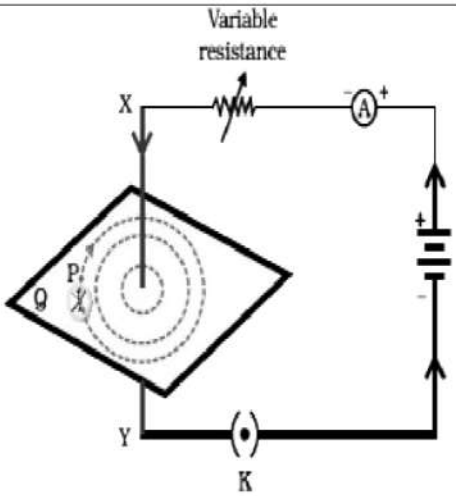
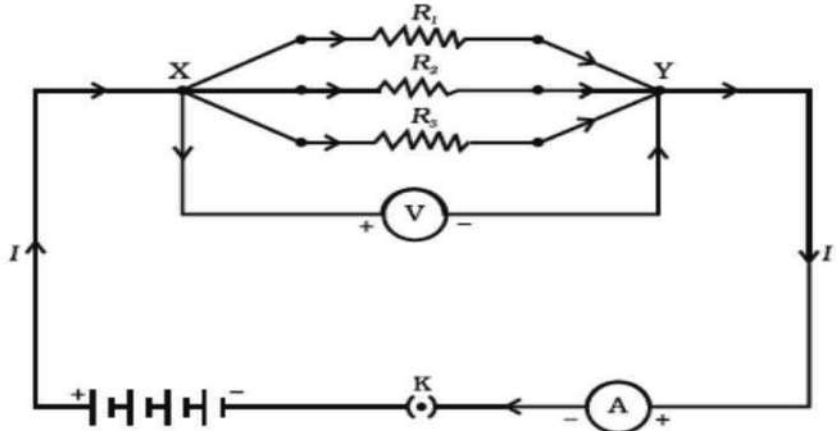
Symbol of some commonly used components in circuit diagrams

13 Chapter-
12
Electricity

12.2

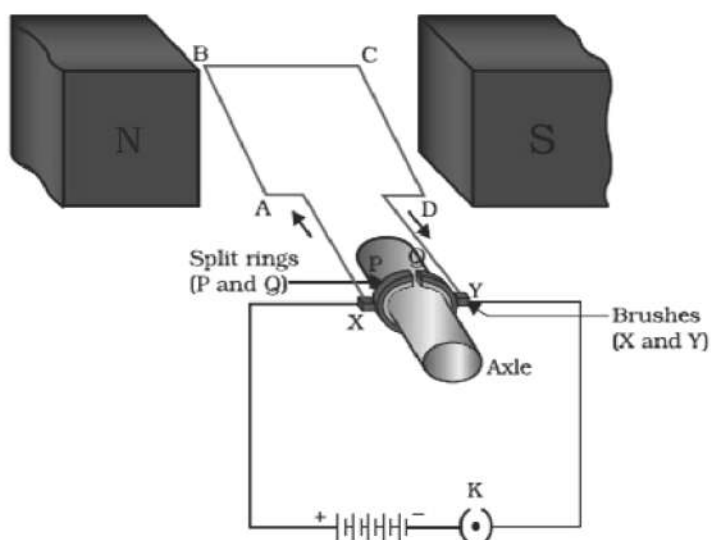


Electric circuit for studying Ohm's Law

14	Chapter-12 Electricity	12.6	 <p style="text-align: center;">Resistors in series</p>
15		12.6a	 <p style="text-align: center;">A pattern of concentric circles indicating the field lines of a magnetic field around a straight conducting wire</p>
16	Chapter-12 Electricity	12.7	 <p style="text-align: center;">Resistors in parallel</p>

17 Chapter-13
Magnetic effect of electric current

13.15



A simple electric motor (2D or 3D)

18 Chapter-13
Magnetic effect of electric current

13.19

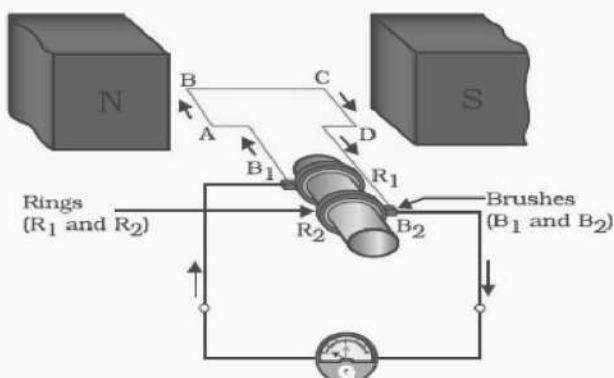
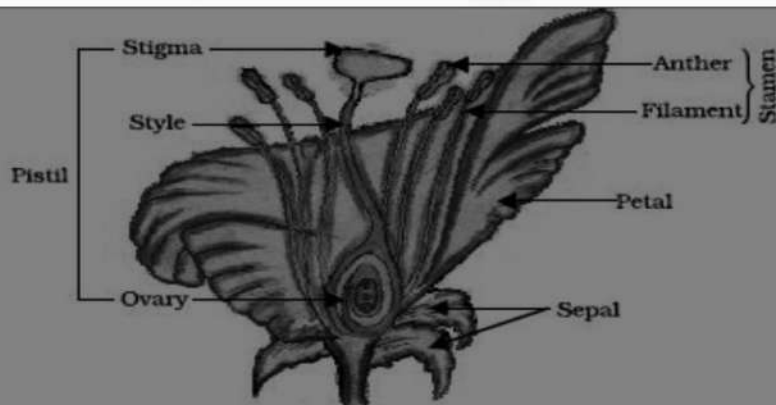


Illustration of the principle of electric generator (2D or 3D)

19 Chapter-8
How do organisms reproduce?

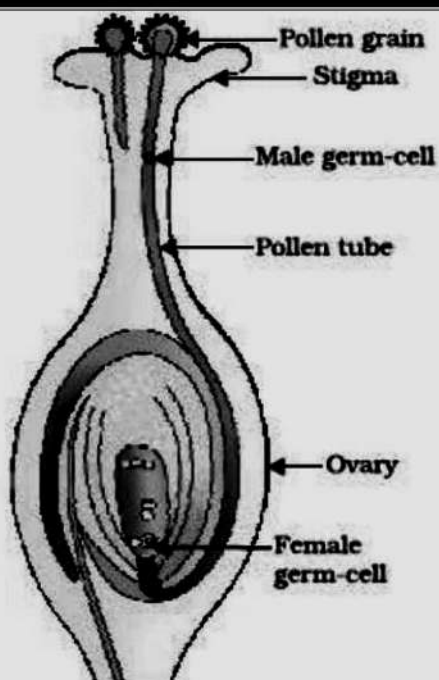
8.7



Longitudinal section of flower

20 Chapter-8
How do organisms reproduce?

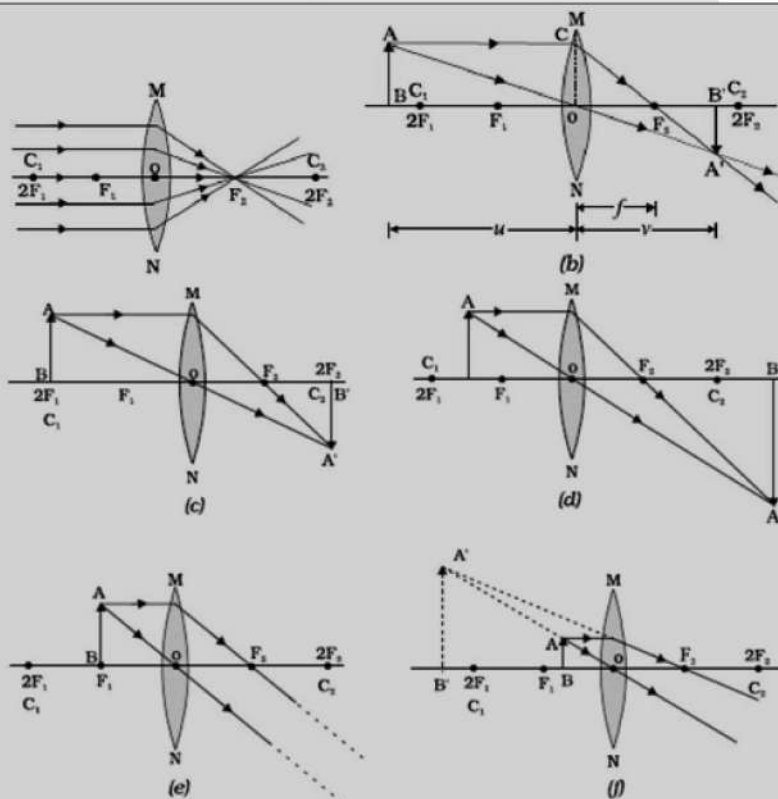
8.8



Germination of pollen on stigma

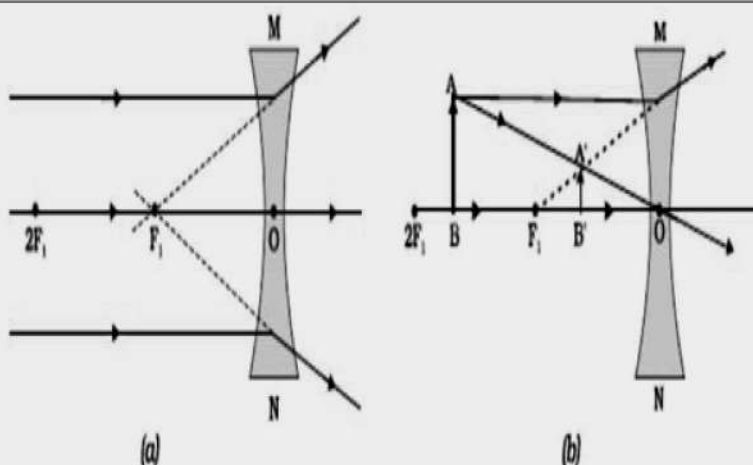
21 Chapter-10
Light Reflection and refraction

10.16



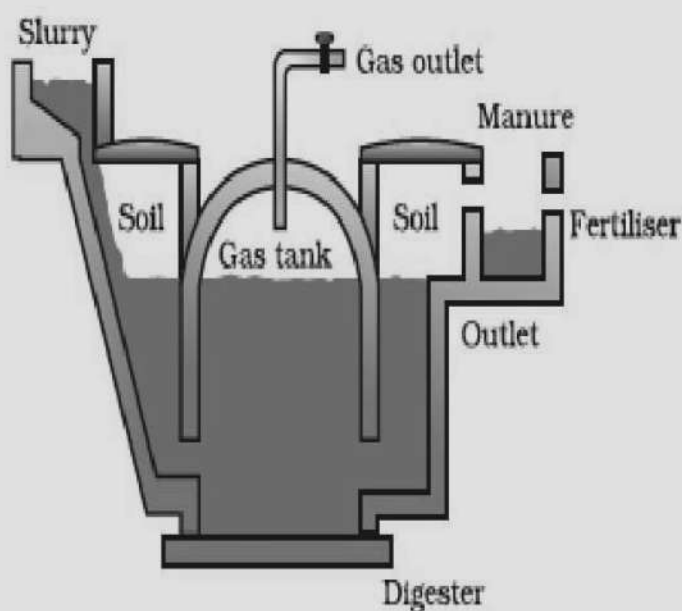
Position, size and nature of image formed by a convex lens

22 Chapter-10 10.17

Light
Reflection
and
refraction

Nature, position and relative size of image formed by a concave lens

23 Chapter 14 14.4

Sources
of energy

Schematic diagram of a bio-gas plant

REFERENCES

- 10th State/NCERT Science Text book
- NCERT Solution Book
- NCERT App and My CBSE GUIDE App.

