

केन्द्रीय विद्यालय संगठन, एर्नाकुलम क्षेत्र

KENDRIYA VIDYALAYA SANGATHAN , ERNAKULAM REGION



सत्यं त्वं पूषन् अपागृणु
केन्द्रीय विद्यालय संगठन

CLASS X 2022-23
STUDENT SUPPORT MATERIAL
SCIENCE 086



KENDRIYA VIDYALAYA SANGATHAN, ERNAKULAM REGION
केन्द्रीय विद्यालय संगठन, एर्नाकुलम क्षेत्र

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MESSAGE FROM DEPUTY COMMISSIONER

It gives me immense pleasure to publish the study material for class X Science. I am sure that the support material will definitely be great help to the class X Students of all Kendriya Vidyalayas of our region.

This students ' Support Material has been prepared to improve their academic performance. This is a product of the combined efforts of a team of dedicated and experienced teachers with expertise in their subjects. This material is designed to supplement the NCERT text book.

The support material contains all the important aspects required by the students. Care has been taken to include the latest syllabus, summary of all the chapters, important formulae, sample question papers, problem solving and case - based questions. It covers all essential components that are required for quick and effective revision of the subject.

I would like to express my sincere gratitude to the in-charge Principal and all the teachers who have persistently striven for the preparation of this study material. Their selfless contribution in making this project successful is commendable.

"An ounce of practice is worth tons of Knowledge, "Students will make use of this material meticulously to reap the best out of this effort.

With Best Wishes

(R Senthil Kumar)

Deputy Commissioner

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Curriculum for the Academic Year 2022-23

COURSE STRUCTURE CLASS X (Annual Examination)

UNIT NO	UNIT	MARKS
I	Chemical Substances-Nature and Behaviour	25
II	World of Living	25
III	Natural Phenomena	12
IV	Effects of Current	13
V	Natural Resources	05
	Total	80
	Internal assessment	20
	Grand Total	100

Theme: Materials

Unit I: Chemical Substances - Nature and Behaviour

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

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

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

Carbon compounds: Covalent bonding in carbon compounds. Versatile nature of carbon.

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

Theme: The World of the Living

Unit II: World of Living

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

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

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

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

Theme: Natural Phenomena

Unit III: Natural Phenomena

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

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

Functioning of a lens in human eye, defects of vision and their corrections, applications of

spherical mirrors and lenses.

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

Theme: How Things Work

Unit IV: Effects of Current

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

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

Theme: Natural Resources

Unit V: Natural Resources

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

PRACTICALS

LIST OF EXPERIMENTS

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

- (i) Dilute Hydrochloric Acid
- (ii) Dilute NaOH solution
- (iii) Dilute Ethanoic Acid solution
- (iv) Lemon juice
- (v) Water
- (vi) Dilute Hydrogen Carbonate solution

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

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

2. Performing and observing the following reactions and classifying them into:

- A. Combination reaction
- B. Decomposition reaction
- C. Displacement reaction
- D. Double displacement reaction

- (i) Action of water on quicklime
- (ii) Action of heat on ferrous sulphate crystals
- (iii) Iron nails kept in copper sulphate solution
- (iv) Reaction between sodium sulphate and barium chloride solutions

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

- i) $\text{ZnSO}_4(\text{aq})$
- ii) $\text{FeSO}_4(\text{aq})$
- iii) $\text{CuSO}_4(\text{aq})$
- iv) $\text{Al}_2(\text{SO}_4)_3(\text{aq})$

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

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

5. Determination of the equivalent resistance of two resistors when connected in series and parallel.

6. Preparing a temporary mount of a leaf peel to show stomata.

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

8. Study of the following properties of acetic acid (ethanoic acid):

i) Odour

ii) solubility in water

iii) effect on litmus

iv) reaction with Sodium Hydrogen Carbonate

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

10. Determination of the focal length of:

i) Concave mirror

ii) Convex lens

by obtaining the image of a distant object.

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

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

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

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

CHAPTER 1

CHEMICAL REACTIONS AND EQUATIONS

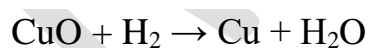
GIST OF THE LESSON

1. **Chemical reaction-** The processes, in which a substance or substances undergo a chemical change to produce new substance or substances, with entire new properties, are known as chemical reactions.
2. **Signs of a chemical reaction-** These factors denote that a chemical reaction has taken place- change of state of substance, change of colour of substance, change in temperature, evolution of gas and formation of precipitate.
3. **Chemical Equation:** The representation of chemical reaction by means of symbols of substances in the form of formulae is called chemical equation. E.g. -
 $H_2 + O_2 \rightarrow H_2O$
4. **Balanced Chemical Equation:** A balanced chemical equation has number atoms of each element equal on both left and right sides of the reaction.

According to Law of Conservation of Mass, mass can neither be created nor destroyed in a chemical reaction. To obey this law, the total mass of elements present in reactants must be equal to the total mass of elements presents in products.

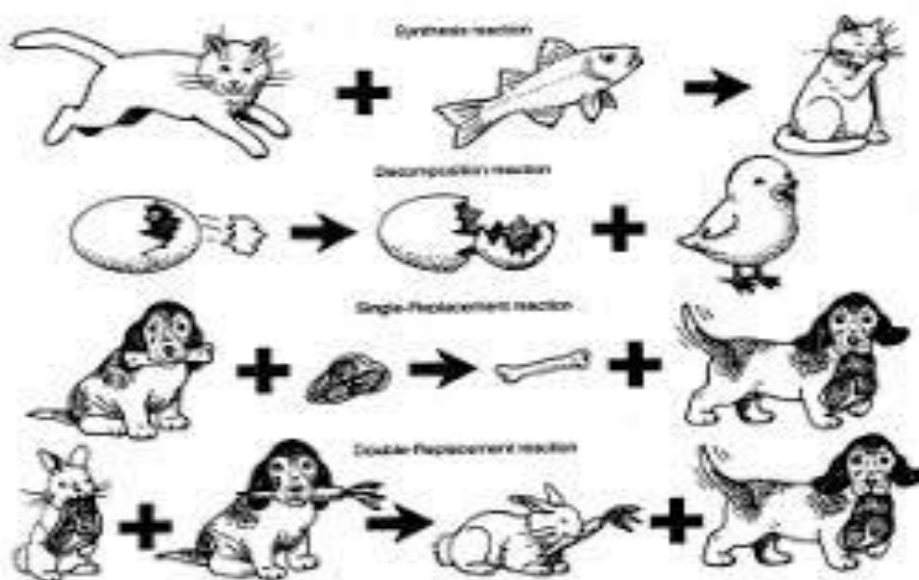
TYPES OF CHEMICAL REACTIONS-

1. **Combination reactions** - Reactions in which two or more reactants combine to form one product is called Combination Reactions.
2. **Decomposition reactions-** Reactions in which one compound decomposes into two or more compounds or elements are known as Decomposition Reaction.
3. **Displacement reactions-** The chemical reaction in which a more reactive element displaces a less reactive element from a compound is known as a displacement reaction.
4. **Double displacement reactions-** Reactions in which ions are exchanged between two reactants forming new compounds are called Double Displacement Reactions.
5. **Precipitation reactions-** The reaction in which precipitate is formed by the mixing of the aqueous solution of two salts is called precipitation reaction.
6. **Exothermic reactions-** Reactions which produce energy are called exothermic reaction. Most of the decomposition reactions are exothermic.
7. **Endothermic reactions-** Reactions which absorb energy are called endothermic reaction. Most of the combination reactions are endothermic.
8. **Oxidation:** Addition of oxygen or non-metallic element or removal of hydrogen or metallic element from a compound is known as oxidation.
9. **Reduction:** Addition of hydrogen or metallic element or removal of oxygen or non-metallic element from a compound is called reduction.
10. **Redox reactions** -A chemical reactions where oxidation and reduction both take place simultaneously are also known as redox reaction.

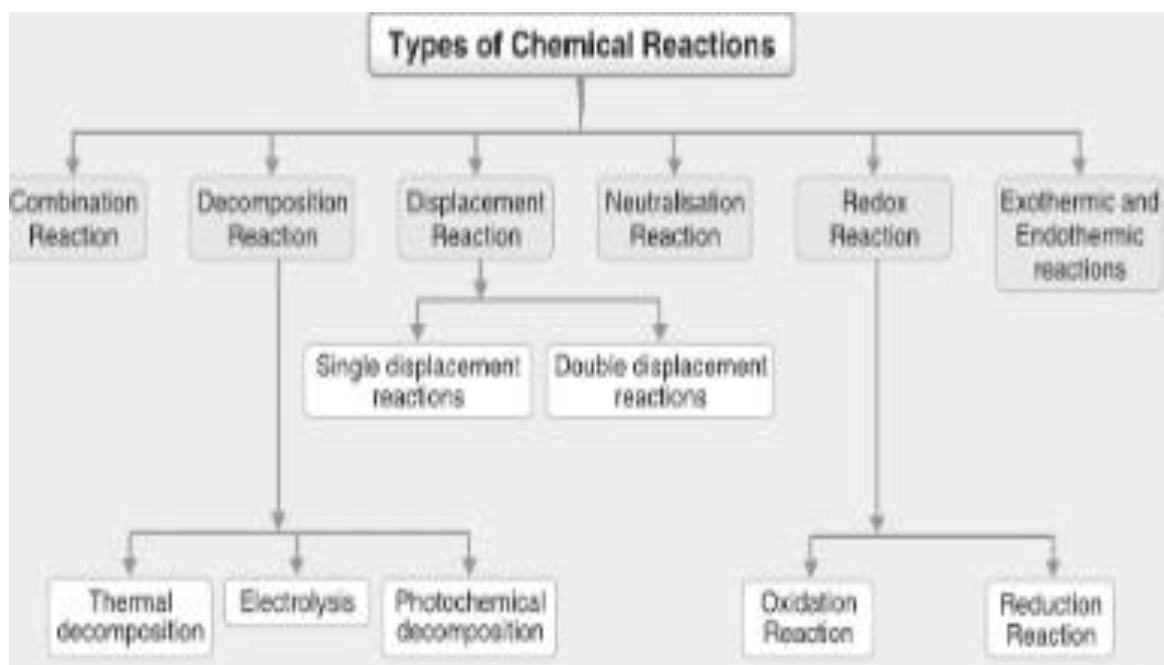


11. **Neutralization Reaction:** The reaction in which an acid reacts with a base to form salt and water by an exchange of ions is called Neutralization Reaction.

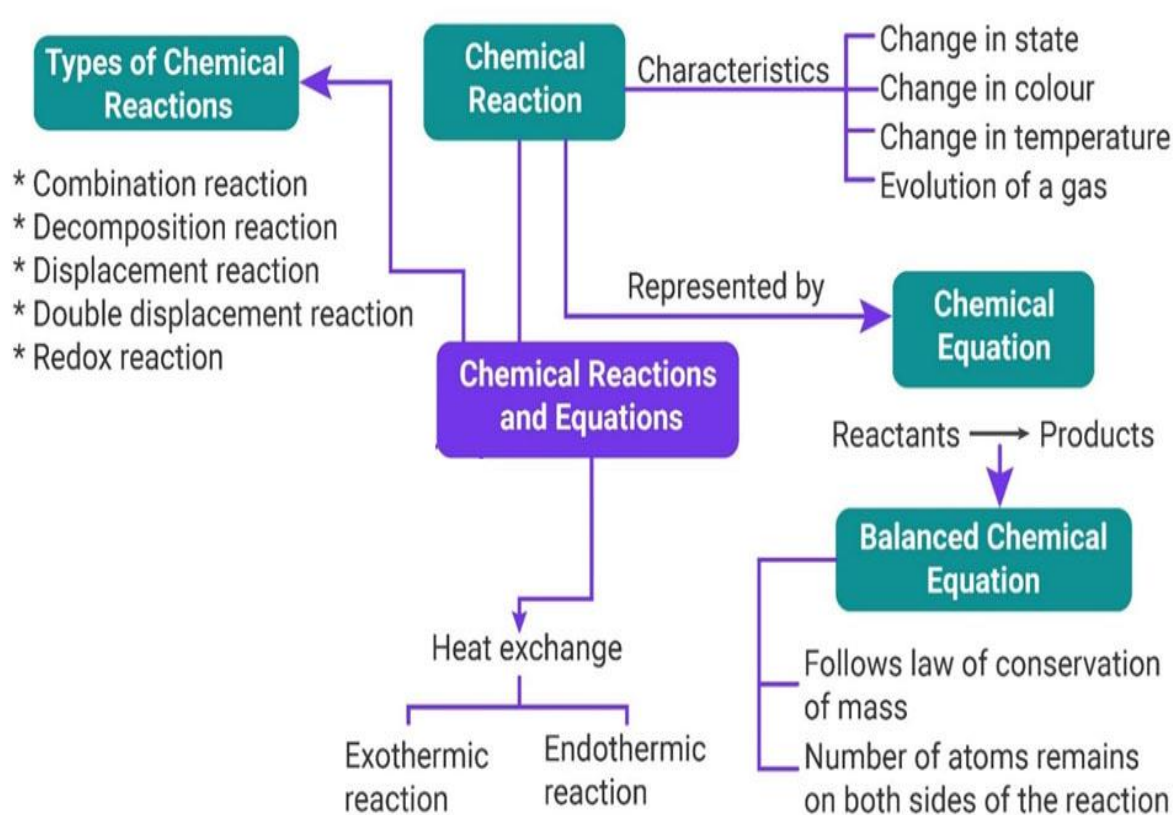
Example: $NaOH + HCl \rightarrow NaCl + H_2O$



FLOWCHART



MIND MAPPING



SHORT NOTES

Physical changes

Processes in which no new chemical substances are formed are called physical changes.

- Eg – 1. Melting of Ice
2. Evaporation of water.
3. Dissolution of sugar in water.

All these processes do not lead to the formation of new chemical substances. For example, Ice, water, and water vapour are chemically same. i.e., water (H_2O). Solution of sugar in water still remains the same chemical substances, that is, sugar and water.

Chemical changes

Processes in which the original substances lose their nature and identity and form new chemical substances with different properties are called chemical changes.

- Eg – 1. Rusting of iron articles especially in the rainy season.
2. Souring of milk in summer
3. Burning of coke in air.

In all these processes, the original substances lose their nature and identity, and form new chemical substances. For example – Rust is chemically a different compound than the original substance, iron. Similarly, we cannot drink milk which has turned sour because the properties of milk have changed to form some new substances.

The process involving a chemical change is called a chemical reaction.

Characteristics of Chemical Reaction

When a chemical reaction takes place, some changes are observed. The easily observable changes that take place in a chemical reaction are called the characteristics of the chemical reaction. These changes help us to check that a chemical reaction has taken place. Some important characteristics of chemical reactions are given below:

- 1. Formation of a precipitate:** Some chemical reactions are accompanied by the formation of a precipitate. A precipitate is a solid substance formed on mixing two substances. For example,
 - (i) In the reaction between lead nitrate and potassium iodide solutions, a yellow precipitate of lead iodide appears.
 - (ii) When silver nitrate solution is mixed with sodium chloride solution, a white precipitate of silver chloride is obtained, or when barium chloride solution is mixed with sodium sulphate solution, a white precipitate of barium sulphate is obtained.
- 2. Evolution of gas:** Some chemical reactions are accompanied by the evolution of gas. For example,
 - (i) In the reaction between zinc and dilute sulphuric acid or hydrochloric acid, hydrogen gas is evolved.
 - (ii) When calcium carbonate is heated, or calcium carbonate reacts with dilute hydrochloric acid, carbon dioxide is evolved.
- 3. Change in colour:** Some chemical reactions are accompanied by change in color. For example,
 - (i) Rust is brown in colour whereas iron is greyish black in colour.
 - (ii) Lead nitrate and potassium iodide solutions are colourless, but on mixing the two, the precipitate of lead iodide formed is yellow in color.
- 4. Change in state:** Some chemical reactions are accompanied by change in state. For example,
 - (i) Solid wax (in the form of candle) burns to form water vapour and carbon dioxide which are gaseous.
 - (ii) Petrol, which is a liquid, burns to form water vapour and carbon dioxide which are gaseous.
- 5. Change in temperature:** Some chemical reactions are accompanied by change in temperature, i.e., rise or fall of temperature. Reactions which are accompanied by rise in temperature are those in which heat is involved. Such reactions are called exothermic reactions.

For example,

- (i) When zinc pieces react with sulphuric acid in a beaker or a flask, it is found to be warm. This can be seen by touching the beaker or the flask.
- (ii) When water is added into quick lime (CaO), taken in a beaker, slaked lime $\text{Ca}(\text{OH})_2$, is formed and the beaker is found to be quite hot.

Reactions which are accompanied by fall in temperature are those in which heat is absorbed. Such reactions are called endothermic reactions. For example, when barium hydroxide, $\text{Ba}(\text{OH})_2$, is added into ammonium chloride, NH_4Cl , taken in a test tube, and mixed with a glass rod, then on touching the bottom of the test tube, it is found to be cooler. This is due to the following endothermic reaction taking place:



Reactions involve several changes simultaneously. It is important to know that in several reactions; more than one change may be observed. i.e., they may possess more than one characteristic. For example,

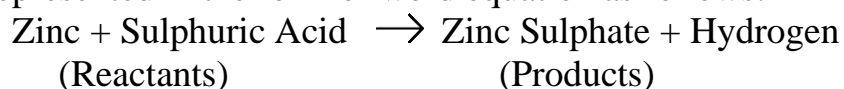
- (i) When zinc reacts with dilute sulphuric acid, a gas i.e. (H_2) is evolved and a rise in temperature takes place.
- (ii) When lead nitrate and potassium iodide solutions are mixed, a precipitate of lead iodide is formed. Also, change in colour takes place because the solutions taken are colourless while the precipitate formed is yellow.
- (iii) If hydrochloric acid is added into solid calcium carbonate taken in a beaker, solid disappears to give solution, i.e., change of state takes place. Also, gas (carbon dioxide) is evolved and rise in temperature takes place.

As several changes are taking place in the different substances present around us, this means that a large number of chemical reactions are occurring in the nature.

Chemical Equation

There are two ways of representing a chemical reaction as follows:

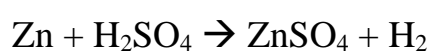
- (i) In terms of words (called word equation), For example, the above reaction (i) may be represented in the form of word equation as follows:



Thus, the names of the reactants are written on the left-hand side (LHS) with a plus sign (+) between them. The names of the products are written on the right-hand side (RHS) with a plus sign between them. An arrow (\rightarrow) is put between the reactants and the products, such that the direction of the arrowhead is from the reactants towards products.

- (ii) In terms of symbols and formulae (called chemical equation): Even the above method of representing a chemical reaction is not too short. A still shorter and faster method is used by writing symbols and formulae of the different reactants and products in place of their names.

Thus in terms of symbols and formulae, the above reaction may be represented as follows:



This is called a chemical equation.

In fact, this is the most common method of representing a chemical reaction. Hence, we define a chemical equation as follows:

“The short-hand method of representing a chemical reaction in terms of symbols and formulae of the different reactants and products is called a chemical equation.

Balancing of a Chemical Equation

Balancing of a chemical equation means making the number of atoms of each element equal on both sides of the equation.

Steps involved in the balancing of a chemical equation:

Step I: To write the word equation-Write down the equation in the word form by writing the names of the reactants on the left side, and those of the products on the right side. This step is not required if the equation is given in terms of symbols and formulas.

Step II: To write the skeletal chemical equation- Write down the symbols and formulas of the various reactants and products. This gives us the skeletal chemical equation.

Step III: To enclose the formulas in boxes- Enclose the formula of each reactant and product in a box. This is done to remember that during balancing of the chemical equation, the formula of any reactant or product cannot be changed.

Step IV: To list the number of atoms of different elements on LHS(Reactants) and RHS (Products)

Step V: To select the biggest formula to start balancing- Start the process of balancing by choosing the compound which has the maximum number of atoms, irrespective of the fact whether it is a reactant or a product.

Step VI: To start balancing of different elements-Having selected the compound with the biggest formula as above, first balance the element of this compound which has the highest number of atoms. Then balance other elements one by one. To balance the atoms of an element, put a small whole number coefficient before the formula of the compound (or symbol of the element for elementary substances).

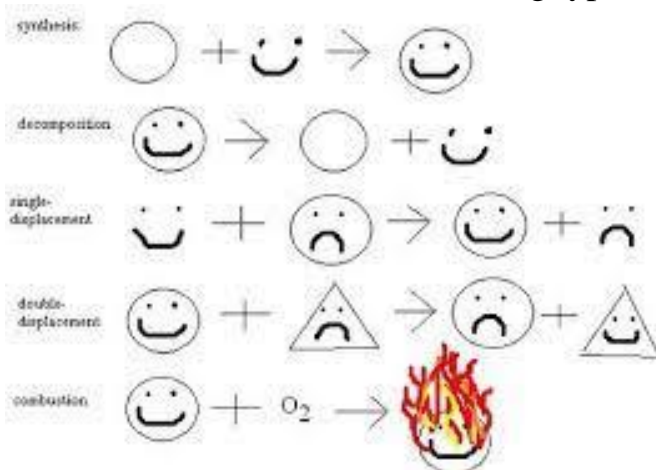
If selection of the biggest formula appears inconvenient, balance the atoms of that element which occurs at minimum number of places on both sides of the equation. Atoms of the element which occur at maximum places are balanced last of all.

Step VII: To check the correctness of the balanced equation- Finally check the correctness of the balanced equation by counting the number of atoms of each element on both sides of the equation.

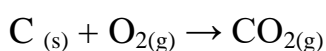
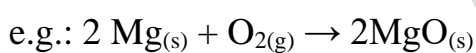
The above method of balancing of chemical equation is called Hit and Trial method as we keep on trying to balance the equation using smallest whole number coefficients.

TYPES OF CHEMICAL REACTIONS

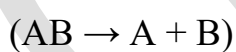
Chemical reactions can be classified in following types:



(i) **Combination Reaction:** Reactions in which two or more reactants combine to form one product is called Combination Reactions. ($A + B \rightarrow AB$)



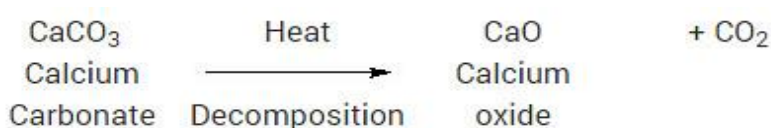
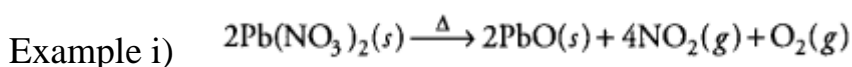
(ii) **Decomposition Reaction:** Reactions in which one compound decomposes into two or more compounds or elements are known as Decomposition Reaction. A decomposition reaction is just opposite of combination reaction.



DECOMPOSITION

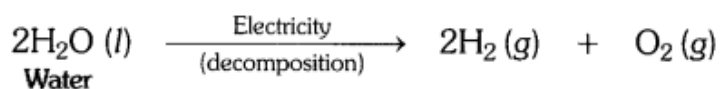
Types of decomposition:

1. **Thermal Decomposition:** The decomposition of a substance on heating is known as Thermal Decomposition.



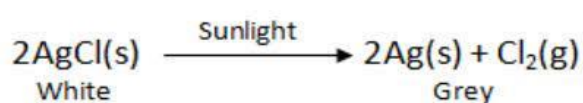
2. Electrolytic Decomposition: Reactions in which compounds decompose into simpler compounds because of passing of electricity, are known as Electrolytic Decomposition. This is also known as Electrolysis.

Example: When electricity is passed in water, it decomposes into hydrogen and oxygen.



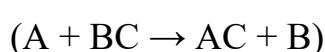
3. Photochemical Decomposition: Reactions in which a compound decomposes because of sunlight are known as photolysis or photo chemical decomposition reaction.

Example: When silver chloride is put in sunlight, it decomposes into silver metal and chlorine gas.

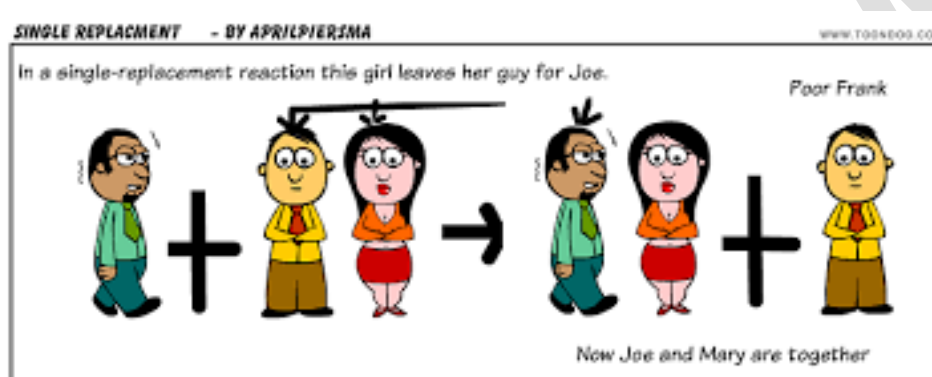


Photographic paper has a coat of silver chloride, which turns into grey when exposed to sunlight. It happens because silver chloride is colourless while silver is a grey metal.

(iii) **Displacement Reaction:** The chemical reaction in which a more reactive element displaces a less reactive element from a compound is known as a displacement reaction



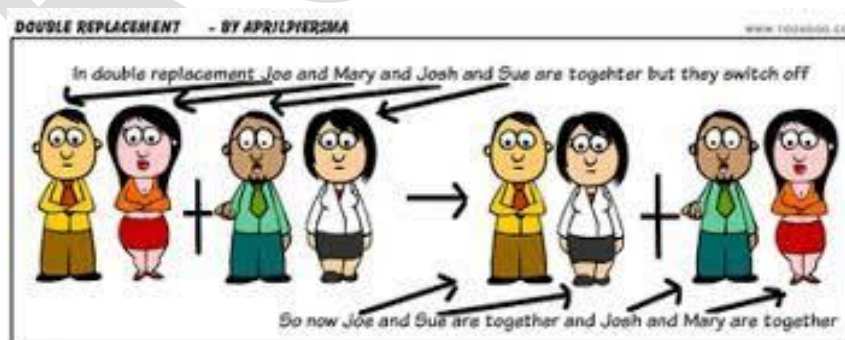
Displacement reaction takes place only when 'A' is more reactive than B.



Eg:



(iv) **Double Displacement Reaction:** Reactions in which ions are exchanged between two reactants forming new compounds are called Double Displacement Reactions.

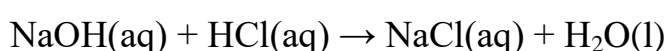


eg:

i) When the solution of barium chloride reacts with the solution of sodium sulphate, white precipitate of barium sulphate is formed along with sodium chloride.



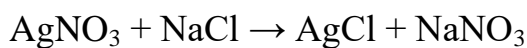
ii) When sodium hydroxide (a base) reacts with hydrochloric acid, sodium chloride and water are formed.



Note: Double Displacement Reaction, in which precipitate is formed, is also known as precipitation reaction. Neutralisation reactions are also examples of double displacement reaction.

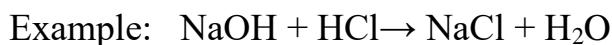
Precipitation Reaction: The reaction in which precipitate is formed by the mixing of the aqueous solution of two salts is called precipitation reaction.

Example:

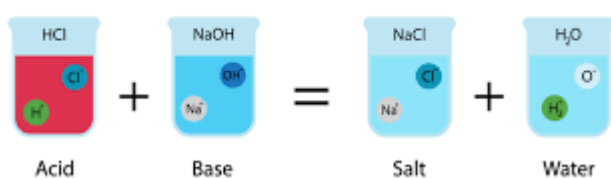


precipitate

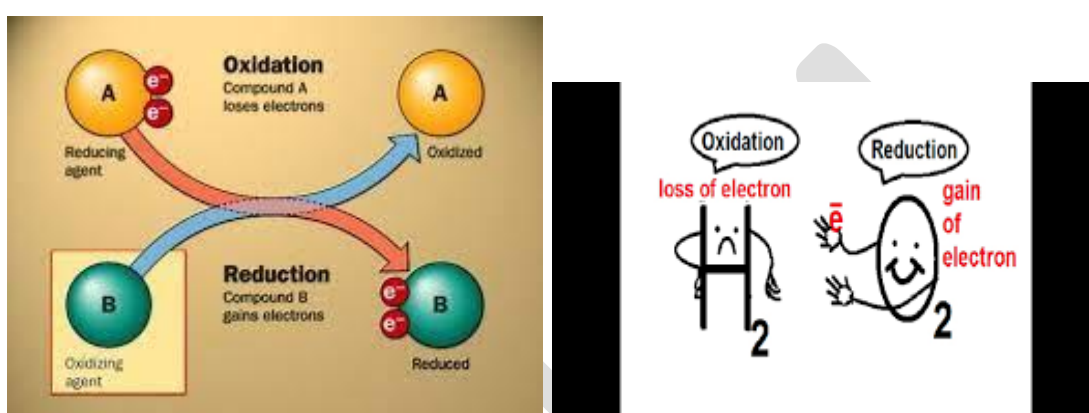
(v) Neutralization Reaction: The reaction in which an acid reacts with a base to form salt and water by an exchange of ions is called Neutralization Reaction.



Acid - base reactions



(vi) Redox reactions



Oxidation: Addition of oxygen or removal of hydrogen from a compound is known as oxidation.

Elements or compounds in which oxygen or non-metallic element is added or hydrogen or metallic element is removed are called to be oxidized.

Reduction: Addition of hydrogen or removal of oxygen from a compound is called Reduction.

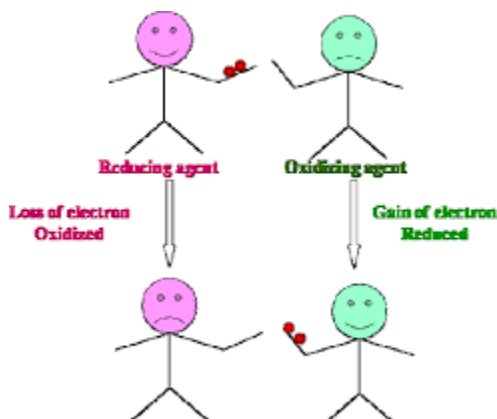
The compound or element which undergoes reduction is called to be reduced.

Oxidizing agent:

- The substance which gives oxygen for oxidation is called an Oxidizing agent.
- The substance which removes hydrogen is also called an Oxidizing agent.

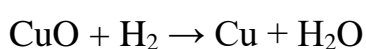
Reducing agent:

- The substance which gives hydrogen for reduction is called a reducing agent.
- The substance which removes oxygen is also called a reducing agent.



The reaction in which oxidation and reduction both take place simultaneously is called **Redox reaction**.

When copper oxide is heated with hydrogen, then copper metal and water are formed.



(i) In this reaction, CuO is changing into Cu. Oxygen is being removed from copper oxide.

Removal of oxygen from a substance is called reduction, so copper oxide is being reduced to copper.

(ii) In this reaction, H_2 is changing to H_2O . Oxygen is being added to hydrogen. Addition of oxygen to a substance is called oxidation, so hydrogen is being oxidised to water.

- The substance which gets oxidised is the reducing agent.
- The substance which gets reduced is the oxidizing agent.

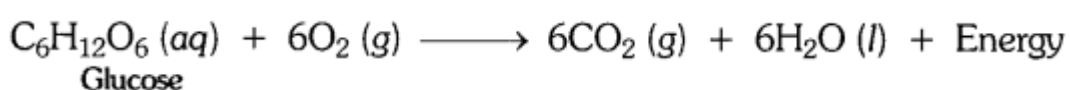
(vii) **Exothermic and Endothermic Reactions:**

Exothermic Reaction: Reaction in which energy is produced is called Exothermic Reaction.

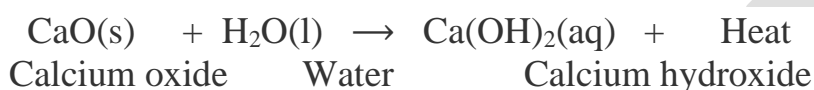
Most of the decomposition reactions are exothermic.

Example:

(i) Respiration is an exothermic reaction in which energy is released.

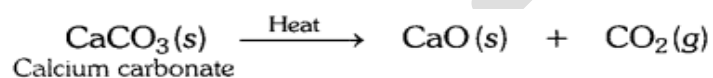


(ii) When quick lime (CaO) is added to water, it releases heat energy.



Endothermic Reaction: A chemical reaction in which heat energy is absorbed is called Endothermic Reaction.

Example: Decomposition of calcium carbonate.



SECTION A

MULTIPLE CHOICE QUESTIONS

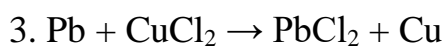


Identify the substance oxidized in the above equation.

- (a) $MnCl_2$ (b) HCl (c) H_2O (d) MnO_2

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

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



The above reaction is an example of:

- (a) combination (b) double displacement (c) decomposition (d) displacement

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

- (a) it is decomposed to ferric oxide (b) it loses water of crystallisation
(c) it forms SO_2 (d) it forms SO_3

5. $2HNO_3 + Ca(OH)_2 \rightarrow Ca(NO_3)_2 + 2H_2O$; is an example of

(i) displacement reaction (ii) double displacement reaction

(iii) neutralisation reaction (iv) combination reaction.

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

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

- (a) No reaction takes place (b) White precipitate of silver iodide is formed
(c) yellow precipitate of AgI is formed (d) AgI is soluble in water.

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



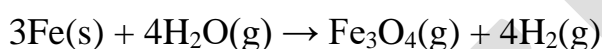
- (a) 2, 4, 2 (b) 2, 2, 4 (c) 2, 4, 4 (d) 4, 2, 2

8. Oxidation involves

- (i) gain of electron
(ii) loss of electron
(iii) addition of oxygen or electronegative element
(iv) removal of hydrogen or electropositive element

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

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



- (i) Iron metal is getting oxidised
(ii) Water is getting reduced
(iii) Water is acting as reducing agent
(iv) Water is acting as an oxidising agent

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

10. Barium chloride on reacting with ammonium sulphate forms barium sulphate and ammonium chloride. Which of the following correctly represents the type of the reaction involved?

- (i) Displacement reaction
(ii) Precipitation reaction
(iii) Combination reaction
(iv) Double displacement reaction

- (a) (i) only (b) (ii) only (c) (iv) only (d) (ii) and (iv)

11. The brown gas evolved on heating of copper nitrate is

- (a) O₂ (b) NO₂ (c) N₂ (d) NO

12. Zinc reacts with silver nitrate to form which compounds?

- (a) Zn(NO₃)₂ + Ag (b) ZnNO₃ + Ag (c) AgNO₃ + Zn(NO₃)₂ (d) Ag + Zn(NO₃)₃

13. Which of the reactions is used in black and white photography?

- (a) Combination Reaction (b) Decomposition Reaction
(c) Displacement reaction (d) Oxidation reaction

14. Which option shows oxidation?

- (a) Zn → Zn²⁺ (b) 2H⁺ → H₂ (c) Zn²⁺ → Zn (d) H₂ → 2H

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

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

16. On immersing an iron nail in CuSO_4 solution for few minutes

- (a) no reaction takes place
(b) the colour of solution fades away
(c) the surface of iron nails acquires a black coating
(d) the colour of solution changes to green

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

- (a) Electrolysis of water
(b) Dissolution of NH_4Cl in water
(c) Burning of L.P.G.
(d) Decomposition of AgBr in the presence of sunlight

18. A substance 'X' is used in white-washing and is obtained by heating limestone in the absence of air. Identify 'X'.

- (a) CaOCl_2 (b) $\text{Ca}(\text{OH})_2$ (c) CaO (d) CaCO_3

19. In the double displacement reaction between aqueous potassium iodide and aqueous lead nitrate, a yellow precipitate of lead iodide is formed. While performing the activity if lead nitrate is not available, which of the following can be used in place of lead nitrate?

- a) Lead sulphate (insoluble) (b) Lead acetate
(c) Ammonium nitrate (d) Potassium sulphate

20. When Ag is exposed to air it gets a black coating of

- (a) AgNO_3 (b) Ag_2S (c) Ag_2O (d) Ag_2CO_3

MULTIPLE CHOICE QUESTIONS

ANSWERS

1. b 2. b 3. d 4. b 5. b 6. c 7. b 8. b 9. c 10. d 11. b 12. a

13. b 14. a 15. b 16. d 17. c 18. c 19. b 20. b

SECTION B

ASSERTION- REASON TYPE QUESTIONS

DIRECTION: Each of these questions contains an assertion followed by reason. Read them carefully and answer the question on the basis of following options. You have to select the one that best describes the two statements.

- (a) If both Assertion and Reason are correct and reason is the correct explanation of Assertion.
(b) If both Assertion and Reason are correct, but reason is not the correct explanation of Assertion.
(c) If Assertion is correct but Reason is incorrect.
(d) If Assertion is incorrect but Reason is correct.

Q1. **Assertion (A):** Photosynthesis is considered as an endothermic reaction.

Reason (R): Energy gets released in the process of photosynthesis

Q2. **Assertion (A):** Decomposition of vegetable matter into compost is an example of exothermic reactions.

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

Q3. **Assertion (A):** When HCl is added to zinc granules, a chemical reaction occurs.

Reason (R): Evolution of a gas indicates that the chemical reaction is taking place.

Q4. **Assertion (A):** Calcium carbonate when heated gives calcium oxide and water.

Reason (R): On heating calcium carbonate, decomposition reaction takes place.

Q5. **Assertion (A):** Chemical reaction changes the physical and chemical properties of a substance

Reason (R): Chemical change involves a change in the chemical composition of matter, and a new substance is formed

6. **Assertion (A):** AgBr is used in photographic and X-ray film.

Reason (R): AgBr is photosensitive and changes to Ag and bromine in presence of sunlight and undergoes decomposition reaction.

7. **Assertion (A):** Magnesium ribbon keeps on burning in atmosphere of nitrogen.

Reason (R): Magnesium reacts with nitrogen to form magnesium nitrides and this reaction is combination reaction.

8. **Assertion (A):** Zinc reacts with sulphuric acid to form zinc sulphate and hydrogen gas and it is displacement reaction.

Reason (R): Zinc reacts with oxygen to form zinc oxide.

9. **Assertion (A):** $\text{MnO}_2 + 4\text{HCl} \rightarrow \text{MnCl}_2 + \text{Cl}_2 + 2\text{H}_2\text{O}$ is redox reaction.

Reason (R): MnO_2 oxidises HCl to Cl_2 and gets reduced to MnCl_2 .

10. **Assertion (A):** White silver chloride turns grey in sunlight.

Reason (R): Decomposition of silver chloride in presence of sunlight takes place to form silver metal and chlorine gas.

ASSERTION – REASON ANSWER KEY

Q NO	1	2	3	4	5	6	7	8	9	10
ANS	C	A	A	A	A	A	A	B	A	A

SECTION C

CASE STUDY QUESTIONS

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

(i) The massive force that pushes the rocket forward through space is generated due to the

- (a) combination reaction
- (b) decomposition reaction
- (c) displacement reaction
- (d) double displacement reaction

Answer: (b) The massive force that pushes the rocket forward through space is generated due to the decomposition reaction. Hydrogen peroxide decomposes and provides it with a considerable reaction force thrust.

(ii) A white salt on heating decomposes to give brown fumes and yellow residue is left behind. The yellow residue left is of

- (a) lead nitrate
- (b) nitrogen oxide
- (c) lead oxide
- (d) oxygen gas

Answer: (c) Lead nitrate decomposes to give brown fumes of nitrogen dioxide gas and yellow residue of lead oxide is left behind.

(iii) Which of the following reactions represents a combination reaction?

- (a) $\text{CaO (s)} + \text{H}_2\text{O (l)} \rightarrow \text{Ca (OH)}_2 \text{ (aq)}$
- (b) $\text{CaCO}_3 \text{ (s)} \rightarrow \text{CaO (s)} + \text{CO}_2 \text{ (g)}$
- (c) $\text{Zn (s)} + \text{CuSO}_4 \text{ (aq)} \rightarrow \text{ZnSO}_4 \text{ (aq)} + \text{Cu (s)}$
- (d) $2\text{FeSO}_4 \text{ (s)} \rightarrow \text{Fe}_2\text{O}_3 \text{ (s)} + \text{SO}_2 \text{ (g)} + \text{SO}_3 \text{ (g)}$

Answer: (a) A reaction in which two or more reactants combine to form a single product is known as a combination reaction.

(iv) Complete the following statements by choosing correct type of reaction for X and Y.

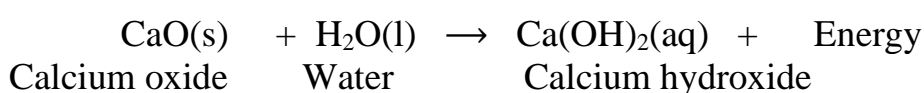
Statement 1: The heating of lead nitrate is an example of 'X' reaction.

Statement 2: The burning of magnesium is an example of 'Y' reaction.

- (a) X-Combination, Y-Decomposition
- (b) X-Decomposition, Y-Combination
- (c) X-Combination, Y-Displacement
- (d) X- Displacement, Y-Decomposition

Answer: (b) Heating of lead nitrate to form nitrogen dioxide and lead oxide is an example of thermal decomposition reaction and the burning of magnesium ribbon in the air to form magnesium oxide is an example of combination reaction.

2. A reaction in which two or more reactants combine to form a single product is called a combination reaction. For example, calcium oxide reacts vigorously with water to form calcium hydroxide. The reaction is highly exothermic in nature, as lots of heat is produced during the reaction.



Solution of Ca (OH)_2 is used to white wash the walls. Calcium hydroxide reacts slowly with carbon dioxide in air to form a thin layer of calcium carbonate on the wall which gives a shiny appearance to wall. Calcium carbonate will form after two or three days of whitewash.

(i) What is the chemical name of quick lime?

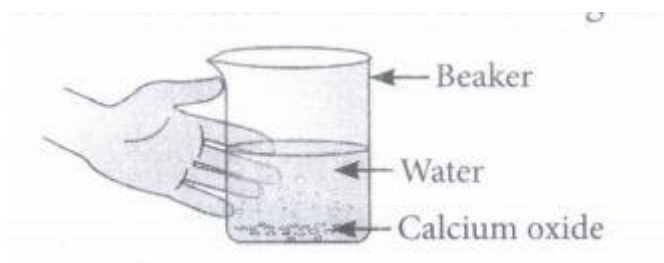
- (a) Calcium oxide
- (b) Calcium carbonate
- (c) Calcium hydroxide
- (d) Carbon dioxide

(ii) When carbon dioxide is passed through lime water,

- (a) calcium hydroxide is formed
- (b) white precipitate of CaO is formed
- (c) lime water turns milky
- (d) colour of lime water becomes green.

Answer: c

(iii) Following observations are observed when calcium oxide reacts vigorously with water.



Identify the incorrect observations

- (I) It is an endothermic reaction
- (II) Slaked lime is produced.

(III) Quick lime is produced. (IV) It is an exothermic reaction.

(V) It is a combination reaction

(a) (I) and (II) (b) (III) and (IV) (c) (I) and (III) (d) (II), (IV) and (V)

Answer: c

(iv) Quick lime combines vigorously with water to form (A) which reacts slowly with the carbon dioxide in air to form (B)

Identify the compounds(A) and (B)

(A)

(B)

(a) Calcium carbonate

Calcium hydroxide

(b) Calcium hydroxide

Calcium carbonate

(c) Calcium

Calcium bicarbonate

(d) Calcium bicarbonate

Calcium

Answer : b

3. Reactions in which one element takes place of another element in a compound, are known as displacement reactions. In general, more reactive elements displaces a less reactive element from its compound. In all single displacement reactions, only one element displaces another element from its compound. The single displacement reactions are, however, written as just displacement reactions. The displacement reaction between iron (III) oxide and powdered aluminium produces so much heat that iron metal obtained is in molten form.

(i) Copper displaces which of the following metals from its salt solution?

(a) ZnSO_4

(b) FeSO_4

(c) AgNO_3

(d) NiSO_4

Answer: c

(ii) When zinc reacts with dilute sulphuric acid, the gas evolved is

(a) red in colour and have a sweet smelling

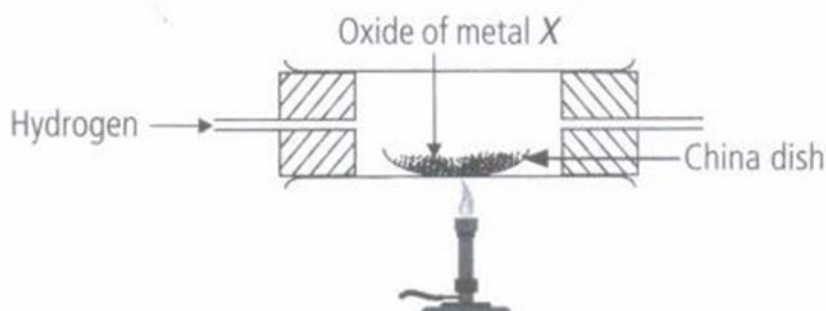
(b) green in colour and have a foul smell

(c) colourless, odourless and burns with a pop sound

(d) colourless, pungent smelling and burns with a pop sound

Answer: c

(iii) When dry hydrogen is passed over a heated oxide of metal X using the apparatus shown below, a reddish-brown residue is obtained



The reddish -brown residue could be

(a) copper

(b) lead

(c) silver

(d) zinc

Answer: a

(iv) Which of the following reactions is a displacement reaction?

(a) $\text{CaO} + \text{H}_2\text{O} \rightarrow \text{Ca}(\text{OH})_2$

(b) $\text{MgCO}_3 \rightarrow \text{Mg} + \text{CO}_2$

(c) $\text{Mg} + \text{CuSO}_4 \rightarrow \text{MgSO}_4 + \text{Cu}$

(d) $\text{H}_2 + \text{Cl}_2 \rightarrow 2\text{HCl}$

Answer: c

(v) When dilute hydrochloric acid is added to granulated zinc placed in a test tube, the observation made is

(a) the surface of the metal turns shining

(b) the reaction mixture turns milky

(c) greenish yellow gas is evolved

(d) the colourless and odourless gas evolves with a pop sound.

Answer: d

4. Those reactions in which two compounds react by an exchange of ions to form two new compounds are called double displacement reactions. A double displacement reaction usually occurs in solution and one of the products, being insoluble, precipitates out (separates as a solid). Any reaction in which an insoluble solid (called precipitate) is formed that separates from the solution is called a precipitation reaction. The reaction in

which acid or acidic oxide reacts with base or basic oxide to form salt and water is called neutralisation reaction.

For example, $2\text{NaOH} + \text{H}_2\text{SO}_4 \rightarrow \text{Na}_2\text{SO}_4 + 2\text{H}_2\text{O}$

(i) When hydrogen sulphide gas is passed through a blue solution of copper sulphate, a black precipitate of copper sulphide is obtained, and the sulphuric acid so formed remains in the solution. The reaction is an example of a

- (a) combination reaction (b) displacement reaction
(c) decomposition reaction (d) double displacement reaction

Answer: d

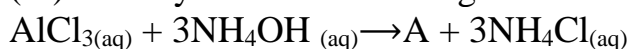
(ii) Barium chloride on reaction with ammonium sulphate forms barium sulphate and ammonium chloride. Which of the following correctly represents the type of the reaction involved?

- (I) Displacement reaction
(II) Precipitation reaction
(III) Combination reaction
(IV) Double displacement reaction

- (a) (I) only (b) (II) only (c) (III) and (IV) only (d) (II) and (IV) only

Answer: d

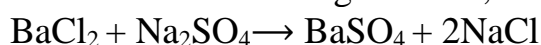
(iii) Identify A in the following reaction.



- (a) $\text{Al}(\text{OH})_3$ (b) Al_2O_3 (c) AlH_3 (d) AlN

Answer: a

(iv) Consider the following reaction,

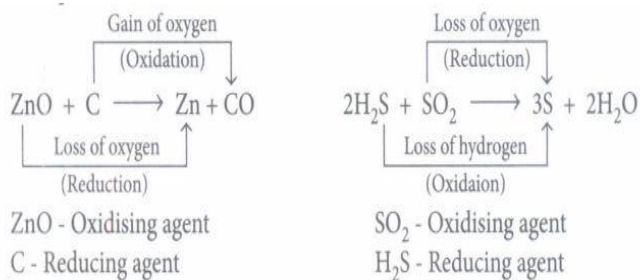


identify the precipitate in the reaction,

- (a) BaCl_2 (b) BaSO_4 (c) Na_2SO_4 (d) NaCl

Answer: b

5. The earlier concept of oxidation and reduction is based on the addition or removal of oxygen or hydrogen elements so, in terms of oxygen and hydrogen, oxidation is addition of oxygen to a substance and removal of hydrogen from a substance. On the other hand, reduction is addition of hydrogen to a substance and removal of oxygen from a substance. The substance which gives oxygen to another substance or removes hydrogen from another substance in an oxidation reaction is known as oxidising agent, while the substance which gives hydrogen to another substance or removes oxygen from another substance in a reduction reaction is known as reducing agent. For example,



(i) A redox reaction is one in which

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

Answer: d

(ii) In the reaction, $\text{H}_2\text{S} + \text{Cl}_2 \rightarrow \text{S} + 2\text{HCl}$

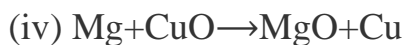
- (a) H_2S is the reducing agent. (b) HCl is the oxidising agent.
(c) H_2S is the oxidising agent. (d) Cl_2 is the reducing agent.

Answer: a

(iii) Which of the following processes does not involve either oxidation or reduction?

- (a) Formation of slaked lime from quick lime.
- (b) Heating mercuric oxide.
- (c) Formation of manganese chloride from manganese oxide (MnO₂).
- (d) Formation of zinc from zinc blende.

Answer : a



Which of the following is wrong relating to the above reaction?

- (a) CuO gets reduced
- (b) Mg gets oxidised.
- (c) CuO gets oxidised.
- (d) It is a redox reaction.

Answer : c

SECTION D

Short Answer Type Questions-I (2 Marks)

Question 1 List four observations that help us to determine whether a chemical reaction has taken place. [Board Term-I, 2012]

Answer :

- (i) Evolution of gas
- (ii) Change in temperature
- (iii) Change in state
- (iv) Change in colour

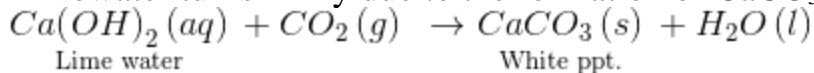
Question 2. What is observed when carbon dioxide gas is passed through lime water.

- (i) For a short duration
- (ii) For long duration?

Also, write the chemical equations for the reaction involved. [Board Term I, 2016]

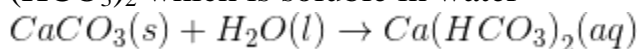
Answer : (i) For short duration:

Limewater turns milky due to the formation of CaCO₃, Which is insoluble in water.



(ii) For Long duration:

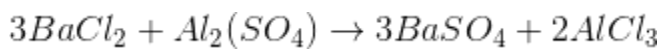
A clear solution is obtained due to the formation of calcium bicarbonate. Ca(HCO₃)₂ which is soluble in water



Question 3 Write the balanced chemical equation for the following reaction and write the name of the reaction

Barium Chloride + Aluminium Sulphate \rightarrow Barium Sulphate + Aluminium Chloride

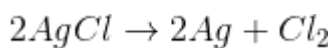
Answer :



It is a double displacement reaction.

Question 4 Why do we store silver chloride in dark coloured bottles? Explain in brief. [CBSE 2010]

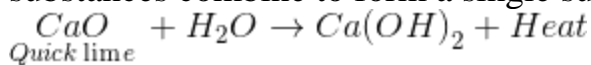
Answer : Silver chloride on exposure to sunlight may decompose as per the following reaction



Therefore it is stored in dark coloured bottles.

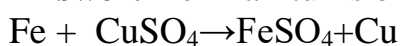
Question 5. Define a combination reaction. Give one example of a combination reaction which is also exothermic.

Answer: A combination reaction is said to have occurred when two or more than two substances combine to form a single substance.



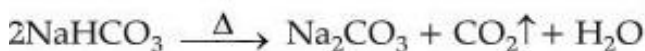
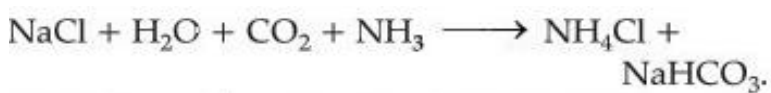
Question 6. What happens when an iron nail is put inside the copper sulphate solution? Write a reaction with observation.

Answer: Iron nail turns brown, blue colour of CuSO₄ changes to colourless.



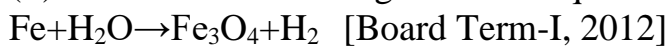
Question 7 Name the raw materials that are required for the manufacture of washing soda by Solvay process. Describe the chemical reactions involved in the process. [2007]

Answer: The raw materials needed for the manufacture of washing soda are NaCl (sodium chloride), water, ammonia gas, and limestone to give CO₂ gas. Chemical reactions involved:

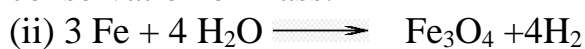


Question 8 (i) State the law which is followed in balancing a chemical equation.

(ii) Balance the following chemical equation:



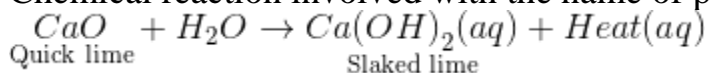
Answer :(i) Mass can neither be created nor destroyed in a chemical reaction-Law of conservation of mass.



Question 9 A white solid when dropped in water produces a hissing sound. What the solid may be? Give the chemical reaction for the above. Name the product formed. [2010]

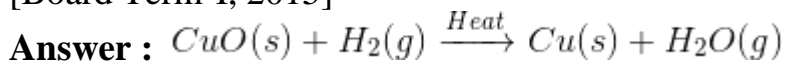
Answer : White solid is quicklime CaO

Chemical reaction involved with the name of products is



Question 10 When Hydrogen gas is passed over heated copper (II) oxide, copper and steam are formed. Write the balanced chemical equation with physical states for this reaction. State what kind of chemical reaction is this?

[Board Term-I, 2015]



This is a Redox reaction.

Question 11

Lead nitrate solution is added to a test tube containing potassium iodide solution.

(a) Write the name and colour of the compound precipitated.

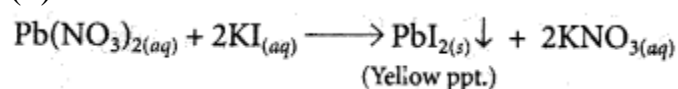
(b) Write the balanced chemical equation for the reaction involved.

(c) Name the type of this reaction justifying your answer. (2020)

Answer:

(a) When lead nitrate is added to potassium iodide then yellow precipitate of lead iodide is formed along with potassium nitrate.

(b) Balanced chemical reaction is as follows :

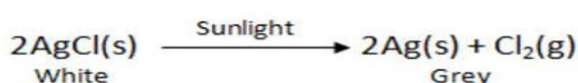


(c) This type of reaction is called precipitation reaction in which one of the products formed is an insoluble substance or this is also called double displacement reaction.

Question 12

2 g of silver chloride is taken in a China dish and the China dish is placed in sunlight for some time. What will be your observation in this case? Write the chemical reaction involved in the form of a balanced chemical equation. Identify the type of chemical reaction. (Delhi 2019)

Answer: When 2 g of silver chloride is taken in a china dish and the china dish is placed in sunlight for some time, the white sodium chloride turns grey due to the decomposition reaction through the sunlight that decomposes silver chloride into silver and chlorine by light.



It is a type of reaction photolytic decomposition reaction.

Question 13.

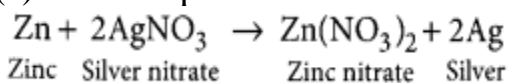
Identify the type of reactions taking place in each of the following cases and write the balanced chemical equation for the reactions.

(a) Zinc reacts with silver nitrate to produce zinc nitrate and silver.

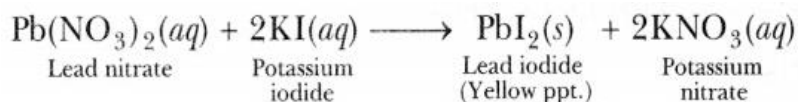
(b) Potassium iodide reacts with lead nitrate to produce potassium nitrate and lead iodide. (Delhi 2019)

Answer:

(a) It is a displacement reaction.



(b) Double displacement (precipitation reaction)



Question 14.

2 g of ferrous sulphate crystals are heated in a dry boiling tube. (AI 2019, Board Term 1, 2017, 2016)

(a) List any two observations.

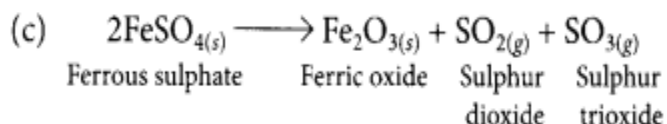
(b) Name the type of chemical reaction taking place.

(c) Write balanced chemical equation for the reaction and name the products formed.

Answer:

(a) Ferrous sulphate crystals ($\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$) lose water when heated and the colour of the crystal changes. It then decomposes to ferric oxide (Fe_2O_3), sulphur dioxide (SO_2) and sulphur trioxide (SO_3) with a smell of burning sulphur.

(b) This is a thermal decomposition reaction.



Question 15.

You might have noted that when copper powder is heated in a China dish, the reddish brown surface of copper powder becomes coated with a black substance. (AI 2019)

(a) Why is this black substance formed?

(b) What is the black substance?

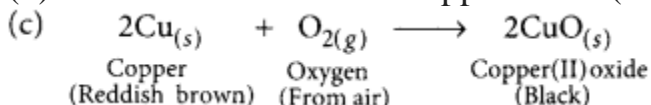
(c) Write the chemical equation of the reaction that takes place.

(d) How can the black coating on the surface be turned reddish brown?

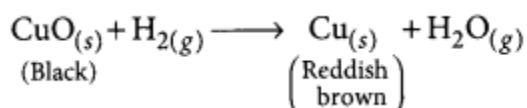
Answer:

(a) The black substance is formed because copper combines with oxygen.

(b) The black substance is copper oxide (CuO).



(d) The black coating on the surface can be turned reddish brown by passing hydrogen gas over the hot copper oxide.

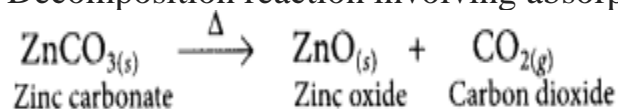


Question 16.

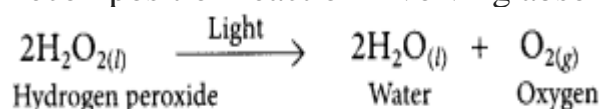
Decomposition reactions require energy either in the form of heat or light or electricity for breaking down the reactants. Write one equation each for decomposition reactions where energy is supplied in the form of heat, light and electricity. (2018)

Answer:

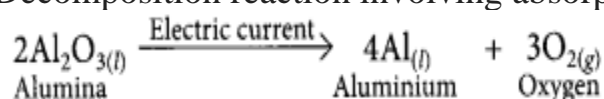
Decomposition reaction involving absorption of heat:



Decomposition reaction involving absorption of light:



Decomposition reaction involving absorption of electrical energy:



Question 17.

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

(i) What do you feel on touching the test tube?

(ii) State the inference about the type of reaction occurred.

(iii) Write the balanced chemical equation of the reaction involved. (Board Term I, 2017)

Answer:

(i) When barium hydroxide is added into ammonium chloride, the bottom of test tube is found to be cooler.

(ii) It is an endothermic reaction.

(iii) $\text{Ba}(\text{OH})_2 + 2\text{NH}_4\text{Cl} \rightarrow \text{BaCl}_2 + 2\text{NH}_4\text{OH}$

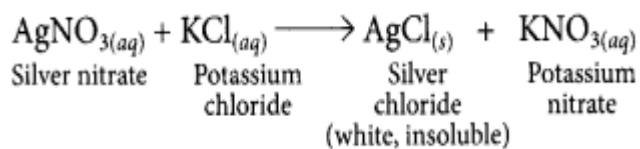
Question 18.

(a) A solution of potassium chloride when mixed with silver nitrate solution, an insoluble white substance is formed. Write the chemical reaction involved and also mention the type of the chemical reaction.

(b) Ferrous sulphate when heated, decomposes with the evolution of a gas having a characteristic odour of burning sulphur. Write the chemical reaction involved and identify the type of reaction. (Board Term I, 2016)

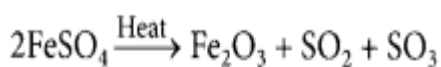
Answer:

(a)



It is a double displacement reaction.

(b) Thermal decomposition reaction



Question 19.

Name the type of chemical reaction represented by the following equation: (Board Term I, 2016)

(i) $\text{CaO} + \text{H}_2\text{O} \rightarrow \text{Ca}(\text{OH})_2$

(ii) $3\text{BaCl}_2 + \text{Al}_2(\text{SO}_4)_3 \rightarrow 2\text{AlCl}_3 + 3\text{BaSO}_4$

(iii) $2\text{FeSO}_4 \xrightarrow{\text{Heat}} \text{Fe}_2\text{O}_3 + \text{SO}_2 + \text{SO}_3$

Answer:

(i) Combination reaction.

(ii) Precipitation reaction or double displacement reaction.

(iii) Thermal decomposition reaction.

Question 20.

i) Can a displacement reaction be a redox reaction? Explain with the help of an example.?

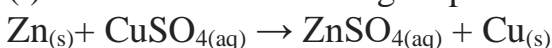
ii) Identify the substances that are oxidised and the substances that are reduced in the following reactions. (Board Term I, 2015)

(a) $\text{Fe}_2\text{O}_3 + 2\text{Al} \rightarrow \text{Al}_2\text{O}_3 + 2\text{Fe}$

(b) $2\text{PbO} + \text{C} \rightarrow 2\text{Pb} + \text{CO}_2$

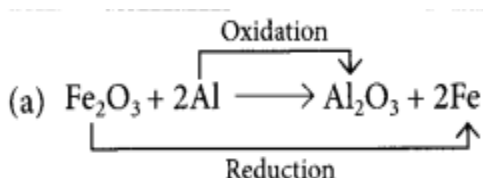
Answer:

(i) Consider the following displacement reaction:

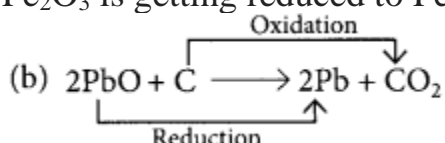


Here, Zn has changed into ZnSO_4 (i.e., Zn^{2+} ions) by loss of electrons. Hence, Zn has been oxidised. CuSO_4 (i.e., Cu^{2+}) has changed into Cu by gain of electrons. Hence, CuSO_4 has been reduced. Thus, the above reaction is a displacement reaction as well as a redox reaction.

(ii)



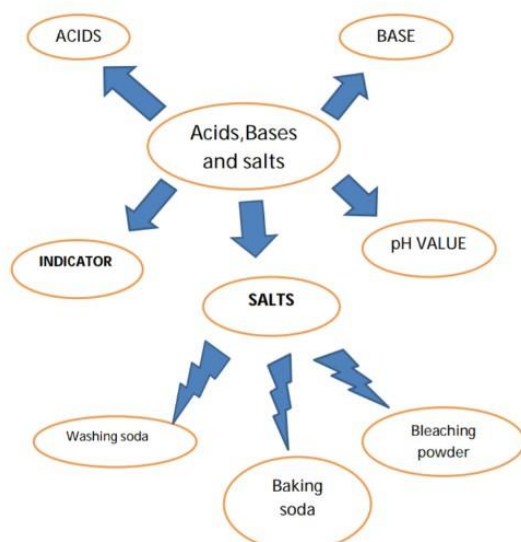
Fe_2O_3 is getting reduced to Fe and Al is getting oxidised to Al_2O_3 .



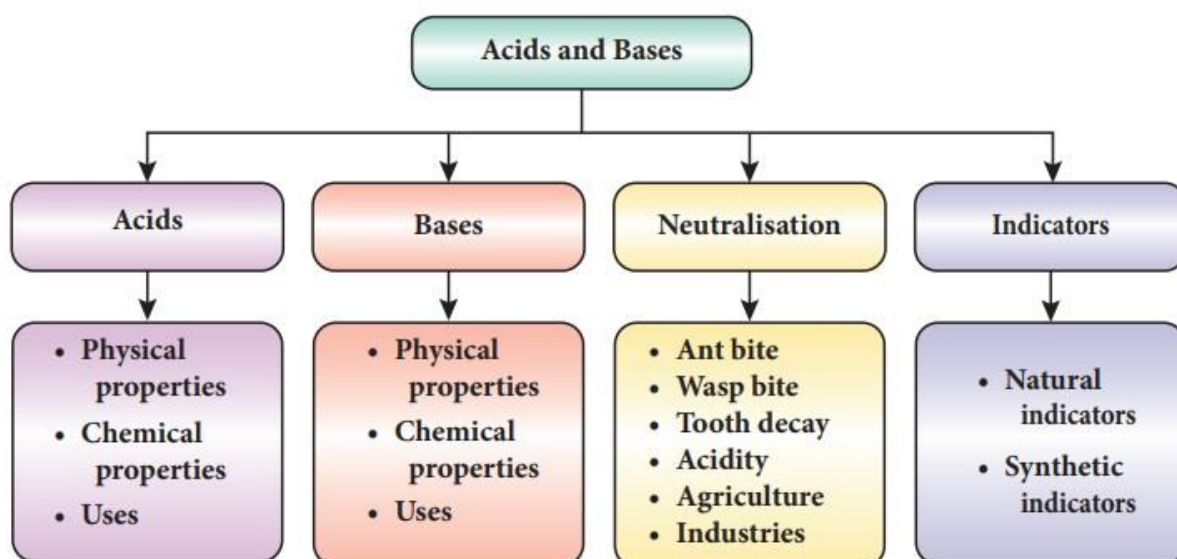
PbO is reduced to Pb and C is oxidised to CO_2 .

CHAPTER 2- -ACIDS, BASES AND SALTS

MIND MAP



Concept Map



FOCUS AREAS

Acids: Substances which turn blue litmus solution red are called acids. Acids are sour in taste

Bases: Substances which change red litmus solution blue are called bases. They are bitter in taste.

Mineral Acids: Acids which are obtained from minerals like sulphates, nitrates, chlorides etc. Are called mineral acids, e.g., H_2SO_4 (Sulphuric acid), HNO_3 (Nitric acid) and HCl (Hydrochloric acid).

Organic Acids: Acids which are obtained from plants and animals are called organic acids.e.g.citric acid, ascorbic acid, tartaric acid, lactic acid, acetic acid.

Hydronium Ions(H_3O^+): They are formed by reaction of H^+ (from acid) and H_2O . It is because H^+ is unstable.

Strong Acids: Acids which dissociate into ions completely are called strong acids. E.g. $\text{H}_2\text{SO}_4, \text{HCl}$

Weak Acids: Acids which do not dissociate into ions completely are called weak acids
E.g. Citric acid, acetic acid.

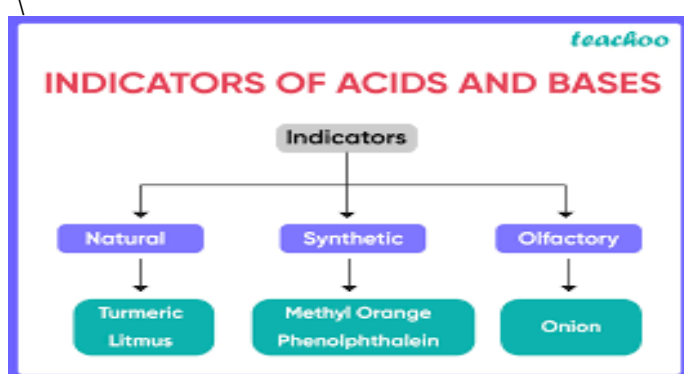
Chemical properties of acids

- (i) Acids react with active metals to give salt and hydrogen gas.
- (ii) Acids react with metal carbonate and metals hydrogen carbonate to give salt, water and carbon dioxide.
- (iii) Acids react with bases to give salt and water. This reaction is called neutralization reaction.
- iv) Acids react with metals oxides to give salt and water.

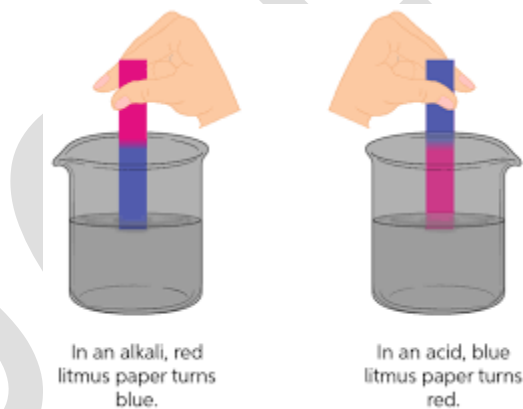
Chemical properties of Bases

- (i) Reaction with Metals – Certain metals such as Zinc and Aluminum react with alkali solutions on heating and hydrogen gas is evolved
- (ii) Reaction with acids – Bases react with acids to form salt and water

Indicators - Indicators are substances which indicate the acidic or basic nature of the solution by their colour change.



Litmus:



Phenolphthalein: It is a colourless organic dye in acidic or neutral medium, but it changes to pink in basic medium.

Methyl orange: It is an orange-coloured dye and keeps this colour in the neutral medium. In the acidic medium, the colour of the indicator becomes red and in the basic medium, it changes to yellow.

Red cabbage juice: Its colour remains red in acidic medium but changes to green if the medium is basic or alkaline.

Turmeric solution: It is a yellow dye. In the acidic as well as in neutral medium, its colour remains yellow. In the basic medium the colour changes to reddish brown.

Olfactory indicators: These are chemical substances whose odour changes in acidic or basic medium.

For example, onion, vanilla and clove oil.

Indicator	Colour in acid (pH < 7)	Colour at pH = 7	Colour in base (pH > 7)
Red cabbage water	red, pink	purple	blue, green, yellow
Red onion water	red	violet	green
Turmeric water	yellow	yellow	red
Phenolphthalein	colourless	colourless	pink, red
Bromothymol blue	yellow	green	blue
Red litmus	red	red	blue
Blue litmus	red	blue	blue
Universal indicator	red, orange, yellow	green	Blue, violet, purple

Universal Indicator: A universal indicator is a mixture of indicators which shows a gradual but well-marked series of colour changes over a very wide range of change in concentration of H⁺ ion.

pH scale: A scale for measuring hydrogen ion concentration in a solution.

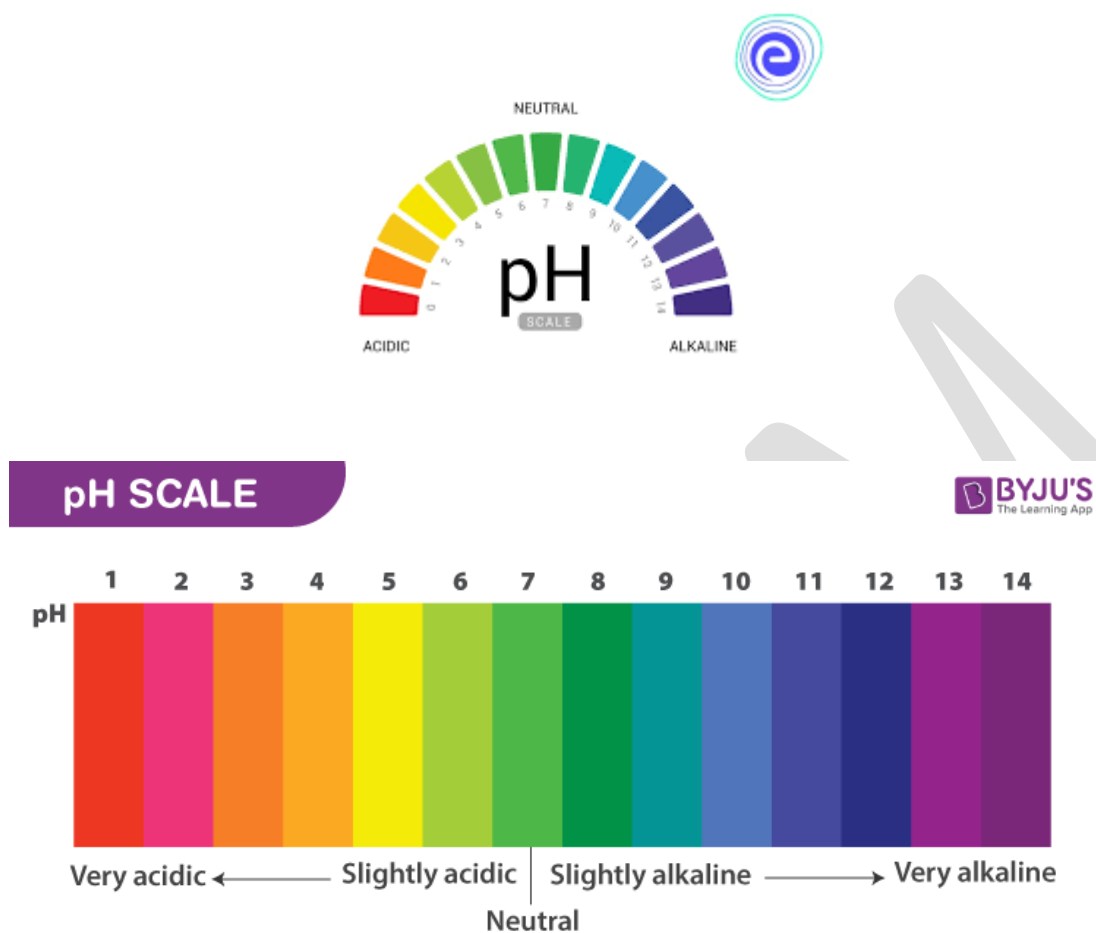
The pH of a solution is defined as the negative logarithm of hydrogen ion concentration in moles per litre.

The pH of a solution is inversely proportional to the concentration of hydrogen ions in it. That is, a solution having a high concentration of hydrogen ions has a low pH value.

The pH of a neutral solution is 7

The pH of an acidic solution is < 7

The pH of a basic solution is > 7



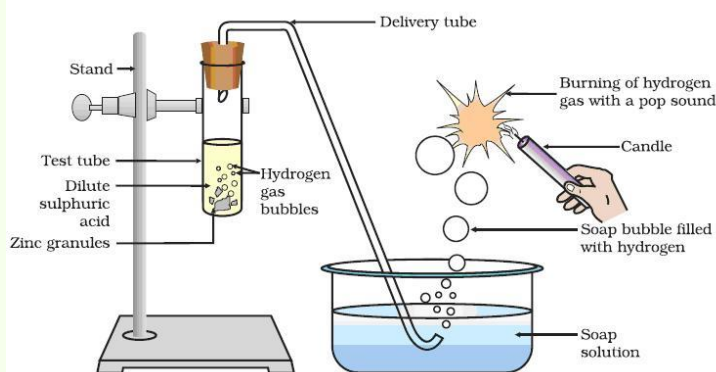
CHEMICAL REACTIONS OF ACIDS & BASES:

(i) Reaction of acid or base with metal: Generally, Metals react with acids to liberate hydrogen gas and form salt.

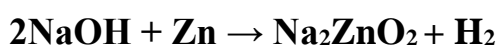


Hydrogen gas is not evolved when a metal reacts with nitric acid. It is because HNO₃ is a strong oxidizing agent. It oxidises the H₂ produced to water and itself gets reduced to any of the nitrogen oxides (N₂O, NO, NO₂).

The metal Copper (Cu) does not liberate Hydrogen gas with acids.

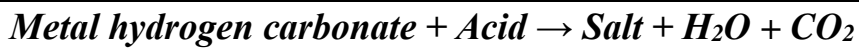


A few metals like zinc, lead and aluminium react with bases to give off hydrogen.

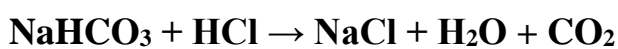
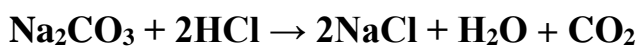
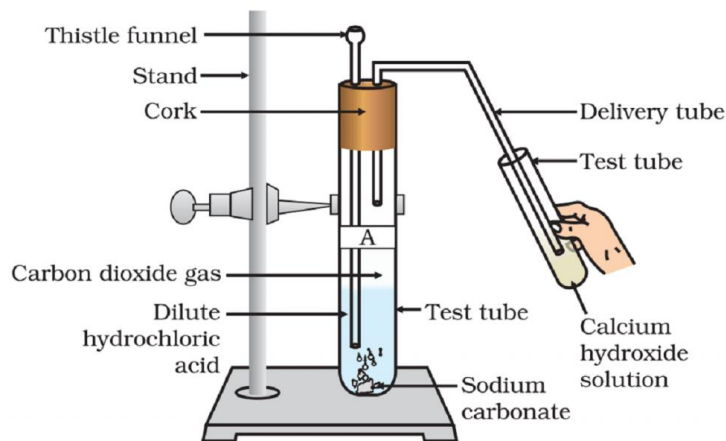


(sodium zincate)

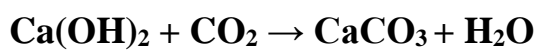
(ii) Reaction of acids with metal hydrogen carbonate and metal carbonates: All metal carbonates and hydrogen carbonates react with acids to give the corresponding salt, carbon dioxide and water.



For example,



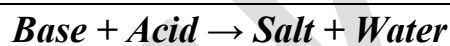
The released CO_2 gas turns lime water milky due to formation of CaCO_3 .



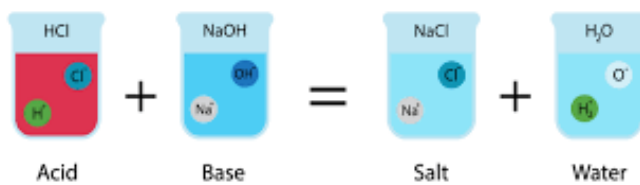
(Lime water)

(Milky white)

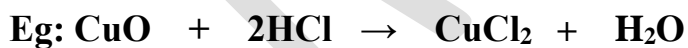
(iii) Neutralisation reaction: A chemical reaction between an acid and a base to give a salt and water is known as neutralisation reaction. In general neutralisation reaction can be written as



Acid - base reactions



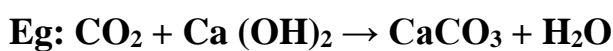
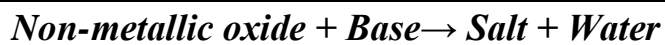
(iv) Reactions of metal oxides with acids



Copperoxide

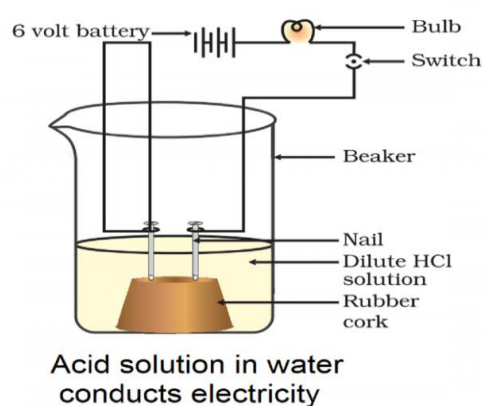
Copper Chloride

(v) Reactions of non-metallic oxide with base



How strong are acid or base solutions: Any aqueous solution, be it acidic, alkaline, or neutral, will have both H^+ and OH^- ions.

The solution will be either acidic or alkaline depending upon the type of ions present in the solution with the larger concentration.



Acid solution in water conducts electricity

Chlor-Alkali Process:

When electricity is passed through an aqueous solution of sodium chloride (called brine), it decomposes to form sodium hydroxide. The process is called the chlor-alkali process. This process is taken place by electrolysis of aqueous sodium chloride.

The chemical equation of this process is as follow:
 $2\text{NaCl}(\text{aq}) + 2\text{H}_2\text{O}(\text{l}) \rightarrow 2\text{NaOH}(\text{aq}) + \text{Cl}_2(\text{g}) + \text{H}_2(\text{g})$

When electricity is passed through an aqueous solution of sodium chloride (called brine), Chlorine gas is given off at the anode, and hydrogen gas at the cathode. Sodium hydroxide solution is formed near the cathode.

Products of chlor-alkali Process:

- (1) Sodium Hydroxide
- (2) Chlorine Gas
- (3) Hydrogen Gas

Uses of Sodium Hydroxide: -

- (i) It is used for de-greasing Metals.
- (ii) In soaps and detergents.
- (iii) In Paper making.
- (iv) For making of artificial fibres.

Uses of Hydrochloric acid:

of Hydrochloric acid: Chlorine and Hydrogen are the main products of chlor-alkali process. These are used for production of Hydrochloric acids. Hydrochloric acid is important chemical product which is used in manufacturing of medicines, cosmetics and ammonium chloride and also used for cleaning steel. Uses of hydrogen:

- (i) It is used as fuels.
- (ii) It is used in Margarine.
- (iii) In manufacturing of ammonia for fertilisers.

Uses of Chlorine gas :-

1. It is used In water treatment.
2. In swimming pool.
3. In manufacturing of PVC, CFCs and pesticides.
4. It is also used as disinfectants.

Production

Some Important Compounds and their uses

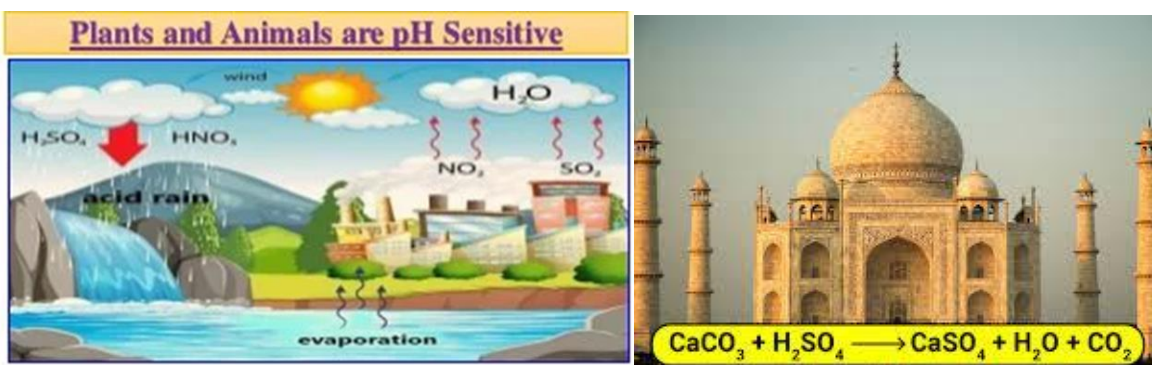
Common Name	Chemical name/ Chemical formula	Preparation	Uses
Washing soda	Sodium carbonate decahydrate $\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$	$\text{Na}_2\text{CO}_3 + 10\text{H}_2\text{O} \rightarrow \text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$	Manufacture of borax, caustic soda, softening of hard water
Baking soda	Sodium hydrogen carbonate NaHCO_3	$\text{NaCl} + \text{NH}_3 + \text{CO}_2 + \text{H}_2\text{O} \rightarrow \text{NaHCO}_3 + \text{NH}_4\text{Cl}$	Used as antacid, ingredient of baking powder
Bleaching powder	Calcium oxychloride CaOCl_2	By the action of chlorine on dry slaked lime $\text{Ca}(\text{OH})_2 + \text{Cl}_2 \rightarrow \text{CaOCl}_2 + \text{H}_2\text{O}$	Bleaching clothes, used as oxidizing agent, disinfecting water, manufacture of chloroform
Plaster of Paris	Calcium sulphate hemihydrate $\text{CaSO}_4 \cdot 1/2\text{H}_2\text{O}$	$\text{CaSO}_4 \cdot 2\text{H}_2\text{O} \xrightarrow{373\text{K (Heat)}} \text{CaSO}_4 \cdot 1/2\text{H}_2\text{O} + 1.1/2\text{H}_2\text{O}$	Plastering fractured bones, making toys, decorative materials, statues

Importance of pH in everyday life:

The pH Scale



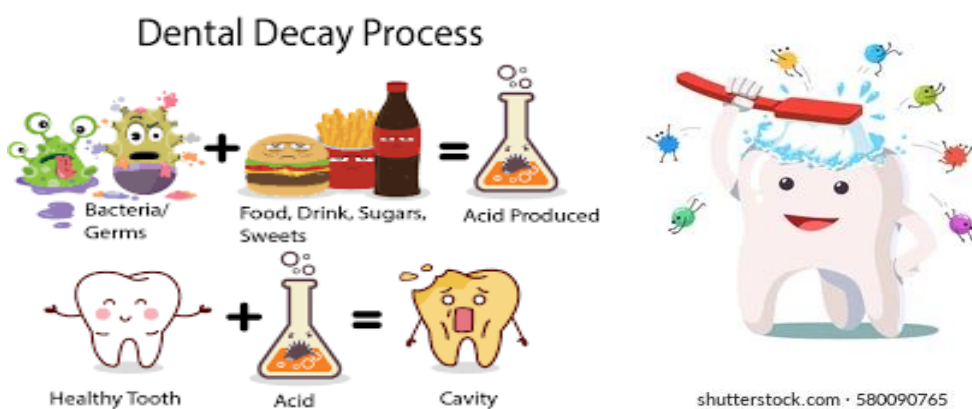
(i) If pH of rainwater is less than 5.6, it is called **acid rain**. When acid rain flows into the rivers, it lowers the pH of river water. The survival of aquatic life in such rivers become difficult. Acid rain also damages crops and cause a change in pH of the soil.



(ii) **pH in our digestive system:** Our stomach produces digestive juices/hydrochloric acid (HCl), which helps in the digestion of food without harming the stomach. However, sometimes the stomach produces too much of acid and this causes indigestion, which is accompanied by pain and irritation. To get rid of this pain, people use antacids like magnesium hydroxide. These antacids neutralise the excess acid formed.



(iii) **pH change as the cause of tooth decay:** Tooth decay starts when the pH of the mouth is lower than 5.5. Tooth enamel, made up of calcium phosphate is the hardest substance in the body. It does not dissolve in water but is corroded when the pH in the mouth is below 5.5. Using toothpaste, which are generally basic, for cleaning the teeth can neutralise the excess acid and prevent tooth decay.

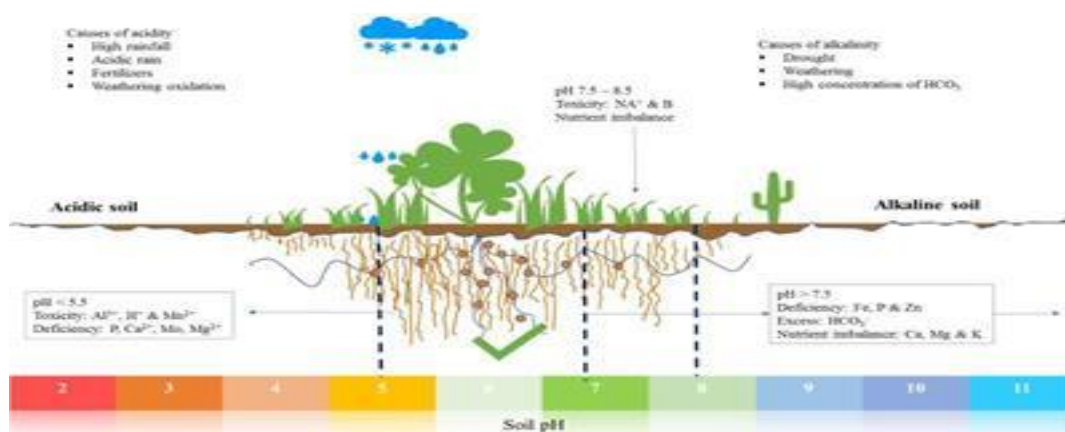


(iv) **Bee-sting** leaves an acid which causes pain and irritation. Using a mild base like baking soda on the stung area gives relief. Stinging hair of nettle leaves inject methanoic acid causing a burning pain. A traditional remedy is rubbing the area with the leaf of the dock plant.

(v) Various fluids in our body work within a particular range of pH such as, pH of **human blood** should be between 7.3 to 7.5.

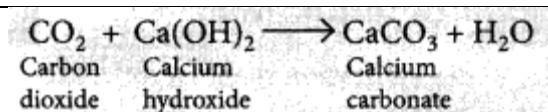
(vi) **For the growth of plants**, a particular pH range of soil is essential. Usually, neutral soil is best for crops. If the soil is acidic, farmers treat the soil with quick lime or slaked lime.

(vii) The tarnished surface of a copper vessel due to the formation of copper oxide layer (which is basic) can be cleaned by rubbing with lemon (which is acidic).



QUESTION BANK

	<u>VERY SHORT ANSWER TYPE QUESTIONS</u>
1.	The pH of three solutions A, B and C are 4, 9 and 6 respectively. Arrange them in increasing order of acidic strength. Ans: The increasing order of acidic strength is : $B < C < A$.
2.	Write the chemical name and formula of the compound which is used as an antacid Ans: Sodium bicarbonate, NaHCO_3
3.	A cloth strip dipped in onion juice is used for testing a liquid 'X'. The liquid 'X' changes its odour. Which type of an indicator is onion juice? Ans: Olfactory indicator
4.	The pH of a salt used to make tasty and crispy pakoras is 14. Identify the salt and write a chemical equation for its formation Ans: Baking soda (Sodium Hydrogen Carbonate)
5.	A milk man adds a very small amount of baking soda to fresh milk Why? Ans: It is done to prevent the formation of lactic acid which spoils the milk
6.	What is meant by an acidic salt? Ans: The salt formed by the reaction between a strong acid and weak base
7.	Which bases are called alkalies? Ans: Soluble bases are called alkalies.
8.	Name the hardest substance in the body. Ans: Tooth enamel (Calcium phosphate).
9.	What is meant by water of crystallisation? Ans: Water of crystallisation is the fixed number of water molecules chemically attached to each formula unit of a salt in its crystalline form.
10.	Acidic and basic solutions in water conduct electricity. Why? Ans: Because they produce hydrogen and hydroxide ions respectively.
	<u>SHORT ANSWER TYPE QUESTIONS</u>
1.	With the help of an example explain what happens when a base reacts with a non-metallic oxide. What do you infer about the nature of non-metal oxide? Ans: Oxides of non-metals react with bases to form salt and water. For example, the reaction between carbon dioxide and calcium hydroxide. Calcium hydroxide, which is a base, reacts with carbon dioxide to produce salt and water.



Hence, oxides of non-metals are acidic in nature.

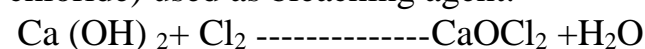
2. To a solution of sodium hydroxide in a test tube, two drops of phenolphthalein are added.
 (i) State the colour change observed.
 (ii) If dil HCl is added dropwise to the solution, what will be the colour change?
 (iii) On adding few drops of NaOH solution to the above mixture the colour of the solution reappears. Why?

Ans:

- (i) On adding phenolphthalein to NaOH solution, the colour becomes pink.
 (ii) On adding dilute HCl solution dropwise to the same test tube, the pink colour disappears and the solution again becomes colourless.
 (iii) On again adding NaOH to the above mixture, pink colour reappears because the medium becomes basic again.

3. A gas X reacts with lime water and forms a compound Y which is used as bleaching agent in the chemical industry. Identify X and Y. Give the chemical equation of the reaction involved.

Ans: X is chlorine Y is CaOCl₂ (calcium oxy chloride) used as bleaching agent.



4. You are given two solutions A and B. The pH of solution A is 6 and pH of solution B is 8.

- (i) Which solution is acidic and which is basic?
 (ii) Which solution has more H⁺ ion concentration?
 (iii) Why is HCl a stronger acid than acetic acid?

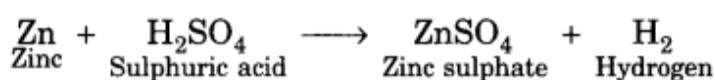
Ans:

- (i) The solution with pH 6 is acidic while the solution with pH 8 is basic.
 (ii) The solution with pH 6 has more H⁺ ion concentration.
 (iii) HCl is a stronger acid than CH₃COOH since its degree of dissociation (α) is more or it releases more H⁺ ions in solution than acetic acid.

5. When zinc metal is treated with a dilute solution of a strong acid, a gas is evolved. Name the gas evolved. Write the chemical equation of the reaction involved and also write a test to detect the gas formed.

Ans:

Zinc metal gives hydrogen gas when it is treated with dilute sulphuric acid. Therefore, the gas evolved is hydrogen.

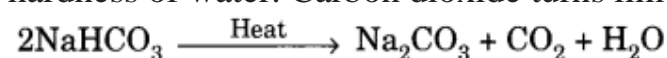


Test for hydrogen gas: When a burning candle is brought near hydrogen gas, it burns with a pop sound which confirms the presence of hydrogen gas

6. Salt A commonly used in bakery products on heating gets converted into another salt B which itself is used for removal of hardness of water and a gas C is evolved. The gas C when passed through lime water, turns it milky. Identify A, B and C.

Ans:

Baking soda is a salt used in bakery products. It give sodium carbonate and carbon dioxide gas on heating. Sodium carbonate is used to remove hardness of water. Carbon dioxide turns lime water milky.

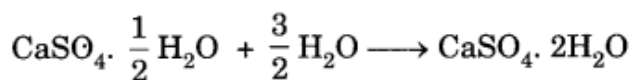
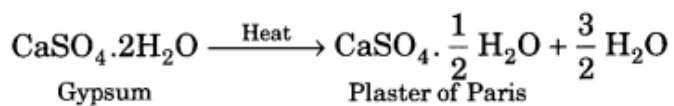


Therefore,

- Salt A is sodium bicarbonate
- Salt B is sodium carbonate, which is used to remove hardness of water.

	<ul style="list-style-type: none"> The C is carbon dioxide gas which turns lime water milky.
7.	<p>When electricity is passed through a common salt solution, sodium hydroxide is produced along with the liberation of two gases 'X' and T. The gas 'X' burns with a pop sound whereas T is used for disinfecting drinking water.</p> <p>(i) Identify X and Y. (ii) Give the chemical equation for the reaction stated above. (iii) State the reaction of Y with dry slaked lime.</p> <p>Answer:</p> <p>(i) The gas X' is H₂ and gas 'Y' is Cl₂. (ii) The chemical equation for the reaction is:</p> $2\text{NaCl}(aq) + 2\text{H}_2\text{O}(l) \xrightarrow{\text{Electric current}} 2\text{NaOH}(aq) + \text{H}_2(g) + \text{Cl}_2(g)$ <p>(iii) Cl₂ reacts with slaked lime to form bleaching powder. Ca(OH)₂ + Cl₂ → CaOCl₂ + H₂O</p>
8.	<p>Mohan and Priyanka were playing in the garden. Priyanka was stung by a bee and started crying and returned home. Her mother immediately observed the affected area and applied a thin coating of toothpaste as first aid, then took her to the nearest doctor.</p> <p>(i) Why did Priyanka cry? (ii) Name the chemical substance present in bee sting. (iii) How is toothpaste effective in such an incident?</p> <p>Answer:</p> <p>(i) Priyanka cried because the bee injected an acid while stinging which caused pain and irritation. (ii) Formic acid or Methanoic acid (HCOOH)</p>
9.	<p>(iii) Toothpaste is basic in nature so it neutralise the effect of formic acid and gives relief.</p> <p>(i) Explain, why is hydrochloric acid a strong acid and acetic acid, a weak acid? (ii) Explain, why aqueous solution of an acid conducts electricity. (iii) You have four solutions A, B, C and D. The pH of solution A is 6, B is 9, C is 12 and D is 7.</p> <p>(a) Identify the most acidic and most basic solutions. (b) Arrange the above four solutions in the increasing order of H⁺ ion concentration. (c) State the change in colour of pH paper on dipping in solution C and D.</p> <p>Ans:</p> <p>(i) Hydrochloric acid (HCl) is a stronger acid than acetic acid (CH₃COOH) because it dissociates completely into H⁺ and Cl⁻ ions in aqueous solution. In</p> <p>(ii) An aqueous solution of an acid releases ions in aqueous solutions. These ions conduct electricity.</p>
10	<p>(iii) (a) Most acidic is A (pH = 6) and most basic is C (pH = 12). (b) The increasing order of H⁺ ion concentration is: C < B < D < A. (c) The pH paper acquires dark purple colour in solution C and green in solution D.</p> <p>A compound which is prepared from gypsum has the property of hardening when mixed with proper quantity of water. Identify the compound. Write chemical equation to prepare the compound. Mention one important use of the compound.</p> <p>Ans:</p>
1.	<p>The compound is Plaster of Paris (CaSO₄. 1/2 H₂O). It is formed from</p>

gypsum ($\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$) upon heating to a temperature of 373 K. It changes back to gypsum on adding water. Plaster of Paris is used for setting fractured bones.



CASE STUDY TYPE QUESTIONS

A copper vessel gets tarnished due to formation of an oxide layer on its surface. On rubbing lemon on the vessel, the surface is cleaned, and the vessel begins to shine again. This is due to the fact that which reacts with the acid present in lemon to form a salt which is washed away with water. As a result, the layer of copper oxide is removed from the surface of the vessel and the shining surface is exposed.

2. 1. Which of the following acids is present in lemon?

- (a) Formic acid (b) Acetic acid (c) Citric acid (d) Hydrochloric acid

Ans – (c)

2. The nature of copper oxide is

- a) acidic (b) basic (c) neutral (d) amphoteric

Ans – b)

3. Name the salt formed in the above reaction

- a) copper carbonate (b) copper chloride
c) copper citrate (d) copper citrate

Ans – d)

4. The phenomenon of copper getting tarnished is

- a) corrosion (b) rancidity (c) displacement (d) none of these

Ans- a)

Salt of a strong acid and strong base is neutral with a pH value of 7. NaCl common salt is formed by a combination of hydrochloric acid and sodium hydroxide solution. This is the salt that is used in food. Some salt is called rock salt which was formed when seas of bygone ages dried up. The common salt thus obtained is an important raw material for various materials of daily use, such as sodium hydroxide, baking soda, washing soda, and bleaching powder.

1.

1. Which of the following does not form an acidic salt?

- a) Phosphoric acid (b) Carbonic acid
2. c) Hydrochloric acid (d) Sulphuric acid

Ans -b)

2. Which of the following salts has no water of crystallization?

3.

- a) Copper sulphate (b) Washing soda
c) Baking soda (d) Gypsum

Ans -c)

4.

3. The formula of baking soda is

- a) NaCl (b) KHCO_3 (c) NaHCO_3 (d) Na_2CO_3

Ans -c)

5.

4. Which of the following is treated with chlorine to obtain bleaching powder

- a) CaSO_4 (b) Ca(OH)_2 (c) Mg(OH)_2 (d) KOH

Ans- b)

1.

ASSERTION-REASON TYPE QUESTIONS

2. The following questions consist of two statements – Assertion (A) and Reason (R).

Answer these questions selecting the appropriate option given below:

3. A. Both A and R are true, and R is the correct explanation of A
B. Both A and R are true, and R is not the correct explanation of A
C. A is true but R is false
D. A is False but R is true

Assertion (A): The aqueous solutions of glucose and alcohol do not show acidic character.

Reason (R): Aqueous solutions of glucose and alcohol do not give H⁺ ions

4. **Ans - A**

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

Reason (R): On strong heating, Copper sulphate crystals lose all the water of crystallization and form anhydrous salt.

5. **Ans- A**

Assertion (A): Water must always be added to acid with constant stirring.

6. **Reason (R):** Mixing of an acid with water decreases the concentration of H⁺ ions per unit volume

Ans-B

Assertion (A): HCl gas does not change the colour of dry blue litmus paper.

7. **Reason (R):** HCl gas dissolves in the water present in wet litmus paper to form H⁺ ions

8. **Ans-C**

9. **Assertion (A):** Baking powder is used in making cake instead of using only baking soda.

Reason (R): Baking powder contains tartaric acid which reacts with sodium carbonate and removes bitter taste.

Ans-A

10. **MULTIPLE CHOICE QUESTIONS**

Which one of the following can be used as an acid– base indicator by a visually impaired student?

- (A) Litmus (B) Turmeric
(C) Vanilla essence (D) Petunia leaves

Ans -C

Generally, when certain metals react with an acid they release gas.

- (a) Nitrogen (b) Oxygen
(c) Hydrogen (d) Argon

Ans -C

Which of the following statement is correct about an aqueous solution of an acid and of a base?

- (i) Higher the pH, stronger the acid (ii) Higher the pH weaker the acid
(iii) Lower the pH, stronger the base (iv) Lower the pH, weaker the base

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

Ans -d

What is formed when zinc reacts with sodium hydroxide?

- (a) Zinc hydroxide and sodium
(b) Sodium zincate and hydrogen gas
(c) Sodium zinc-oxide and hydrogen gas
(d) Sodium zincate and water

Ans -b

Tooth enamel is made up of

- (a) calcium phosphate
- (b) calcium carbonate
- (c) calcium oxide
- (d) potassium sulphate

Ans - a

Rain is called acid rain when its:

- (a) pH falls below 7
- (b) pH falls below 6
- (c) pH falls below 5.6
- (d) pH is above 7

Ans -c

When copper oxide and dilute hydrochloric acid react, colour changes to

- (a) white
- (b) bluish-green
- (c) blue-black
- (d) black

Ans -b

Sodium hydroxide turns phenolphthalein solution

- (a) pink
- (b) yellow
- (c) colourless
- (d) orange

Ans -a

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

- (a) Baking powder
- (b) Lime
- (c) Ammonium hydroxide solution
- (d) Hydrochloric acid

Ans -d

Which one of the given is true, if a substance has a pH value of 7?

- (a) The substance is a base
- (b) The substance is an acid
- (c) The substance is a neutral substance
- (d) Either (A) or (B)

Ans -c

CHAPTER 3

METALS AND NON-METALS

- Elements are divided into **Metals**, **non –Metals** and **Metalloids**. Metalloids possess the characters of both metals and nonmetals.
- Metals - Iron, Zinc, Copper, Aluminium etc.
- Non – metals: Chlorine, Nitrogen, Hydrogen, Oxygen, Sulphur etc.
- Metalloids - Silicon, Arsenic, Germanium

Physical properties of Metals and Non-Metals

PROPERTY	METALS	NON- METALS
STATE OF EXISTENCE	Metals are solids at room temperature (Exception: - Mercury is a liquid at room temperature)	Non–metals exist in all three stages of matter. The most common state is gaseous
LUSTRE	Metals are having shiny appearance. (lustre)	Non-Metals appear dull (Exception: - Crystals of iodine have bright lustre)
HARDNESS	Metals like Iron, copper, and Aluminium are hard. (Exceptions: Sodium and potassium are soft. We can cut with knife. Mercury is in liquid state at room temperature.)	Coal and sulphur are not very hard.

SONOROSITY	Metals produce sound, when struck with some hard object	Non –Metals are non-sonorous
MALLEABILITY	Metals are malleable. It can be beaten into thin sheets.	<u>Non-Metals are not malleable. If we beat them, they change into tiny particles. (powder)</u>
DUCTILITY	Metals can be drawn into thin wires.	We can't make metals into wires.
ELECTRICAL CONDUCTIVITY	Metals are good conductors of electricity.	Non-metals are poor conductors of electricity.
MELTING POINT	Metals have high melting point. But gallium and caesium have very low melting point. These two metals will melt if you keep them on your palm	Non-metals have low melting point

COMPARISON OF CHEMICAL PROPERTIES OF METALS AND NON-METALS

REACTION WITH	METALS	NON - METALS
OXYGEN	<i>Metal + Oxygen → Metal oxide</i>	<i>Non-metal + Oxygen → Non-metal oxide</i>
Amphoteric Oxides	<p>K, Na and Ca React vigorously $4\text{Na(s)} + \text{O}_2\text{(g)} \rightarrow 2\text{Na}_2\text{O(s)}$</p> <p>Mg, Al and Zn React with oxygen $4\text{Al(s)} + 3\text{O}_2\text{(g)} \rightarrow 2\text{Al}_2\text{O}_3$</p> <p>Al and Zn form Amphoteric oxides (They show the properties of both acidic and basic oxides)</p> <p>Gold and Silver are less reactive metals</p> <p>Metals form Basic oxides</p>	<p>$\text{C} + \text{O}_2 \rightarrow \text{CO}_2$ $\text{S} + \text{O}_2 \rightarrow \text{SO}_2$</p> <p>Non-metals form acidic oxides.</p> <p>CO and H_2O are neutral</p> <p>Nonmetal oxides are soluble in water.</p> <p>They dissolve in water to form acids</p> <p>$\text{SO}_2\text{(g)} + \text{H}_2\text{O(l)} \rightarrow \text{H}_2\text{SO}_3$</p>

	<p>Most of the metal oxides are insoluble in water</p> <p>Some of them dissolve in water to form alkali</p> $\text{Na}_2\text{O}(\text{s}) + \text{H}_2\text{O}(\text{l}) \rightarrow 2\text{NaOH}(\text{aq})$ $\text{MgO}(\text{s}) + \text{H}_2\text{O}(\text{l}) \rightarrow \text{Mg}(\text{OH})_2(\text{aq})$	(Sulphurous acid)
WATER	<p><i>Metals + water → metal oxides or metal hydroxide + H₂</i></p> $2\text{Na}(\text{s}) + 2\text{H}_2\text{O}(\text{l}) \rightarrow 2\text{NaOH} + \text{H}_2(\text{g}) + \text{heat}$ $2\text{Mg} + \text{O}_2 \rightarrow 2\text{MgO}$ $\text{Cu} + \text{H}_2\text{O} \rightarrow \text{No Reaction}$	Non-metals do not react with water or steam to evolve hydrogen gas. Because Nonmetals cannot give electrons to hydrogen in water
	<p><i>Metal + Acid → Metal salt + H₂</i></p> $2\text{Na}(\text{s}) + \text{H}_2\text{SO}_4 \rightarrow \text{Na}_2\text{SO}_4(\text{aq}) + \text{H}_2(\text{g})$ <p>Metal + HNO₃ → H₂ gas is not released.</p> <p>Reason-HNO₃ is strong oxidizing agent</p> <p>Exceptional</p> $\text{Mn} + 2\text{HNO}_3 \rightarrow \text{Mn}(\text{NO}_3)_2 + \text{H}_2(\text{g})$ <p>from HNO₃)</p> <p>Magnesium (Mg) and manganese (Mn) react with very dilute HNO₃ to evolve H₂ gas</p>	
DILUTE ACIDS		
SALT SOLUTION	<p>When metals react with salt solution, more reactive metal will displace a less reactive metal from its salt solution.</p> $\text{CuSO}_4(\text{aq}) + \text{Zn}(\text{s}) \rightarrow \text{ZnSO}_4(\text{aq}) + \text{Cu}(\text{s})$	<p>When non-metals react with salt solution, more reactive non-metal will displace a less reactive nonmetal from its salt solution.</p> $2\text{NaBr}(\text{aq}) + \text{Cl}_2(\text{g}) \rightarrow 2\text{NaCl}(\text{aq}) + \text{Br}_2(\text{aq})$
CHLORINE	<p><i>Metal + Chlorine → Metal Chloride</i></p> <p>Ionic bond is formed.</p> <p>Therefore an Ionic compound is obtained</p> $2\text{Na}(\text{s}) + \text{Cl}_2(\text{g}) \rightarrow 2\text{NaCl}(\text{s})$	<p><i>Non-metal + Chlorine → Non-metal Chloride</i></p> <p>covalent bond is formed.</p> <p>Therefore ia covalent compound is formed</p> $\text{H}_2 + \text{Cl}_2 \rightarrow 2\text{HCl}$

- Metals such as potassium and sodium react so **vigorously** that they catch fire if kept in the open.

Hence, they are kept immersed in **kerosene oil** to protect them and prevent accidental fires.

- At ordinary temperature, the surfaces of metals such as magnesium, aluminium, zinc, lead, etc., are covered with a **thin layer of oxide**.

The protective oxide layer prevents the metal from further oxidation.

- Iron does not burn on heating, but **iron filings burn vigorously** when sprinkled in the flame of the burner.

To burn the surface of iron in contact with air must be heated to its **ignition temperature**.

Iron has a strong molecular force of attraction. Hence when heated it doesn't reach to its ignition temperature and doesn't burn.

But iron fillings when sprinkled in flames attain the ignition temperature, as iron fillings are comparatively smaller particles and gain larger surface area for the reaction.

Therefore, they burn vigorously.

- Copper does not burn, but the hot metal is coated with a black coloured layer of copper (II) oxide.
- Silver and gold do not react with oxygen even at high temperatures
- Most of the metals do not react with water. Alkali metals react vigorously with water
- Reaction of Calcium metal with Water. The reaction of calcium with water is less violent. The heat evolved is not sufficient for the hydrogen to catch fire. Calcium starts floating because the bubbles of hydrogen gas formed stick to the surface of the metal.
- Reaction of Magnesium metal with Water Magnesium does not react with cold water. It reacts with hot water to form magnesium hydroxide and hydrogen. It also starts floating due to the bubbles of hydrogen gas sticking to its surface.
- Metals like aluminium, iron and zinc do not react either with cold or hot water. But they react with steam to form the metal oxide and hydrogen.
- **Displacement reactions** In this reaction, more reactive metal displaces the less reactive metal from its salt.

Metal A + Salt solution of B → Salt solution of A + Metal B
 Eg: Iron displaces copper from copper sulphate solution.

The Reactivity Series

- The reactivity series is a list of metals arranged in the order of their decreasing activities.
- In the reactivity series, copper, gold, and silver are at the bottom and hence, least reactive. These metals are known as Noble metals. *
- Potassium is at the top of the series and hence, most reactive.

K	Potassium	Most reactive Reactivity decreases Least reactive
Na	Sodium	
Ca	Calcium	
Mg	Magnesium	
Al	Aluminium	
Zn	Zinc	
Fe	Iron	
Pb	Lead	
H	Hydrogen	
Cu	Copper	
Hg	Mercury	
Ag	Silver	
Au	Gold	

How to remember the Reactivity Series?		
Please	Potassium	Most reactive Least reactive
Stop	Sodium	
Calling	Calcium	
Me	Magnesium	
A	Aluminium	
Careless	(Carbon)	
Zebra	Zinc	
Instead	Iron	
Try	Tin	
Learning	Lead	
How	(Hydrogen)	
Copper	Copper	
Saves	Silver	
Gold	Gold	

Reaction of Metals and Non-metals:

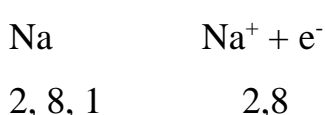
Many metals form ionic bonds when they react with non-metals. Compounds so formed are known as Ionic Compounds.

Ions: Positive or negative charged atoms are known as ions. Ions are formed because of loss or gain of electrons

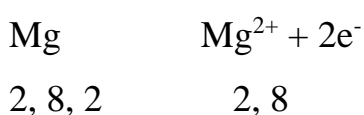
Positive ion: A positive ion is formed because of the loss of electrons by an atom.

Example;

Sodium forms sodium ion because of the loss of one electron. Because of the loss of one electron, one positive charge comes over sodium.



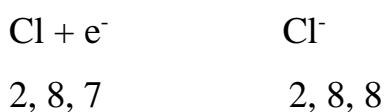
Magnesium forms positive ion because of the loss of two electrons. Two positive charges come over magnesium because of loss of two electrons.



Negative ion: A negative ion is formed because of the gain of an electron.

Example:

Chlorine gains one electron in order to achieve a stable configuration. After the gain of one electron, chlorine gets one negative charge over it forming chlorine ion.



Ionic Bonds: Ionic bonds are formed because of transfer of electrons from metal to non-metal. In this course, metals get positive charge because of transfer of electrons and non-metal gets negative charge because of acceptance of electrons. In other words, bond formed between positive and negative ion is called Ionic Bond.

Example;

Formation of Sodium Chloride (NaCl):

In sodium chloride, sodium is a metal (alkali metal) and chlorine is a non-metal.

Atomic number of sodium = 11

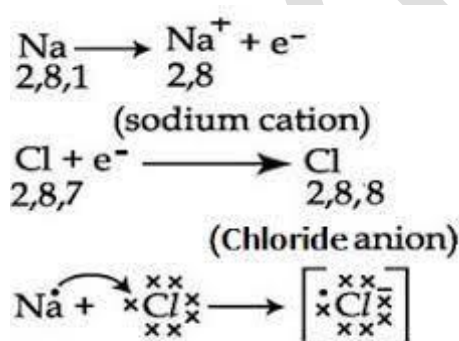
Electronic configuration of sodium: 2, 8, 1

Number of electrons in outermost orbit = 1

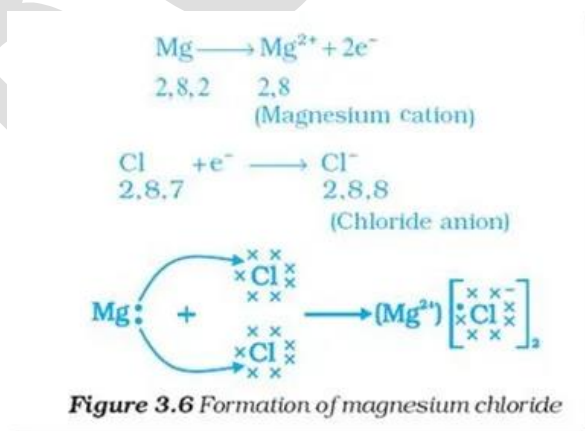
Atomic number of chlorine = 17

Electronic configuration of chlorine: 2, 8, 7

Electrons in outermost orbit = 7



Sodium has one valence electron and chlorine has seven valence electrons. Sodium requires losing one electron to obtain stable configuration and chlorine requires gaining one electron in order to obtain stable electronic configuration. Since, sodium chloride is formed because of ionic bond, thus, it is called Ionic compound. In similar way, Magnesium chloride (MgCl₂) is formed



In similar way, potassium chloride (KCl) is formed.

Properties of Ionic compound

(i) Physical nature: Ionic compounds are solid. Ionic bonds have a greater force of attraction because of which ions attract each other strongly. This makes ionic compounds solid.

Ionic compounds are brittle.

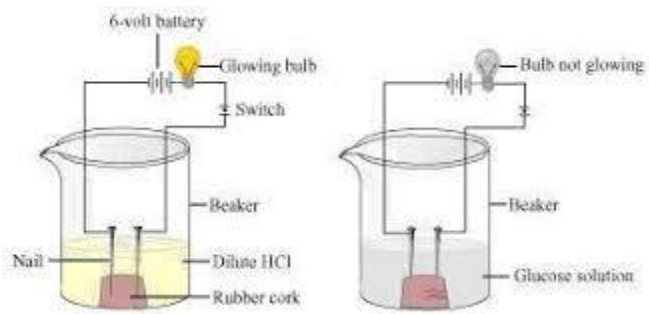
(ii) Melting and boiling point: Ionic compounds have high melting and boiling points because the force of attraction between ions of ionic compounds is very strong.

(iii) Solubility: Ionic compounds generally dissolve in water.

Ionic compounds are generally insoluble in organic solvents; like kerosene, petrol, etc.

Ionic compounds do not conduct electricity in the solid state.

(iv) Conduction of Electricity: The solution of ionic compounds in water conduct electricity. This happens because ions present in the solution of ionic compound facilitate the passage of electricity by moving towards opposite electrodes. Ionic compounds conduct electricity in the molten state as in the molten state the electrostatic forces of attraction between the oppositely charged ions overcome due to the heat. Thus, the ions move freely and conduct electricity.



Occurrence and Extraction of Metals:

Source of metal: Metals occur in Earth's crust and in seawater; in the form of ores. Earth's crust is the major source of metal. Seawater contains many salts such as sodium chloride, magnesium chloride, etc.

Mineral: Minerals are naturally occurring substances which have a uniform composition.

Ores: The minerals from which a metal can be profitably extracted are called Ores.

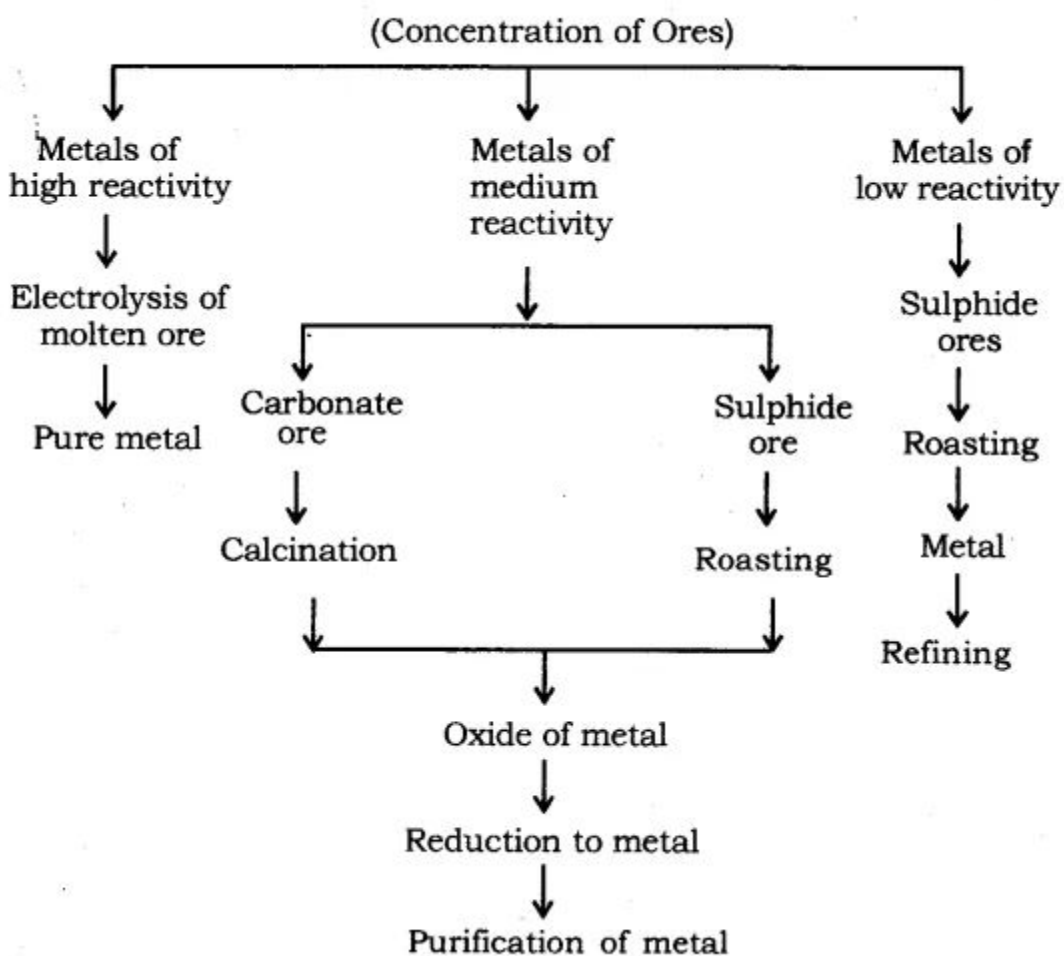
Metals found at the bottom of reactivity series are least reactive and they are often found in nature in free-state; such as gold, silver, copper, etc. Copper and silver are also found in the form of sulphide and oxide ores.

Metals found in the middle of reactivity series, such as Zn, Fe, Pb, etc. are usually found in the form of oxides, sulphides or carbonates.

Metals found at the top of the reactivity series are never found in free-state as they are very reactive, for example; K, Na, Ca, Mg and Al, etc.

Many metals are found in the form of oxides because oxygen is abundant in nature and is very reactive.

Flow Chart : Extraction of Metals



Extraction of Metals:

Metals can be categorised into three parts on the basis of their reactivity: Most reactive, medium reactive and least reactive.

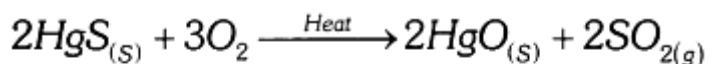
The three major steps involved in the extraction of a metal from its ore are

Concentration or enrichment of ores.

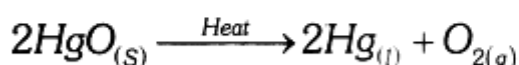
Conversion of concentrated ore into crude metal and,

Refining of impure or crude metal.

(i) Extracting Metals Low in the Activity Series: Metals low in the activity series are very unreactive. The oxides of these metals can be reduced to metals by heating alone. For example, cinnabar (HgS) is an ore of mercury. When it is heated in air, it is first converted into mercuric oxide (HgO). Mercuric oxide is then reduced to mercury on further heating.



Cinnabar



Mercury

Extraction of Copper Metal: copper which is found as Cu_2S in nature can be obtained from its ore by just heating in air.



(ii) Extraction of Metals of Middle Reactivity: The metals in the middle of the activity series such as iron, zinc, lead, copper, etc., are moderately reactive. These are usually present as sulphides or carbonates in nature. It is easier to obtain a metal from its oxide, as compared to its sulphides and carbonates. Therefore, prior to reduction, the metal sulphides and carbonates are converted into metal oxides.

Roasting.

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

Calcination: The carbonate ores are changed into oxides by heating strongly in limited air. This process is known as calcination.

Roasting



Calcination



The metal oxides are then reduced to the corresponding metals by using suitable reducing agents such as carbon. For example, when zinc oxide is heated with carbon, it is reduced to metallic zinc.



Thermite Reaction: Ferric oxide; when heated with aluminium, is reduced to iron metal. In this reaction, a lot of heat is produced. This reaction is known as thermite reaction. It is used in the welding of electric conductors, iron joints, etc. such as joints in railway tracks.



(iii) Extraction of Metals of High Reactivity: Metals of high reactivity; such as sodium, calcium, magnesium, aluminium, etc. are extracted from their ores by electrolytic reduction. These metals cannot be reduced using carbon because carbon is less reactive than them.

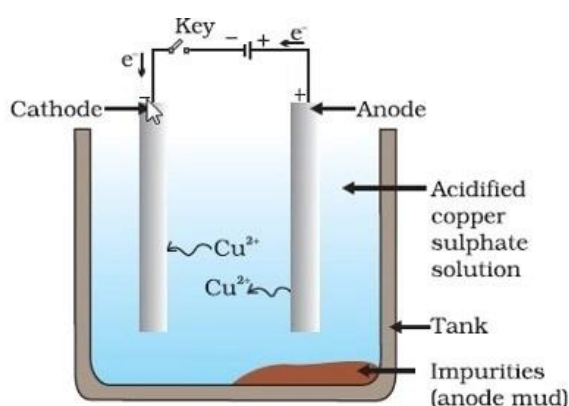
Electrolytic Reduction: Electric current is passed through the molten state of metal ores. Metal being positively charged is deposited over the cathode.

Example: When an electric current is passed through molten state or solution of sodium chloride, sodium metal gets deposited over the cathode.

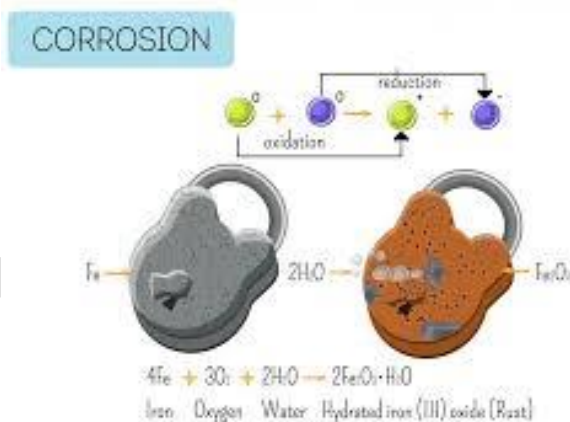


Similarly, aluminium is obtained by the electrolytic reduction of aluminium oxide. Metals obtained from the process of electrolytic reduction are pure in form.

Electrolytic Refining of Copper: A lump of impure copper metal and a thin strip of pure copper are dipped in the solution of copper sulphate. Impure lump of metal is connected with the positive pole and thin strip of pure metal is connected with negative pole. When electric current is passed through the solution, pure metal from anode moves towards the cathode and is deposited over it. Impurities present in metal are settled near the bottom of anode in the solution. Settled impurities in the solution are called Anode Mud.



Corrosion:



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

Rusting of Iron: When iron articles like the gate, grill, fencing, etc. come in contact with moisture present in the air, the upper layer of iron turns into iron oxide. Iron oxide is brown-red in colour and is known as Rust. The phenomenon is called Rusting of Iron.

Prevention of Rusting: For rusting, iron must come in contact with oxygen and water. Rusting is prevented by preventing the reaction between atmospheric moisture and the iron article. This can be done by:

- *Painting
- *Greasing
- *Galvanization
- *Electroplating
- *Alloying

Alloys: The homogeneous mixture of two or more metals, or a metal and a non-metal is called Alloy.

Amalgams: An alloy in which mercury (Hg) is present. For example Sodium amalgams [Na (Hg)] and Zinc amalgams [Zn(Hg)].

Properties of an Alloy

Alloys are stronger than the metal from which they are obtained.

It is harder than the constituent metals.

More resistance to corrosion.

The melting point of alloys is lower than the constituent metals.

The electrical conductivity of alloys is lower than the constituent metals.

Some examples of Alloys: Brass (an alloy of copper and zinc),

Bronze: (an alloy of copper and tin)

Solder: (an alloy of lead and tin) Duralumin: [95% Al + 4% Cu + 0.5% Mg + 0.5 Mn],
Steel: [99.95% Fe + 0.05% C], Stainless steel: [74% Fe + 18% Cr + 8% Ni], Magnesium:
[95% Al + 5% Mg]

Alloys of Gold: Pure gold is said to be of 24 carats. Gold is alloyed with a small amount of silver or copper to make it hard.

Galvanization: Galvanisation is a method of protecting steel and iron from rusting by coating them with a thin layer of zinc. The layer of zinc protects the iron from corrosion.

Electroplating: In this method, an electric current is used to create a thin layer of metal over another metal. It is done to make cheaper metals more appealing as well as to protect them from corrosion.

Painting and Greasing: In this method, a layer is created over the metal surface by painting or greasing. This layer of paint or grease protects the metal from corrosion.

SECTION A MULTIPLE CHOICE QUESTIONS

- Which of the following property is generally not shown by metals?
a) Electrical conduction b) Sonorous
c) Dullness d) Ductility
- Aluminium is used for making cooking utensils. Which of the following properties of aluminium are responsible for the same?
(i) Good thermal conductivity
(ii) Good electrical conductivity
(iii) Ductility
(iv) High melting point
(a) (i) and (ii)
(b) (i) and (iii)
(c) (ii) and (iii)
(d) (i) and (iv)
- Which of the given non-metal is a liquid?
a) Hydrogen b) Bromine
c) Chlorine d) Mercury
- The ability of metals to be drawn into thin wire is known as
a) ductility b) malleability
c) sonorosity d) conductivity
- Which one of the following metals do not react with cold as well as hot water?
a) Na b) Ca c) Mg d) Fe
- A reactive metal can replace a _____ reactive metal, but a _____ reactive one cannot replace a _____ reactive metal from its salt solution.

Fill the blanks with respectively in given order.

- a) less, more, less, more b) less, less, more, more
c) more, more, less, less d) more, less, less, more

7. Phosphorous is a reactive _____ and it is stored in _____

- a) Metal, water b) Metal, kerosene
c) Non-metal, water d) Non-metal, kerosene

8. Generally metals react with acids to give salt and hydrogen gas. Which of the given acids does not give hydrogen gas on reacting with metals (except Mn and Mg)?

- A. H_2SO_4 B. HCl C. HNO_3 D. All the these

9. Which one among the following is an acidic oxide?
 (a) Na_2O (b) CO (c) CO_2 (d) Al_2O_3
10. Which of the following are the allotropes of carbon?
 a) Diamond and graphite (b) Turpentine and kerosene
 c) Glass and borosilicate (d) Fullerene and Soil
11. Metallic oxide are generally _____ in nature.
 a) Acidic (b) Basic (c) Neutral (d) Amphoteric
12. What happens when calcium is treated with water?
 (a) It does not react with water
 (b) It reacts violently with water
 (c) It reacts less violently with water
 (d) Bubbles of hydrogen gas formed stick to the surface of calcium
 A. (A) & (D)
 B. (B) & (C)
 C. (A) & (B)
 D. (C) & (D)
13. Which of the following gas gives limewater test?
 a) Oxygen (b) Nitrogen (c) Carbon dioxide (d) Hydrogen
14. An element A is soft and can be cut with a knife. This is very reactive to air and cannot be kept open in air. It reacts vigorously with water. Identify the element from the following
 a) Mg (b) Na (c) P (d) Ca
15. Which of the following can undergo a chemical reaction?
 (a) $\text{MgSO}_4 + \text{Fe}$ (b) $\text{ZnSO}_4 + \text{Fe}$ (c) $\text{MgSO}_4 + \text{Pb}$ (d) $\text{CuSO}_4 + \text{Fe}$
16. An aluminium strip is kept immersed in a freshly prepared ferrous sulphate solution taken in a test tube, the change observed is that
 a) Green solution slowly gets decolourised with brown deposits.
 b) Lower end of the test tube becomes slightly warm
 c) A colourless gas with smell of burning sulphur is evolved
 d) Light green solution changes to blue
17. Which acid is formed when sulphur dioxide dissolves in water?
 a) Sulphuric acid (b) Sulphurous acid
 c) Sulphate acid (d) Sulphonic acid
18. The chemical reaction between a piece of copper and nitric acid is given by the chemical equations,

$$\text{Cu} + \text{HNO}_3 \longrightarrow \text{Cu}(\text{NO}_3)_2 + \text{H}_2$$

$$\text{H}_2 + \text{HNO}_3 \longrightarrow \text{H}_2\text{O} + \text{NO}_2$$

What can be inferred from the chemical equation?

- (a) Copper causes the oxidation of HNO_3 to form NO_2 .
 (b) Hydrogen gas gets oxidized by HNO_3 to form water.
 (c) gas reacts with oxygen in the air to form water.
 (d) Nitrate reacts with hydrogen to form NO_2 and H_2O .
19. Which among the following statements is incorrect for magnesium metal?
 (a) It burns in oxygen with a dazzling white flame
 (b) It reacts with cold water to form magnesium oxide and evolves hydrogen gas
 (c) It reacts with hot water to form magnesium hydroxide and evolves hydrogen gas
 (d) It reacts with steam to form magnesium hydroxide and evolves hydrogen gas
- 20 Which of the following is the correct arrangement of the given metals in ascending order of their reactivity?
 Zinc, Iron, Magnesium, Sodium
 (a) Zinc > Iron > Magnesium > Sodium

- (b) Sodium > Magnesium > Iron > Zinc
- (c) Sodium > Zinc > Magnesium > Iron
- (d) Sodium > Magnesium > Zinc > Iron

21 An element reacts with oxygen to form an oxide which dissolves in dilute hydrochloric acid. The oxide formed also turns a solution of red litmus blue. The element will be

- a) metal
- b) nonmetal
- c) both a and b
- d) none of these.

22. A student makes an electric circuit using an LED, a battery and connecting wires to test the conductivity of distilled water. The student notices that the LED does not glow. He replaces the distilled water with a salt solution and observes that the LED glows. How does the salt solution help the LED to glow?

- (a) Salt solution is covalent in nature and conducts electricity.
- (b) Salt solution has a low melting point which allows the current to flow through it.
- (c) Salt solution has a high boiling point which allows the flow of current in the circuit without getting hot.
- (d) Salt solution contain ions which makes it conductive and allows the electricity to flow through it.

23. Galvanisation is a method of protecting iron from rusting by coating with a thin layer of

- (a) Gallium
- (b) Aluminium
- (c) Zinc
- (d) Silver

24. Copper becomes green when exposed to moist air for a long period of time due to the

- a) formation of a layer of cupric oxide on the surface of copper.
- b) formation of a layer of basic carbonate on the surface of copper.
- c) formation of a layer of cupric hydroxide on the surface of copper.
- d) none of the above.

25. The colour of aqueous solution of zinc sulphate as observed in the laboratory is:

- a) green
- b) Yellow
- c) Blue
- d) Colourless

26. Paheli took some crystals of copper sulphate and heated it. After some time, she added water to the content of test tube.

The two visible changes observed here are

- a) blue crystals changes to white powder, on adding water it regains its blue colour.
- b) blue crystals changes to pale green, on adding water it regains its blue colour.
- c) No change
- d) blue crystals changes to white crystals and become colourless

27. Which of the following pair of metals exist in their native state in nature?

- (a) Ag and Au
- (b) Ag and Zn
- (c) Au and Hg
- (d) Au and Fe

28. Read the statements carefully.

i Metals are generally ductile but metal W is the most ductile metal.

ii Metals generally possess high melting point but metals like X have very low melting point.

iii Metals generally exist in solid state but Y exists in liquid state.

iv. Among metals, Z is the poorest conductor of heat.

Choose the right option of sequencing W, X, Y and Z.

- (a) Aluminium, Sodium, Lead and Silver.
- (b) Gold, caesium, Mercury and Lead.
- (c) Copper, Zinc, Silver and Mercury.

(d) Iron, Sodium, Gold and Lead.

29. The best conductors of heat are

- a) Silver and Copper b) Lead and Mercury
c) Iron and Tin d) Gold and Platinum

30. A student adds some metallic ash in water taken in a test tube. The ash gets completely dissolved in water and the solution changes its colour. What should the student do next to test the chemical properties of the product formed?

- (a) Evaporate the solution to get crystals.
(b) Measure the temperature change using a thermometer.
(c) Test the acidity using a blue litmus paper.
(d) Test the basicity using a red litmus paper.

31. Reaction between X and Y forms compound Z. X loses electrons and Y gains electrons. Which of the following properties is not shown by Z?

- (a) Has high melting point (b) Has low melting point
(c) Conducts electricity in molten state (d) Occurs as solid

32. The atomic number of an element X is 20. The number of electrons in its ion X^{2+} will be:

- (a) 18 (b) 19 (c) 20 (d) 21

33. In stainless steel alloy, iron metal is mixed with:

- (a) Cu and Cr (b) Cr and Ni (c) Cr and Sn (d) Cu and Ni

34. Which of the given metals are obtained by electrolysis of their chlorides in molten state?

- (A) Na (B) Ca (C) Fe (D) Cu
a. (A) & (D) b. (C) & (D) c. (A) & (C) d. (A) & (B)

35. An alloy can be one of the following types:

- (a) Homogenous (b) Heterogeneous (c) Intermetallic (d) All of the above

36. Rusting of iron takes place in

- a. Ordinary water b. Boiled water
c. Both ordinary & boiled water d. None of these

37. Which one of the following properties is not generally exhibited by ionic compounds?

- a) Solubility in water b) Electrical conductivity in solid state
c) High melting and boiling points d) Electrical conductivity in molten state

38) Which of the following metals exist in their native state in nature?

- (i) Cu (ii) Au (iii) Zn (iv) Ag
(a) (i) and (ii) (b) (ii) and (iii) (c) (ii) and (iv) (d) (iii) and (iv)

39) Sodium chloride is a _____ compound

- a) Covalent b) Ionic c) Non-ionic d) None of these

40. The process in which a carbonate ore is heated strongly in the absence of air to convert it into metal oxide is called _____

- (a) Roasting (b) Reduction (c) Calcination (d) Smelting

SECTION B

ASSERTION/REASON TYPE QUESTION

Following Questions consist of two statements – Assertion (A) and Reason (R).

Answer these questions selecting the appropriate option given below:

- A. Both A and R are true, and R is the correct explanation of A
B. Both A and R are true, and R is not the correct explanation of A

C. A is true, but R is false

D. A is False, but R is true

1. **Assertion (A):** Zinc can easily displace copper on reacting with a solution of copper sulphate.

Reason (R): Copper is more reactive metal as compared to Zinc.

2. **Assertion (A):** Rusting of iron involves formation of red brown flakes and wearing away of metal iron.

Reason (R): Iron shows rusting on its reaction with the moist air around it in which it forms iron oxide hydrated

3. **Assertion (A):** Aluminium is more reactive than iron. Its corrosion is less than that of iron.

Reason (R): Aluminium is covered with a strong protective layer of oxide which protects the metal from further corrosion.

4. **Assertion (A):** Non-metals are electronegative in nature.

Reason (R): They have tendency to lose electrons.

5. **Assertion (A):** All non metals are insulators.

Reason (R): Graphite is a good conductor of electricity.

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

Reason (R): Metal oxides are basic in nature

7. **Assertion (A):** All metals are not solid at room temperature

Reason (R): Mercury is a liquid metal at room temperature

8. **Assertion (A):** Gas bubble are observed when sodium carbonate is added to dilute hydrochloric acid.

Reason (R): Carbon dioxide is given off in the reaction

9. **Assertion (A):** MgCl_2 , is a covalent compound.

Reason (R): MgCl_2 , is a good conductor of electricity in molten state.

10. **Assertion (A):** Iron is the most widely used metal. But it is never used in its pure state.

Reason (R): Pure iron is very soft and stretches easily when hot.

11. **Assertion (A):** Gold occurs in native state.

Reason (R): Gold is a reactive metal.

12. **Assertion (A):** Ionic compounds have high melting and boiling points.

Reason (R): A large amount of energy is required to break the strong inter-ionic attraction in ionic compounds.

13. **Assertion (A):** Sodium chloride conducts electricity in aqueous state but not in solid state.

Reason (R): Sodium chloride is an ionic compound and it forms ions in aqueous solution.

14. **Assertion (A):** Rusting of iron is a slow combustion

Reason (R): Iron slowly reacts with oxygen and form iron oxide.

15. **Assertion (A):** Ionic compounds and solids are somewhat hard.

Reason (R): They are electrovalent compounds and have strong force of attraction between oppositely charged ions.

SECTION C CASE STUDY BASED QUESTIONS

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

i. Which of the following metal is less reactive than hydrogen?

A. Copper B. Zinc C. Magnesium D. Lead

ii. Which of the following represents the correct order of reactivity for the given metals?

A. $\text{Na} > \text{Mg} > \text{Al} > \text{Cu}$ B. $\text{Mg} > \text{Na} > \text{Al} > \text{Cu}$
C. $\text{Na} > \text{Mg} > \text{Cu} > \text{Al}$ D. $\text{Mg} > \text{Al} > \text{Na} > \text{Cu}$

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

A. Pb, Cu B. Na, K C. Mg, Mn D. Al, Zn

iv. Which of the following metals reacts vigorously with oxygen?

A. Zinc B. Magnesium C. Sodium D. Copper

2. Metals as we know, are very useful in all fields, industries in particular. Non-metals are no less in any way. Oxygen present in air is essential for breathing as well as for combustion. Non-metals form a large number of compounds which are extremely useful, e.g., ammonia, nitric acid, sulphuric acid, etc. Non-metals are found to exist in three states of matter. Only solid non-metals are expected to be hard however, they have low density and are brittle. They usually have low melting and boiling points and are poor conductors of electricity.

i. _____ is a non-metal but is lustrous

A. Phosphorus B. Sulphur C. Bromine D. Iodine

ii. Which of the following is known as 'King of chemicals'?

A. Urea B. Ammonia C. Sulphuric acid D. Nitric acid

iii. Which of the following non-metals is a liquid?

A. Carbon B. Bromine C. Iodine D. Sulphur

iv. Hydrogen is used

A. for the synthesis of ammonia B. for the synthesis of methyl alcohol
C. nitrogenous fertilizers D. all of these

3. When a silvery grey powder of a solid (A) is mixed with a powder solid (B) no reaction occurs. But if the mixture is ignited and lighted using magnesium ribbon a reaction occurs with evolution of large amount of heat forming product (C) which settles down as liquid metal and the solid product (D) formed floats on the liquid (C). (C) in solid form reacts with moisture to form rust. The amount of heat generated during the reaction is so high that the reaction is used in welding of electric conductors, joints in railway tracks. Based on this information, answer the following questions.

i. Identify A and C?

A. A - Al and C - Fe B. A - Fe and C - Al
C. A - Mg and C - Al D. A - Al and C - Cu

ii. Identify B and D which are oxides of

- A. B- Fe , D- Al B. B- Mg, D-Al
C. B- Al , D- Cu D. B-Al , D –Fe

iii . Amphoteric oxides are

- A. metal oxides which do not react with acids but react with bases
B. metal oxides which reacts with both acids as well as bases
C. metal oxides which reacts with acids but do not react with bases
D metal oxides which shows no reaction with either acids or bases

iv. Which of the following is amphoteric in nature?

- A. both aluminium oxide and zinc oxide B. Only Zinc oxide
C. Only Aluminium oxide D. Neither of them

4) Metals react with non-metals by losing or gaining electrons. They have a give-and-take relation between them. Ionic compounds are usually solid and hard in nature. They are generally soluble in water and insoluble in solvent like petrol, kerosene, etc. The melting and boiling points of electrovalent compounds are high. In order to change the physical state of the electrovalent compounds (from solid to liquid to gas), a high temperature is needed to overcome the attractive forces.

i) Which of the following properties is not generally exhibited ionic compounds?

- (a) Electrical conductivity in molten state (b) Electrical conductivity in solid state
(c) High melting and boiling points (d) Solubility in water

ii) Ionic compounds are usually solid and hard in nature. This is due to

- (a) Strong forces of attraction between the oppositely charged ions.
(b) Weak forces of attraction between the oppositely charged ions.
(c) Strong forces of attraction between the same charged ions.
(d) Weak forces of attraction between the similarly charged ions.

iii) Transfer of one or more valence electrons from a metal to nonmetal takes place in case of

- (a) Chemical bonding (b) molecular bonding (c) ionic bonding (d) covalent bonding

iv) The atomic number of four elements A, B, C, D is 6, 8, 10 and 12 respectively. The two elements which can react to form ionic compounds are:

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

5) Alloying is a very good method of improving the properties of a metal. This gives the desired properties of the metal. For example, iron is the most widely used metal. But it is never used in its pure state. This is because pure iron is very soft and stretches easily when hot. But, if it is mixed with a small amount of carbon (about 0.05%), it becomes hard and strong. When iron is mixed with nickel and chromium, we get stainless steel, which is hard and does not rust. Thus, if iron is mixed with some other substance, its properties change. In fact, the properties of any metal can be changed, if it is mixed with some other substance. The substance added may be a metal or a non-metal

i) Which among the following alloys contain non-metal as one of its constituents?

- (a) Brass (b) Bronze (c) Amalgam (d) Steel

17 ii) An alloy can be one of the following types:

- (a) Homogenous (b) Heterogeneous
(c) Intermetallic (d) All of the above

17 iii) By adding silicon to stainless steel which of the following property is enhanced?

- (a)Resistance to corrosion (b)Electrical characteristics
(c)Ductility (d)Magnetic property

17 iv) Which of the following alloy(s) contain mercury as one of its constituents?

- (a)Zinc amalgam (b) Alnico (c) Solder (d) Bronze

ANSWER KEY- MCQ

QN NO	ANS	QN NO	ANS	QN NO	ANS	QN NO	ANS
1	c	11	b	21	a	31	b
2	d	12	d	22	d	32	a
3	b	13	c	23	c	33	b
4	a	14	b	24	b	34	d
5	d	15	d	25	d	35	a
6	d	16	a	26	a	36	a
7	c	17	b	27	a	37	b
8	c	18	b	28	b	38	c
9	c	19	b	29	a	39	b
10	a	20	d	30	d	40	c

ANSWER KEY- ASSERTION REASON TYPE QUESTIONS

QN NO	ANS	QN NO	ANS	QN NO	ANS	QN NO	ANS	QN NO	ANS
1	C	4	c	7	a	10	a	13	a
2	A	5	d	8	a	11	c	14	a
3	A	6	b	9	d	12	a	15	a

ANSWER KEY- CASE STUDY QUESTIONS

QN NO	ANS	QN NO	ANS	QN NO	ANS	QN NO	ANS	QN NO	ANS
1 i	A	2 i	d	3 i	a	4 i	b	5 i	d
ii	A	ii	c	ii	a	ii	a	ii	a
iii	C	iii	b	iii	b	iii	c	iii	b
iv	c	iv	d	iv	a	iv	c	Iv	a

VERY SHORT ANSWER QUESTIONS:-

1. Name the metals which can displace hydrogen from acid:-
Metals that are more reactive than hydrogen displace it from acids
Eg:- Potassium, Sodium, Calcium, zinc etc.

2. Metals are electropositive in nature. Why?

Metals are electropositive in nature because all metals lose electrons from their outermost shell in order to become stable and hence become positively charged.

3. Why is sodium kept in kerosene?

Sodium metal is very reactive metal and its interactions with water are extremely exothermic. It reacts vigorously with oxygen and water. It can react with water vapour and oxygen present in the air and can produce a lot of heat.

4. What are amphoteric oxides? Give two examples of amphoteric oxides :-

Amphoteric oxides are oxides that react with both acids and bases to produce salt and water.

Eg. Lead oxide (PbO)

Aluminium oxide (Al₂O₃)

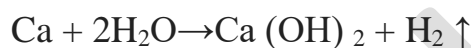
5. Hydrogen gas is not evolved when most of the metals react with nitric acid. Give reason-

Hydrogen gas is not evolved when most metals react with nitric acid. It is because HNO₃ is a strong oxidising agent. It oxidises the H₂ produced to water and itself gets reduced to any of the nitrogen oxides (N₂O, NO, NO₂).

6. Why does calcium start float when it reacts with water?

Write the balanced chemical equation of the reaction.

Calcium reacts with cold water to form calcium hydroxide and hydrogen gas. The bubbles of hydrogen gas produced stick to the surface of calcium and hence, it starts floating on the surface of water.



7. Give reason why copper is used to make hot water tanks and not steel (an alloy of iron)

Copper does not react with cold water, hot water or steam. However, iron reacts with steam. If the hot water tanks are made of steel (an alloy of iron), then iron would react vigorously with the steam formed from hot water.

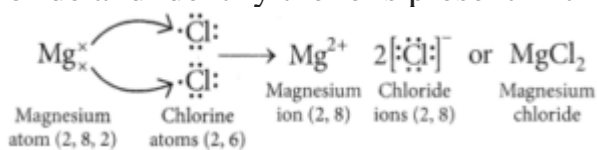
8. What type of oxides are formed when non – metals combine with Oxygen?

When nonmetals react with oxygen, they form acidic oxides or neutral oxides.

Example: Carbon reacts with oxygen to form an acidic oxide called carbon dioxide.

Hydrogen reacts with oxygen to form neutral oxide called water.

9. (i) By the transfer of electrons, illustrate the formation of bonds in magnesium chloride and identify the ions present in this compound.



10. Ionic compounds are solids. Give reasons.

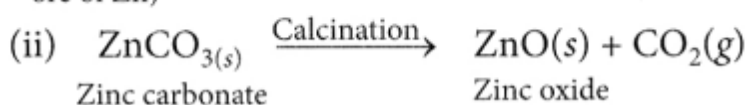
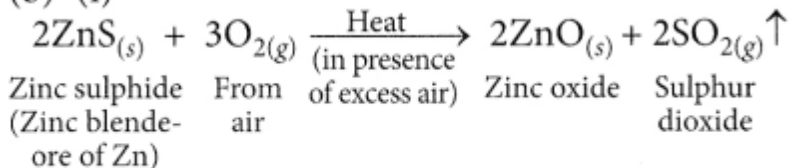
Ionic compounds are solids because the particles which make up ionic compounds are held together by strong electrostatic bonds.

11. Write chemical equations for the reactions taking place when :

(i) zinc sulphide is heated in air.

(ii) zinc carbonate is calcined

(b) (i)



12. How are alloys better than metals? Give composition of solder and amalgam.

Alloys are stronger than the metals from which they are made, more resistant to corrosion, have lower melting point, and have lower electrical conductivity. Solder is an alloy of lead and tin. An amalgam is an alloy of mercury with another metal.

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

It is due to the formation of basic copper carbonate $[\text{CuCO}_3 \cdot \text{Cu}(\text{OH})_2]$

14. How do alloys brass and bronze differ in composition?

Constituents of brass are copper and zinc while those of bronze are copper and tin.

15. Alloys are used in electrically heating devices rather than pure metals. Give one reason

Alloys are generally the combination of two or more metals. Since metals are good conductors of electricity, a combination of metals i.e., alloy is expected to be a better conductor of electricity than the pure metal

SHORT ANSWER QUESTIONS :-

1. Aluminium is a reactive metal but is still used for packing food articles. Give reason.

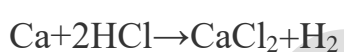
Ans: Aluminium is a strong and cheap metal. It is also a good conductor of heat. But it is highly reactive. When it is exposed to moist air, its surface is covered with a thin impervious layer of aluminium oxide (Al_2O_3). This layer does not allow moist air to come in contact with the fresh metal and hence, protects the metal underneath from further damage or corrosion. Thus, after the formation of this protective layer of Al_2O_3 , aluminium becomes resistant to corrosion. It is because of this reason that although aluminium is a highly reactive metal, it is still used in food packaging.

2. How does metal displace Hydrogen from acid. Give Chemical equation.

Ans: Hydrogen is displaced by the metals from acids that are placed above hydrogen in the reactivity series of the metals.

This is because these metals are more reactive than hydrogen.

Ex: Reaction of calcium with hydrochloric acid.



Here, Hydrogen is displaced by Calcium from Hydrochloric acid.

3. List in tabular form three chemical properties on the basis of which we can differentiate between a metal and a non-metal.

Ans:

S. no.	Chemical property	Metals	Non-metals
1.	Nature of oxides	Metals generally form basic oxides.	Non-metals generally form acidic oxides.
2.	Reaction with water	Metals which lie above hydrogen in the reactivity series displace hydrogen from water.	Non-metals (except F) do not react with water.

3.	Oxidising or reducing character.	Metals generally behave as reducing agents.	Non-metals generally behave as oxidising agents.
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4. Why some metal surfaces acquire a dull appearance when they are exposed to moist air? Write colour acquired by the surfaces of copper and silver in such situation and also write the chemical names of the substances due to which it happens.

Ans: When a metal has been kept exposed to air for a long time, then it gets a dull appearance. The metals lose their shine or brightness due to the formation of a thin layer of oxide, carbonate or sulphide on their surface and thus, the metal surface gets corroded. The surface of copper gets coated with a green layer in moist air due to the formation of basic copper carbonate, silver articles acquire a blackish tinge due to the formation of silver sulphide.

5. Explain the various methods of preventing Rusting.

Ans: The various methods used for preventing the rusting of iron are given below:

(i) By applying paint : Materials like railings, iron gates, iron bridges, bodies of cars, buses and trucks, etc. are all painted to protect them from rusting. Painting the metal surface does not allow them to come in contact with the moist air and thus, prevents rusting.

(ii) Greasing and oiling: When some grease or oil is applied on the surface of an iron object, then moisture and air cannot come in contact with it and hence, rusting is prevented.

(iii) Galvanization: It is a method of protecting iron from rusting by coating them with a thin layer of zinc. The iron coated with zinc is called galvanized iron.

(iv) Electroplating: It is another technique used to prevent articles from rusting. In this process, metals like tin, nickel and chromium which do not corrode are electroplated on iron.

6. Carbon cannot reduce the oxides of sodium, magnesium and aluminium to their respective metals. Why? Where are these metals placed in the reactivity series? How are these metals obtained from their ores? Take an example to explain the process of extraction along with chemical equations.

Ans: Sodium, magnesium and aluminium have higher affinity towards oxygen than that of carbon because these are highly reactive metals. Hence, carbon cannot reduce the oxides of sodium, magnesium, and aluminium to their respective metals.

These metals are placed at the top of the reactivity series. The highly reactive metals like Na, Mg, Al, etc. are extracted by electrolytic reduction of their molten chlorides or oxides. Electrolytic reduction is brought about by-passing electric current through the molten state. Metal gets deposited at the cathode.



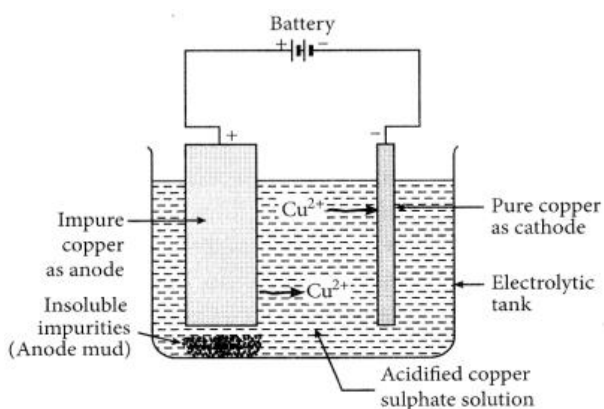
7. How is copper obtained from its ore (Cu₂S)?

Write only the chemical equations. How is copper thus obtained refined? Name and explain the process along with a labelled diagram.

Ans: Copper obtained is refined by electrolytic refining.

Electrolytic refining of crude copper:

Thick block of impure metal acts as anode and a thin strip of pure copper metal acts as cathode. The electrolyte used is aqueous solution of copper sulphate containing a small amount of sulphuric acid. On passing electric current through the electrolyte, the metal from the anode dissolves into the electrolyte. An equivalent amount of copper metal from copper sulphate solution gets deposited on the cathode.



Experimental set-up for the electrolytic refining of copper

8. Why do some metal surfaces acquire a dull appearance when they are exposed to moist air? Write colour acquired by the surfaces of copper and silver in such a situation and also write the chemical names of the substances due to which it happens.

Ans: When a metal has been kept exposed to air for a long time, then it gets a dull appearance. The metals lose their shine or brightness due to the formation of a thin layer of oxide, carbonate or sulphide on their surface and thus, the metal surface gets corroded. The surface of copper gets coated with a green layer in moist air due to the formation of basic copper carbonate, silver articles acquire a blackish tinge due to the formation of silver sulphide.

9. (a) Define corrosion.

(b) What is corrosion of iron called?

(c) How will you recognize the corrosion of silver?

(d) Why is corrosion of iron a serious problem?

(e) How can we prevent corrosion of iron?

Ans:

(a) The process of slowly eating up of metals due to their conversion into oxides, carbonates, sulphides, etc., by the action of atmospheric gases and moisture is called corrosion.

(b) The corrosion of iron is called rusting.

(c) Silver articles become black after some time when exposed to air. This is due to formation of a coating of black silver sulphide (Ag_2S) on its surface by the action of H_2S gas present in the air.

(d) Corrosion of iron is a serious problem. Every year a large amount of money is spent to replace damaged iron articles. Corrosion causes damage to car bodies, bridges and iron railings, ships and to all objects made of metals especially those of iron.

(e) Corrosion of iron is prevented by coating it with a layer of oil. The reason being that the layer of oil does not allow air and water to react with the surface of iron. Corrosion of iron can also be prevented by painting, greasing, galvanizing, anodizing, electroplating or making alloys.

10. Suggest a method of reduction for the following metals during their metallurgical processes:

(i) Metal 'A' which is one of the last, second or third positions in the reactivity.

(ii) Metal 'B' which gives a vigorous reaction even with water and air.

(iii) Metal 'C' which is kept in the middle of activity series.

(i) 'A' can be obtained by chemical reduction using carbon or carbon monoxide as a reducing agent.

(ii) 'B' can be obtained by electrolytic reduction.

(iii) 'C' can be reduced by reducing agents like 'Al'.

11. Define the terms:

(i) Mineral (ii) ore, and (iii) gangue.

Ans:

(i) Mineral: It is a naturally occurring substance from which metal may or may not be extracted profitably or economically, e.g. Al cannot be extracted profitably from mica.

(ii) Ore: It is a rocky material which contains sufficient quantities of minerals so that metal can be extracted profitably, e.g., zinc blende is an ore of zinc from which zinc can be extracted profitably.

(iii) Gangue: It is a rocky material which is present along with the mineral in the ore, e.g., FeO is gangue in extraction of copper.

12. What are alloys? How are they made? Name the constituents and uses of brass, bronze and solder.

Ans: Alloys are homogeneous mixtures of two or more metals. One of them can be non-metal also. They are made by melting a large amount first and then adding the other metal. ,

Brass contains copper and zinc. It is used for making decorative articles. Bronze contains copper and tin. It is used for making statues and medals. Solder contains lead and tin. It is used for soldering purposes.

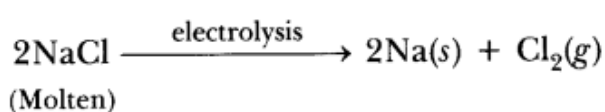
13.(a) Carbon cannot be used as a reducing agent to obtain Mg from MgO. Why?

(b) How is sodium obtained from molten sodium chloride? Give an equation of the reactions.

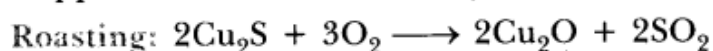
(c) How is copper obtained from its sulphide ore? Give equations of the reactions.

Ans: (a) It is because 'Mg' is a stronger reducing agent than carbon.

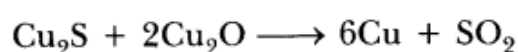
(b) Sodium is obtained from molten NaCl by electrolysis.



(c) Copper ore is concentrated by froth-floatation process.



Bessemerisation: Copper oxide reacts with Cu_2S on heating to form Blister copper and SO_2 .



Blister Copper is purified by electrolytic refining.

14.(a) Distinguish between 'calcination' and 'roasting'. Which of the two is used for sulphide ores and why?

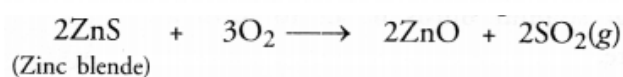
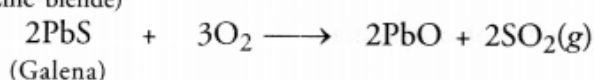
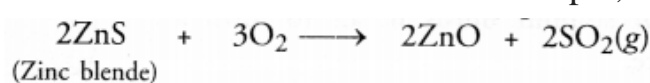
(b) Write a chemical equation to illustrate the use of aluminium for joining cracked railway lines.

(c) Name the anode, the cathode and the electrolyte used in the electrolytic refining of impure copper.

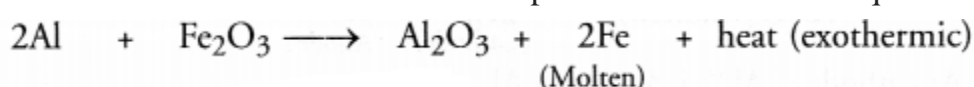
Ans:

Roasting	Calcination
1. Roasting is done in case of sulphide ores.	Calcination is done in case of carbonate ores.
2. In this, the ore is heated in the presence of excess air to convert it into its oxide compound.	The carbonate ore is heated in the absence of air (limited supply of air) to convert into its oxide.
3. The gas given out is SO_2 (sulphur dioxide) gas.	The gas given out is CO_2 (carbon dioxide) gas.
4. Example : $2\text{ZnS} + 3\text{O}_2 \xrightarrow{\text{Heat}} 2\text{ZnO} + 2\text{SO}_2 \uparrow$ (Air)	Example : $\text{ZnCO}_3 \xrightarrow{\text{Heat}} \text{ZnO} + \text{CO}_2 \uparrow$

For the sulphide ores, the process of roasting is commonly used. It is carried by heating the ore below its melting point with excess of air. As a result, the sulphide ore is converted to its oxide form. For example,



(b) Cracked railway lines can be joined or welded with the help of thermit welding. Thermit is a mixture of ferric oxide and aluminium powder. The chemical equation involved is :



c) In the electrolytic refining of copper;

Anode : A rod of impure copper.

Cathode : A rod of pure copper.

Electrolyte : An aqueous solution of copper sulphate containing a small amount of sulphuric acid.

15. Name the process of obtaining a pure metal from an impure metal through electrolysis. Suppose you have to refine copper using this process, then explain with the help of a labelled diagram the process of purification, mentioning in brief the materials used as (i) anode (ii) cathode and (iii) electrolyte.

The process is known as electro-refining. For the electro-refining of copper,

The conversion of a crude metal into pure metal is known as metal refining.

The refining can be done in a number of ways but the most common among these is the electro-refining and is discussed.

This method is commonly used for the purification of the metals like Cu, Ag, Zn, Ni etc. The impure metal is converted into a block which is made anode in an electrolytic cell in which a plate of pure metal acts as the cathode as shown in the

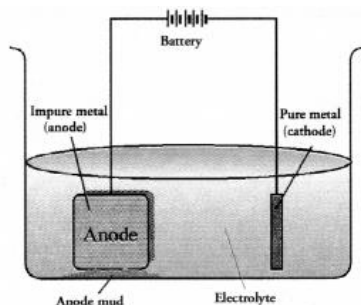


FIGURE 3.16. ELECTRO-REFINING OF METALS.

CHAPTER 4

CARBON AND ITS COMPOUNDS

Chemical properties of carbon compounds

1. Combustion Reaction
2. Oxidation Reaction
3. Addition Reaction
4. Substitution Reaction

Properties Of Carbon

1. Catenation
2. Tetravalency
3. tendency to form multiple bonding
4. Isomerism

Saturated and Unsaturated Hydrocarbons

- Hydrocarbons – Alkanes, alkenes and alkynes
- Cyclic Hydrocarbons

Carbon & Its Compounds

Functional Groups

- Halo
- Alcohol
- Aldehyde
- Ketone
- Carboxylic acid

Allotropes of Carbon

- Graphite
- Diamond
- Fullerenes

Imp. Carbon Compounds

1. Ethanol

* Reaction with Sodium

* Dehydration Reaction

2. Ethanoic Acid

* Esterification reaction

* Saponification reaction

* Reaction with Base

* Reaction with Carbonate & Hydrogen carbonate

Soaps and Detergents

- Advantages of detergents over soap
- Hard water and Soft water
- Cleansing action of soaps and detergents

1. Properties of carbon:

- **Organic compounds** are made up of carbon and form the basis of life of living organisms.

- Carbon is a **versatile** element, it forms large variety of compounds because of its tetravalency and the property of catenation that it exhibits.
 - Carbon is a **nonmetal** which belongs to **group 14** of the periodic table.
 - Carbon has **atomic number 6** and having **electronic configuration 2,4**. So **valency** of carbon is **4**
 - Thus, is **tetravalent** can complete its octet either by gaining 4 electrons or by losing 4 electrons.
 - The chemical bond formed by the sharing of electrons from two atoms is known as a covalent bond.
 - Carbon form **covalent bonds**, which is formed by sharing of electrons. Carbon forms it with oxygen, sulphur, nitrogen and chlorine.
2. **Reactivity of elements** – Tendency to attain a completely filled outer shell, i.e., attain noble gas configuration.

Methane – CH₄

- Widely used as fuel
- Major component of biogas and Compressed Natural Gas
- One of the simplest compounds formed by Carbon

3. What is a Covalent Bond?

- The chemical bond formed by **sharing of electrons from two atoms** is known as a covalent bond.
- Covalently bonded molecules have **strong bonds within molecule**, but **intermolecular forces are small, giving rise to low melting point and boiling point**.
- Electrons are shared between atoms and no charged particles are formed – Covalent compounds are **poor conductors of electricity**.

1. Explain the reactivity of elements
2. Describe the carbon compound Methane.
3. What is a covalent bond?
4. Why is melting point and boiling point low in covalent bonds?
5. Why are covalent bonds poor conductors of electricity?

4. Types of Covalent Bonds

1. **single covalent bond** –

- formed between two atoms when two electrons (one from each two atoms) are shared between them

2. **double bond** –

- formed between two atoms when four electrons (one pair of electrons from each two atoms) are shared between them.
- denoted by double lines (=) between the two atoms.

3. **triple bond**

- formed between two atoms when six electrons (three electrons each from two atoms) are shared between them.
- denoted by triple lines between the two atoms.
-

5. **Allotropy**-

- The phenomenon of existence of the same element in different physical forms with similar chemical properties is known as **allotropy**.
- different forms of an element are called **allotropes**.
- **Carbon exists in two allotropic forms**.
 - The crystalline forms - diamond and graphite
 - amorphous forms - coal, charcoal, lamp black etc
 - Fullerenes form another class of carbon allotropes.

Diamond is a good conductor of heat and a poor conductor of electricity. Graphite is a good conductor of electricity

6. Carbon has two unique features (hence, *Versatile nature of carbon*)- **tetravalency and catenation.**

- **Catenation** - the property of elements to form long chains or branched chains and rings of different sizes is called catenation.

- This property of catenation is due to
 - small size,
 - unique electronic configuration
 - great strength of carbon-carbon bonds.

7. Isomers –

- Organic compounds having the same molecular formula but different structural formulae, and hence, different physical and chemical properties, are called isomers.
- Example, butane with a molecular formula C_4H_{10} has two isomers.

8. Hydrocarbon:

- Compounds made up of hydrogen and carbon is called **Hydrocarbons**.
- When there is a single bond between the carbon atoms it is **saturated hydrocarbons**.
- Alkanes are saturated hydrocarbons. It contains single bond throughout the compound. General formula is C_nH_{2n+2}
- When there is a double or triple bond between carbon atoms then it comes in the category of **unsaturated hydrocarbons**.
- **Alkenes** are unsaturated hydrocarbons. General formula is C_nH_{2n}
- **Alkynes** are also unsaturated hydrocarbons. General Formula is C_nH_{2n-2}

9. Heteroatoms -

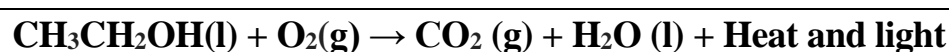
- In hydrocarbon chain, one or more carbon atoms are replaced by other atoms in accordance with their valencies. They are called **heteroatoms**.
- These heteroatoms which make carbon compounds reactive and decides properties of the compound are called **functional group**.

Hetero atom	Functional group	Formula of functional group
Cl/Br	Halo- (Chloro/bromo)	-Cl, -Br (substitutes for hydrogen atom)
Oxygen	1. Alcohol	-OH
	2. Aldehyde	$\begin{array}{c} \text{H} \\ \\ -\text{C} \\ \\ \text{O} \end{array}$
	3. Ketone	$\begin{array}{c} -\text{C}- \\ \\ \text{O} \end{array}$
	4. Carboxylic acid	$\begin{array}{c} \text{O} \\ \\ -\text{C}-\text{OH} \end{array}$

- Carbon and its compounds are good **fuels** as they burn in air releasing lot of heat energy.
- **Saturated hydrocarbons** burn with **blue and non-sooty flame** but **unsaturated hydrocarbons** burn with **yellow and sooty flame** because of the percentage of high carbon and incomplete oxidation in air.

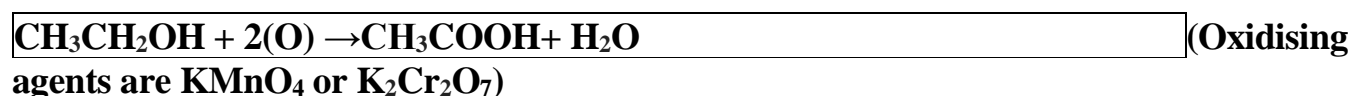
10. Carbon undergoes Combustion, Addition, substitution, and oxidation reactions:

i) **Combustion Reactions:** The complete combustion of carbon compounds in air gives carbon dioxide water, heat and light.



ii) **Oxidation Reactions:**

- In a combustion reaction, carbon compounds are oxidized in the presence of oxygen.
- Though combustion is generally an oxidation reaction, **not all oxidation reactions are combustion reactions**.
- Oxidation is also carried out by using oxidizing agents (Oxidants)



iii) Addition reactions:

- Unsaturated organic compounds, like alkenes and alkynes, contain multiple bonds (C=C, C≡C) between their carbon atoms.
- They undergo addition reactions to become saturated in nature.

For example; ethene is converted into ethane when heated with the catalyst nickel.



Hydrogenation

- the process by which unsaturated hydrocarbons can be transformed into saturated hydrocarbons.
- It is the process of addition of hydrogen to the unsaturated bonds of fatty acid chain.

iv) Substitution Reaction:

- A Substitution reaction is one in which an atom or a group of atoms (functional group) in the compound are replaced by another atom (or group of atoms).
- Substitution reactions are single displacement reactions.

For example, under the presence of Sunlight, Methane reacts with chlorine gas to produce chloromethane and hydrogen chloride.



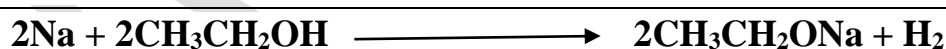
11. Ethanol and Ethanoic acids are chemicals of immense importance which is used in day-to-day life for various purposes.

i) Ethanol –

- Liquid at room temperature
- Commonly called alcohol - Active ingredient of alcoholic drinks
- It is used in medicine such as tincture iodine, syrups and tonics as it is a good solvent
- Soluble in water
- Consumption of small quantities causes drunkardness
- Intake of pure ethanol is lethal

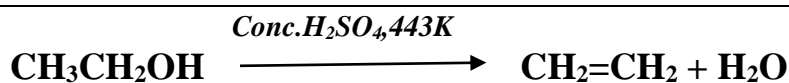
Reactions –

1. With Sodium



2. Dehydration reaction

Heating ethanol at 443K with excess of conc. H_2SO_4 results in the dehydration of ethanol to give ethene.

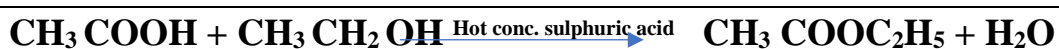


ii) Ethanoic Acid:

- Commonly called acetic acid
- Dil. Solution of ethanoic acid is called **vinegar (5-8%)**
- Characterised by **pungent smell**
- Good solvent
- Weak acid
- Also called **Glacial Acetic Acid** as the melting point of pure ethanoic acid is 290 K. Hence, it often freezes during winter in cold climates.

Reactions -

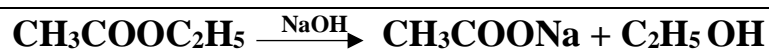
1. When **acid** and alcohol react in the presence of acid catalysts then it dehydrates to form **ester**. This process is called **esterification**.



16. Saponification Reaction

* Esters react in the presence of a base to give back alcohol and sodium salt of carboxylic acid.

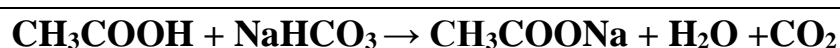
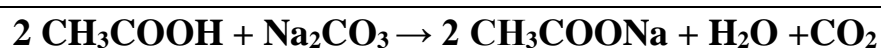
- Used in the preparation of soap



17. Reaction with a base

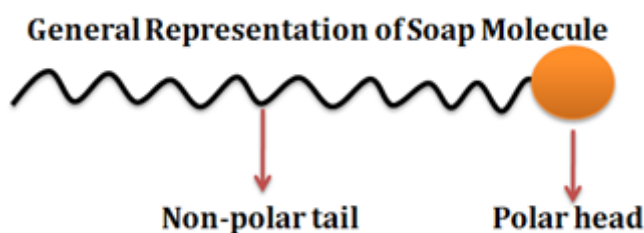


18. Reaction with carbonates and hydrogen carbonates



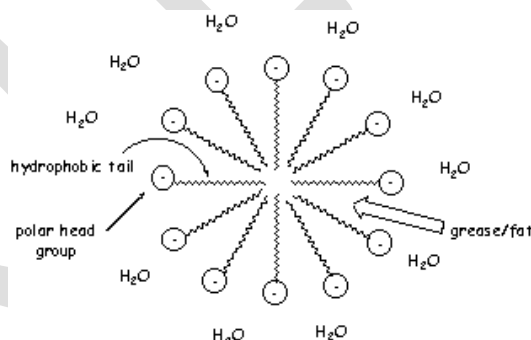
12. Soaps & Detergents:

- The action of **Soaps and detergents** is based on the presence of both **hydrophobic** and **hydrophilic** groups in the molecule. This helps to emulsify the oily dirt and hence its removal.



- **Micelles** are clusters of molecules in which the hydrophobic tails are in the interior of the cluster and ionic ends are on the surface of the cluster.

- **Soap** is the mixture of micelles



COMPARISON OF PROPERTIES OF IONIC COMPOUNDS AND COVALENT COMPOUNDS

<u>IONIC COMPOUNDS</u>	<u>COVALENT COMPOUNDS</u>
Ionic compounds are formed by complete transfer of electrons	They are formed by mutual sharing of electrons between two atoms.
Generally, solids	They may exist in solid, liquid or gases
Melting point and boiling points are high	Low melting point and boiling point
Soluble in water but insoluble in organic solvents.	Generally insoluble in water but soluble in organic solvents like alcohol

Ionic compounds do not conduct electricity in solid state

Covalent compounds do not contain ions and hence are generally bad conductors of electricity.

QUESTION BANK

A. MULTIPLE CHOICE QUESTIONS

1. When vegetable oil is treated with hydrogen in the presence of nickel

Or (Palladium) as a catalyst, it forms vegetable ghee. This process shows

- a) Anodising reaction b) Substitution reaction
c) Displacement reaction d) Addition reaction

2. The soap molecule has a -

- a) hydrophilic head and hydrophilic tail b) hydrophobic head and hydrophilic head
c) hydrophobic head and hydrophobic tail d) hydrophilic head and hydrophobic tail

3. The functional group present in propanal is-

- a) -OH b) -COOH c) -CO- d) -CHO

4. Carbon exists in the atmosphere in the form of

- (a) carbon monoxide only (b) carbon monoxide in traces and carbon dioxide
(c) carbon dioxide only (d) coal

5. Which of the following statements are usually correct for carbon compounds? These

- (i) are good conductors of electricity
(ii) are poor conductors of electricity
(iii) have strong forces of attraction between their molecules
(iv) do not have strong forces of attraction between their molecules
(a) (i) and (iii) (b) (ii) and (iii) (c) (i) and (iv) (d) (ii) and (iv)

6. Ethanol reacts with sodium and forms two products. These are

- (a) sodium ethanoate and hydrogen (b) sodium ethanoate and oxygen
(c) sodium ethoxide and hydrogen (d) sodium ethoxide and oxygen

7. Buckminsterfullerene is an allotropic form of

- (a) phosphorus (b) sulphur (c) carbon (d) tin

8. $\text{CH}_3\text{-CH}_2\text{-OH} \xrightarrow{\text{Alkaline KMnO}_4 + \text{Heat}} \text{CH}_3\text{-COOH}$

In the above given reaction, alkaline KMnO_4 acts as

- (a) reducing agent (b) oxidising agent
(c) catalyst (d) dehydrating agent

9. In which of the following compounds, — OH is the functional group?

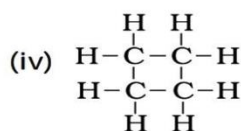
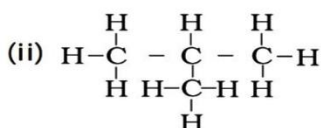
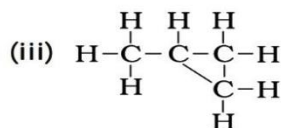
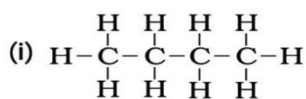
- (a) Butanone (b) Butanol (c) Butanoic acid (d) Butanal

10. Identify the unsaturated compounds from the following

- (i) Propane (ii) Propene (iii) Propyne (iv) Chloropropane

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

11. Which of the following are correct structural isomers of butane?



- (a) (i) and (iii)
(c) (i) and (ii)

- (b) (ii) and (iv)
(d) (iii) and (iv)

12. Pentane has the molecular formula C_5H_{12} . It has

- (a) 5 covalent bonds (b) 12 covalent bonds
(c) 16 covalent bonds (d) 17 covalent bonds

B. SHORT ANSWER QUESTIONS:

1. What are the two properties of carbon which led to the huge number of carbon compounds we see around us? Define them.

2. Is the given statement true? If not, rewrite the correct statement.

'Diamond and graphite are the covalent compounds of carbon elements.'

3. Write the name and structural formulae of all the possible isomers of Pentane.

4. Give the general formula of an: Alkane, Alkene, Alkyne

5. Classify the following compounds as Alkanes, Alkenes, Alkynes

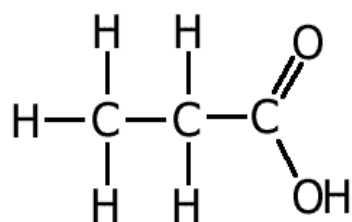
C_2H_4 , C_3H_4 , C_4H_8 , C_5H_{12} , C_5H_8 , C_3H_8 , C_6H_{12} .

6. Give the name and structural formula of the third member of the homologous series of following: (i) Alkane (ii) Alkene (iii) Alkyne (iv) cycloalkane

7. Unsaturated hydrocarbons contain multiple bonds between the two C-atoms and show addition reactions. Give the test to distinguish ethane from ethene.

8. Draw the electron dot structure of ethyne and draw its bond structure.

9. Identify and name the functional group present in the compound.



10. Match the reaction given in column A with the names given in column B

Column (A)	Column (B)
(a) $\text{CH}_3\text{OH} + \text{CH}_3\text{COOH} \xrightarrow{\text{H}^+} \text{CH}_3\text{COOCH}_3 + \text{H}_2\text{O}$	(i) Addition reaction
(b) $\text{CH}_2 = \text{CH}_2 + \text{H}_2 \xrightarrow{\text{Ni}} \text{CH}_3 - \text{CH}_3$	(ii) Substitution reaction
(c) $\text{CH}_4 + \text{Cl}_2 \xrightarrow{\text{Sunlight}} \text{CH}_3\text{Cl} + \text{HCl}$	(iii) Neutralisation reaction
(d) $\text{CH}_3\text{COOH} + \text{NaOH} \longrightarrow \text{CH}_3\text{COONa} + \text{H}_2\text{O}$	(iv) Esterification reaction

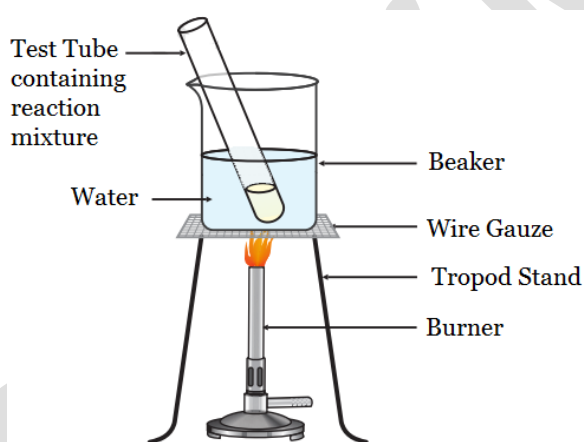
C. CASE-STUDY BASED QUESTIONS.

Read the passage and answer the following questions.

1. Nisha observed that the bottoms of cooking utensils were turning black in colour while the flame of her stove was yellow in colour. Her daughter suggested cleaning the air holes of the stove to get a clean, blue flame. She also told her mother that this would prevent the fuel from getting wasted.

- Identify the reasons behind the sooty flame arising from the stove.
- Can you distinguish between saturated and unsaturated compounds by burning them? Justify your answer.
- Why do you think the colour of the flame turns blue once the airholes of the stove are cleaned?

2. As the reaction takes place, a sweet fruity smell can be sensed coming out from the test tube.



- What can be the reason behind the fruity smell?
- What are the reactants of the reaction mixture? Write the chemical reaction involved.
- Why is it advised to heat the test-tube in a water bath and not directly?

D. ASSERTION REASON QUESTIONS

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

- Both A and R are true and R is the correct explanation of A.
- Both A and R are true but R is not the correct explanation of A.
- A is true but R is false.
- A is false but R is true.

1. **Assertion (A):** Ethanoic acid liberates hydrogen with sodium metal.

Reason (R): More reactive sodium displaces hydrogen from ethanoic acid.

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

2. **Assertion (A):** Diamond and graphite are allotropes of carbon.

Reason (R): Some elements can have several different structural forms while in the same physical state. These differing forms are called allotropes.

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

3. **Assertion (A):** Soaps are not suitable for washing purpose when the water is hard.

Reason (R): Soaps have relatively weak cleansing action.

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

4. **Assertion (A):** In alkanes, alkenes and alkynes the valency of carbon is always four.

Reason (R): All hydrocarbons except alkanes contain double bonds.

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

5. **Assertion (A):** The functional group present in alcohols is – OH.

Reason (R): It is the same group as present in water, hence water and alcohol have similar properties.

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

E. SOURCE BASED QUESTIONS:

1. *One chemical property that all alkanes have in common is that they burn very exothermically. They make good fuels. Controlling their availability and cost can have great political consequences. When they burn in a good supply of air the products are carbon dioxide and water vapour.*

Methane + oxygen ----- \rightarrow carbon dioxide and water

Methane forms the major part of natural gas. Propane and butane burn with very hot flames and are sold as liquefied Petroleum gas. They are kept as liquids under pressure but they vaporize easily when the pressure is released.

- i) Why do alkanes make good fuels? (1)
- ii) What are the constituents of cooking gas? (1)
- iii) Write the balanced equation for the combustion of ethane. (2)

2. *The addition of hydrogen across $C=C$ is known as hydrogenation. Ethene reacts with hydrogen, if the heated gases are passed together over a catalyst nickel ethane is the product.*

Hydrogenation reactions similar to the reaction with Ethene are used in the manufacture of margarine from vegetable oils. The vegetable oils of interest include corn oil and Sunflower oil. They are edible oil and contain long chain organic acids. The hydrocarbon chain of these acids contains one or more $C=C$ double bonds: they are unsaturated molecules. Oil such as Sunflower oil are rich in poly and saturated molecules. This means that the melting point is relatively low and the oil remains liquid at normal temperature. By hydrogenation some but not all of the $C=C$ double bonds, the liquid vegetable oil can be made into a solid but spreadable fat.

Animal fat tend to be more saturated than vegetable oils and fats. The animal fats in cream can be made into butter. Mini doctors now believe that unsaturated fats are more healthy than saturated fats.

- i) Why are corn oil and sunflower oil called unsaturated molecules? (1)
- ii) Which is better for human consumption- Animal fat or vegetable fat? Why? (1)
- iv) How is ethane produced from ethene? Give the equation. (2)
- v)

F. LONG ANSWER TYPE QUESTIONS

1. 6.1ml glacial acetic acid and 1ml of ethanol are mixed together in a test tube. Few drops of concentrated sulphuric acid are added in the mixture are warmed in a water bath for 5 min

- a) Name the resultant compound formed. (1)
- b) Represent the above change by a chemical equation. (1)
- c) What term is given to such a reaction. (1)
- d) What are the special characteristics of the compound formed? (1)

2. An organic compound 'X' with a molecular formula C_2H_6O undergoes oxidation in the presence of alkaline $KMnO_4$ and forms the compound 'Y'.

a) Identify 'X' and 'Y'. (2)

b) Write your observation when the compound 'X' is made to react with compound 'Y' which is used as a preservative for pickles. (2)

3. What is the difference between soaps and detergents? State in brief the cleansing action of soaps in removing an oily spot from a fabric. Why are soaps not effective when a fabric is washed in hard water? How can this problem be resolved?

ANSWER KEY

A. MCQ

1. d) 2. d) 3. d) 4. b) 5. d) 6. c) 7. c) 8. b) 9. b) 10. d) 11. c) 12. c)

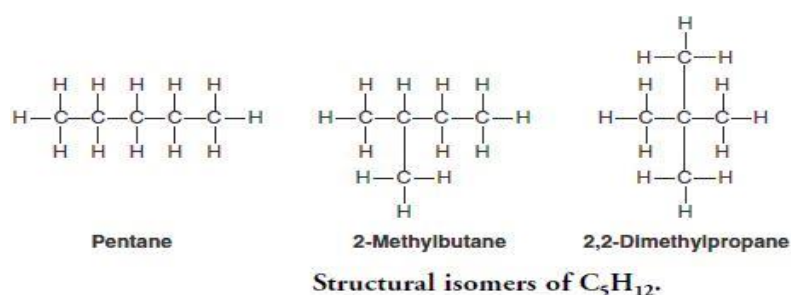
B. SHORT ANSWER QUESTIONS

1. a) Catenation- Property to bond with itself on a large scale

b) Tetravalency- property to make 4 covalent bonds.

2. No. 'Diamond and graphite are allotropes of carbon.'

3.



4. Alkane: C_nH_{2n+2} , Alkene: C_nH_{2n} , Alkyne: C_nH_{2n-2}

5. C_5H_{12} , C_3H_8 -alkane

C_2H_4 , C_4H_8 , C_6H_{12} -alkene

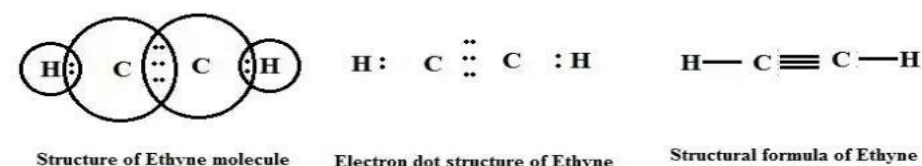
C_3H_4 , C_5H_8 - alkyne

6. Alkane: Propane C_3H_8 , Alkene: Butene C_4H_8 , Alkyne: Butyne C_4H_6 ,

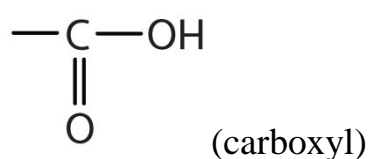
Cycloalkane: Cyclopentane C_5H_{10}

7. Bromine water test: Alkenes are unsaturated and decolourise an orange solution of bromine water. Alkanes are saturated and do not react with bromine water, so the orange colour persists.

8.



9.



10. a- iv, b- i, c- ii, d- iii

C. CASE BASED QUESTIONS

1. a) Sooty deposit is due to incomplete combustion of fuel.

b) yes, Saturated compounds will generally burn in excess of air with a blue flame but unsaturated hydrocarbons burn with a yellow flame with lots of black smoke (sooty flame).

c) Clean holes supply sufficient air(oxygen) and complete combustion of fuel will give blue flame.

2.a) Ester formation

b) Reaction mixture: Ethanol (Alcohol) + Acetic Acid (Carboxylic Acid) , Reaction: Esterification

c) As Alcohol being one of the reactants and its highly flammable, it should not be heated directly. Hence heated in a water bath.

D. ASSERTION REASON QUESTIONS

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

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

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

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

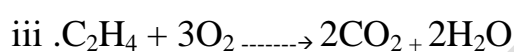
5. (c) A is true but R is false.

E. SOURCE BASED QUESTIONS

1.

i. Alkanes react with oxygen to produce CO_2 and H_2O and a large amount of heat.

ii. Propane and butane



2

i. Corn oil and Sunflower oil contain long chain organic acids with some of the C- C double bonds.

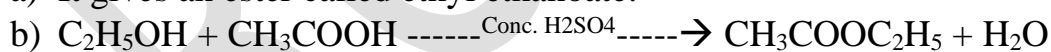
ii. Vegetable fat as they are unsaturated.



F. LONG ANSWER TYPE QUESTIONS

1.

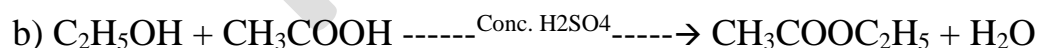
a) It gives an ester called ethyl ethanoate.



c) Esterification reaction

d) It is sweet smelling. It is used in perfumes and as a flavouring agent.

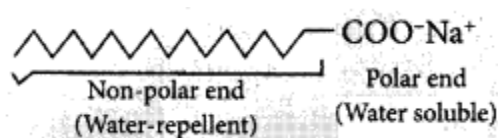
2. a) X is ethanol and Y is ethanoic acid



3.a) Soaps are the sodium or potassium salts of higher fatty acids. Synthetic detergents are the sodium salts of a long chain alkyl benzene sulphonic acids or long chain alkyl hydrogen sulphates.

soap molecule contains a polar part (COO^-Na^+) called polar end and a non-polar part consisting of a long chain carbon atom. This part is called hydrocarbon end.

The polar end is water soluble whereas hydrocarbon part is water-repellent and oil soluble.



When an oily (dirty) piece of cloth is put into soap solution, the hydrocarbon part of the molecule attaches itself to the oily drop and the $-\text{COO}^-$ end orients itself towards water. Na^+ ions in solution arrange themselves around the $-\text{COO}^-$ ions. The negatively charged micelle so formed entraps the oily dirt. The negatively charged micelle repel each other due to the electrostatic repulsion. As a result, the tiny oily dirt particles do not come together and get washed away in water during rinsing.

In hard water, soap does not form lather as hard water contains Ca^{2+} and Mg^{2+} ions. Soap reacts with these ions to form insoluble calcium and magnesium salts of fatty acids.

Detergents can form lather well even in hard water as they do not form insoluble calcium or magnesium salts.

Chapter 6:

LIFE PROCESSES

MULTIPLE CHOICE QUESTIONS:

- The correct order of steps occurring in animals is:
 - Ingestion, Absorption, Digestion, Assimilation, Egestion
 - Ingestion, Digestion, Assimilation, Absorption, Egestion
 - Ingestion, Digestion, Absorption, Assimilation, Egestion
 - Ingestion, Assimilation, Digestion, Absorption, Egestion
- In which of the following groups of organisms, food materials are broken down outside the body and absorbed?
 - Mushroom, green plants, Amoeba
 - Yeast, mushroom, bread mould
 - Paramecium, Amoeba, Cuscuta
 - Cuscuta, lice, tapeworm
- What are the products obtained by anaerobic respiration in microorganisms?
 - Lactic acid + Energy
 - Carbon dioxide + Water + Energy
 - Ethanol + Carbon dioxide + Energy
 - Pyruvate
- The opening and closing of the stomatal pore depends upon
 - Oxygen
 - Temperature
 - water in the guard cells
 - concentration of CO_2
- A plant gets rid of excess water through transpiration. Which is a method used by plants to get rid of solid waste products?
 - shortening of stem
 - dropping down of fruits
 - shedding of yellow leaves
 - expansion of roots into the soil
- Which of the equations show correct conversion of CO_2 and H_2O into carbohydrates in plants?
 - $$6\text{CO}_2 + 6\text{H}_2\text{O} \xrightarrow[\text{Heat energy}]{\text{Chlorophyll}} \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2 + 12\text{H}_2\text{O}$$

(Glucose)
 - $$6\text{CO}_2 + 6\text{H}_2\text{O} \xrightarrow[\text{Sunlight}]{\text{Chlorophyll}} \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2 + 12\text{H}_2\text{O}$$

(Glucose)
 - $$6\text{CO}_2 + 12\text{H}_2\text{O} \xrightarrow[\text{Sunlight}]{\text{Chlorophyll}} \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2 + 6\text{H}_2\text{O}$$

(Glucose)
 - $$6\text{CO}_2 + 12\text{H}_2\text{O} \xrightarrow[\text{Heat energy}]{\text{Chlorophyll}} \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2 + 6\text{H}_2\text{O}$$

(Glucose)

7. Which option correctly shows the transport of oxygen to the cell?

- Lungs → pulmonary vein → left atrium → left ventricle → aorta → body cells
- Lungs → pulmonary vein → right atrium → right ventricle → aorta → body cells
- Lungs → pulmonary artery → left atrium → left ventricle → vena cava → body cells

(d) Lungs → pulmonary artery → right atrium → right ventricle → vena cava → body cells

8. How is food transported from phloem to the tissues according to plants' needs?

(a) food is transported along with the water in the plant's body.

(b) food is transported in only one direction like water in the plant body through xylem.

(c) food is transported from a region with low concentration to higher concentration.

(d) food is transported from a region where it is produced to other parts of the plants.

9. In which mode of nutrition an organism derives its food from the body of another living organism without killing it?

(a) Saprotrophic nutrition

(b) Parasitic nutrition

(c) Holozoic nutrition

(d) Autotrophic nutrition

10. Which of the following events in the mouth cavity will be affected if salivary amylase is lacking in the saliva?

(a) Starch breaking down into sugars.

(b) Proteins breaking down into amino acids.

(c) Absorption of vitamins.

(d) Fats breaking down into fatty acids and glycerol.

11. Glycolysis process occurs in which part of the cell?

(a) Cytoplasm

(b) Nucleus

(c) Mitochondria

(d) Chloroplast

12. Name the substances whose build up in the muscles during vigorous physical exercise may cause cramps?

(a) Ethanol + Carbon dioxide + Energy

(b) Lactic acid + Energy

(c) Carbon dioxide + Water + Energy

(d) Pyruvate

13. Name a circulatory fluid in the human body other than blood.

(a) Platelets

(b) RBC

(c) Lymph

(d) Plasma

14. Single circulation, i.e., blood flows through the heart only once during one cycle of passage through the body, is exhibited by which of the following:

(a) hyla, rana, draco

(b) whale, dolphin, turtle

(c) labeo, chameleon, salamander

(d) hippocampus, exocoetus, anabas

15. Which part of nephron allows the selective reabsorption of useful substances like glucose, amino acids, salts and water into the blood capillaries?

(a) Tubule

(b) Glomerulus

(c) Bowman's capsule

(d) Ureter

16. Identify the correct path of urine in the human body.

(a) Kidney → urinary bladder → urethra → ureter

(b) Urinary bladder → ureter → kidney → urethra

(c) Kidney → ureter → urethra → urinary bladder

(d) Kidney → ureter → urinary bladder → urethra

17. Which of the following statements are true about respiration?

(i) during inhalation, ribs move inward and diaphragm is raised.

(ii) the gaseous exchange takes place in the alveoli

- (iii) haemoglobin has greater affinity for carbon dioxide than oxygen
- (iv) alveoli increase surface area for the exchange of gases
- (a) i and iv
- (b) ii and iii
- (c) i and iii
- (d) ii and iv

18. Water absorption in plants can be increased by keeping the potted plants:

- (a) in the shade
- (b) in dim light
- (c) under the fan
- (d) covered with a polythene bag

19. What prevents the backflow of blood inside the heart during contraction?

- (a) thick muscular walls of ventricles
- (b) valves
- (c) thin walls of atria
- (d) septum

20. Coagulation of blood in a cut or wound is brought about by:

- (a) plasma
- (b) platelets
- (c) WBC
- (d) RBC

ANSWERS:

Question No	Answer	Question No	Answer
1	c	11	a
2	b	12	b
3	c	13	c
4	c	14	d
5	c	15	a
6	c	16	d
7	a	17	d
8	d	18	c
9	b	19	b
10	a	20	b

TWO MARK QUESTIONS:

1. (a) Photosynthesis converts energy X into energy Y. What are X and Y?
 (b) Write the stages involved in the process of photosynthesis.

Answer:

- (a) X is solar energy, Y is chemical energy
- (b) Absorption of light energy.

conversion of light energy to chemical energy and splitting of water molecule.
 reduction of CO₂ to carbohydrates.

2. Major amount of water is selectively reabsorbed by the tubular part of nephron in humans. What are the factors on which the amount of water reabsorbed depends?

Answer:

1. Amount of excess water present.
2. Amount of dissolved wastes to be excreted.

3. Differentiate between single and double circulation found in vertebrates.

Answer:

Single Circulation	Double Circulation
1. In this, blood passes only once through the heart in one complete cycle	Blood passes, twice through the heart in one complete
2. Heart has only deoxygenated blood	Heart has both oxygenated and deoxygenated blood
3. It is less efficient	It is more efficient

4. What advantage over an aquatic organism does a terrestrial organism have with regard to obtaining oxygen for respiration?

Answer:

Adaptation of terrestrial organism over aquatic organism for efficient uptake of oxygen from air –

- (i) Increased respiratory surface area.
- (ii) Very fine and delicate surface for easy exchange of oxygen and carbon – dioxide.
- (iii) Placement of respiratory surface within the body for protection
- (iv) Mechanism for moving the air in and out of respiratory surface where the oxygen is absorbed.

5. What is villi? What are its functions?

Answer:

Finger like projection present in the inner lining of small intestine are called villi. They increase the surface area for the absorption of digested food in the small intestine.

6. Differentiate between aerobic and anaerobic respiration.

Aerobic Respiration	Anaerobic Respiration
a) It occurs in the presence of oxygen	a) It occurs in the absence of oxygen
b) It occurs in cytoplasm and in the mitochondria	b) It occurs in cytoplasm
b) Complete breakdown of glucose	c) Incomplete breakdown of glucose
d) End products are CO_2 and H_2O	d) End products are CO_2 and ethyl alcohol or lactic acid

Answer:

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

Answer:

Separation of oxygenated and deoxygenated blood allows good supply of oxygen to the body. This system is useful in animals that have high energy requirement. Mammals and birds constantly need oxygen to get energy to maintain constant body temperature.

8. Why is diffusion insufficient to meet the oxygen requirements of multicellular organisms like humans?

Answer:

As in multicellular organisms, all the cells are not in direct contact with environment, simple diffusion does not meet the requirement of all the body cells.

9. In the process of Photosynthesis food A is prepared which gets converted into food B. What are A and B? Why is A converted to B?

Answer:

Food A is glucose and food B is Starch.

A is converted to B as B is insoluble form of carbohydrate. It is more compact and hence, suitable for storage.

10. Name the respiratory organs of (i) fish (ii) mosquito (iii) earthworm.

Answer:

Fish – gills

Mosquito – Trachea (air tubes)

Earthworm – moist skin

11. Why is the rate of breathing much faster in aquatic organisms than those of terrestrial organisms?

Answer:

The aquatic organisms obtain oxygen dissolved in water. As compared to air, the availability of oxygen in water is fairly low. Hence, the aquatic organisms have to breathe faster as compared to the terrestrial organisms.

12. Name the two ways in which glucose is oxidised to provide energy in various organisms.

Answer:

- (i) Aerobic respiration in which glucose is completely oxidised to carbon dioxide and water with the help of oxygen releasing 686 kcal of energy per mole.
- (ii) Anaerobic respiration in which glucose is incompletely broken down in the absence of oxygen to form generally either lactic acid or ethyl alcohol and carbon dioxide releasing about 50 kcal of energy.

13. State basic difference in the processes of respiration and photosynthesis.

Answer:

Respiration is a catabolic process in which glucose is broken down to release energy while photosynthesis is an anabolic process in which glucose and other organic substances are manufactured from raw materials with help of solar radiations.

14. Ventricles have thicker muscular walls than atria. Give reason.

Answer:

Ventricles have to pump blood forcefully so as to reach even distant capillaries, right ventricle into lungs and left ventricle to all the remaining body parts, while atria are to pump blood into adjacent ventricles.

15. What is the function of trachea? Why do the walls not collapse even when there is less air in it?

Answer:

Trachea is a tube that connects pharynx with lungs for carrying air to and from lungs. Trachea is lined by ciliated mucus secreting pseudostratified epithelium for trapping dust particles and microbes.

Trachea does not collapse in reduced air pressure due to support of C-shaped cartilaginous rings.

16. Explain the significance of peristaltic movement that occurs all along the gut during digestion.

Answer:

Peristaltic movement or peristalsis is a wave of alternate contraction and expansion that passes through the gut from oesophagus to large intestine. It moves the food forward in a regulated manner along the digestive tract for processing in each part properly.

17. Name two digestive glands associated with digestive system in humans. Name their secretions.

Answer:

- 1. Salivary glands — saliva.
- 2. Pancreas — pancreatic juice.

18. Which mechanism plays an important role in transportation of water in plants

- (a) During daytime
- (b) At night?

Answer:

- (a) Transpiration pull
- (b) Water deficit of daytime and afterwards root pressure.

19. How desert plants perform photosynthesis if their stomata remain closed during the day?

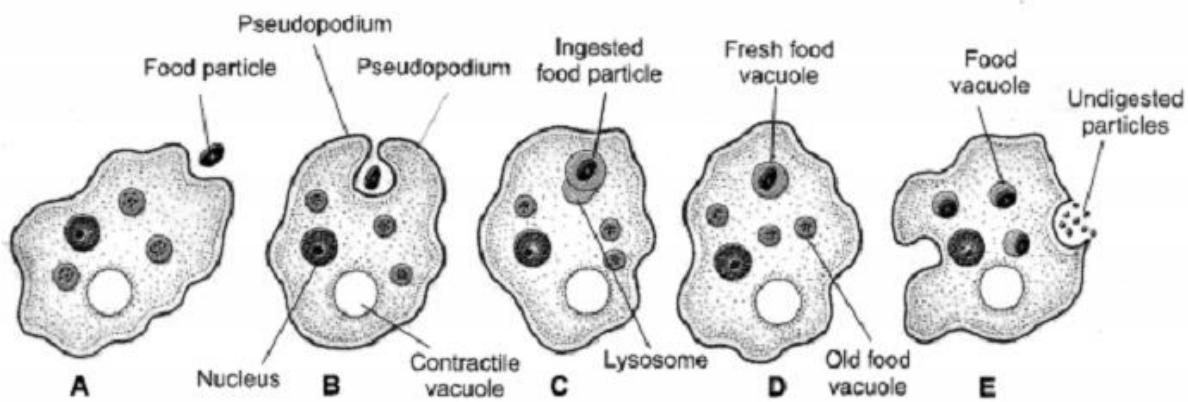
Answer:

Carbon dioxide is absorbed during night when stomata are open. It is fixed in malic acid from which the same is released during day time for performing Calvin cycle in light.

20. Explain the process of nutrition in Amoeba.

Answer:

Amoeba ingests food particles with the help of its pseudopodia. The ingested food particle or phagosome fuses with lysosome to form food vacuole. The digested food passes out of the vacuole into cytoplasm. The undigested matter is thrown out.



Holozoic nutrition in Amoeba.

CCT QUESTIONS:

I. There is a range of strategies by which the food is taken in and used by the organisms in heterotrophic nutrition. Some organism breakdown the food material outside the body and then absorb it. Others take in whole material and break it down inside their bodies. What can be taken in and broken down depends on the body design and functioning. Some others derive nutrition from plants and animals without killing them.

1. Organisms which derive nutrition from plants and animals without killing them.

A. Parasites

B. Saprophytes

C. Heterotrophs

D. Autotrophs

2. In which part of amoeba complex food particles are broken down into simpler ones.

A. Cytoplasm

B. Pseudopodia

C. Nucleus

D. Food vacuole

3. Which of the following is an example of saprotroph.

A. Cuscuta

B. Sugarcane

C. Bread mould

D. Amoeba

4. Taking in whole material and breaking it down inside the body is

A. Parasitic nutrition

B. Holozoic nutrition

C. Saprophytic nutrition

D. Symbiosis

5. Heterotrophic nutrition involves

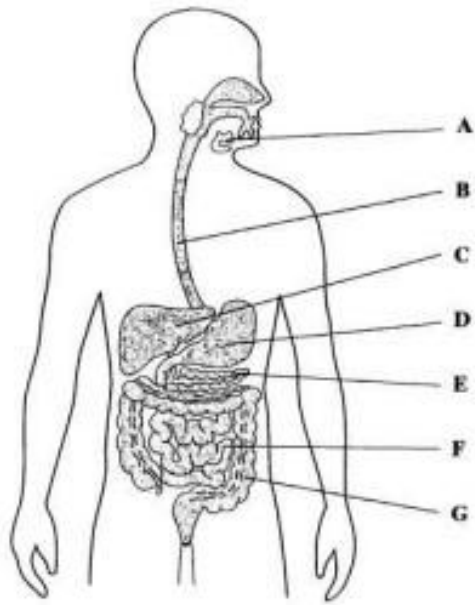
A. Production of simple sugar from inorganic compounds

B. Utilisation of chemical energy to prepare food

C. Utilisation of energy obtained by plants

D. All of these

II. Human Digestive System



1. Which of these correctly represent the labels B, C, D and E?

- A. Pancreas, Oesophagus, Stomach, Liver
- B. Oesophagus, Liver, Stomach, Pancreas**
- C. Stomach, Liver, Oesophagus, Pancreas
- D. Oesophagus, Pancreas, Liver, Stomach

2. Villi are present in

- A. D
- B. E
- C. F**
- D. A

3. The enzyme that is released by the part label A is

- A. Trypsin
- B. Amino acids
- C. Amylase**
- D. Intestinal juices

4. The movements that occur along part B to push the food forward.

- A. Rotation
- B. Peristalsis**
- C. Flexion
- D. Protrusion

5. In case of diarrhoea, which major process does not take place normally in region G?

- A. Absorption of food
- B. Absorption of water**
- C. Secretion of hormones
- D. Removal of waste material

III. Pathways of breakdown of glucose

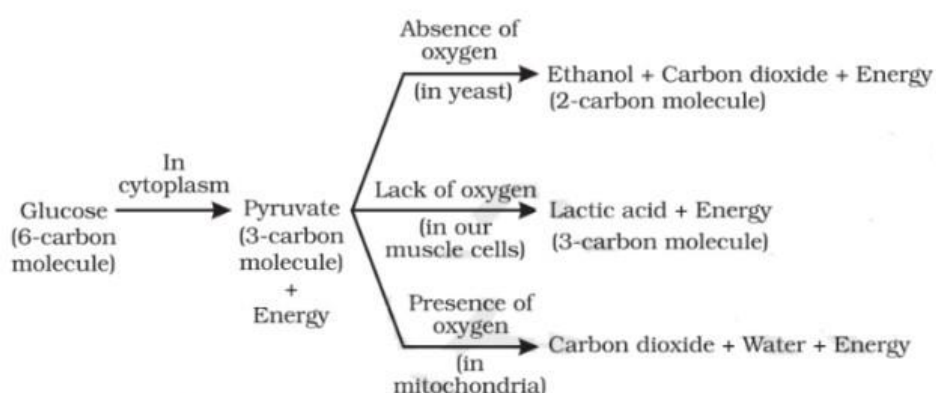


Fig: Break-down of glucose by various pathways

1. The pathway of respiration common in all living organisms is X; it occurs in the Y and the products formed are two molecules of Z. Identify X, Y and Z.

- A. Glycolysis, Mitochondria, Pyruvic acid
- B. Glycolysis, Cytoplasm, Pyruvic acid**
- C. Citric acid cycle, Cytoplasm, Phosphate

D. Krebs's cycle, Mitochondria, Acetyl CoA

2. During vigorous physical exercise, lactic acid is formed from glucose inside the muscle cells because

- A. there is lack of oxygen
- B. there is lack of water
- C. there is excess of carbon dioxide
- D. none of the above

3. Type of respiration seen during fermentation

- A. Aerobic
- B. Anaerobic
- C. Reduction
- D. Oxidation

4. End product of Aerobic respiration

- A. NADH
- B. Oxygen
- C. ATP
- D. $\text{CO}_2 + \text{ATP} + \text{H}_2\text{O}$

5. Amount of energy released is more during

- A. Anaerobic respiration
- B. Fermentation
- C. Aerobic respiration
- D. Reduction

IV. Blood transport food, Oxygen and waste materials in our bodies. It consists of plasma as a fluid medium. A pumping organ [heart] is required to push the blood around the body. The blood flow through the chambers of heart in a specific manner and direction. While flowing throughout the body, blood exert a pressure against the wall or a vessel.

1. Oxygenated blood from lungs enters left atrium through

- A. Vena cava
- B. Pulmonary artery
- C. Pulmonary vein
- D. Aorta

2. The rate of blood flow in the capillaries is very low because capillaries are

- A. Very narrow and have high resistance
- B. Much wide and have low resistance
- C. Very narrow and have low resistance
- D. Much wide and have high resistance

3. Which of the following statements are true about human heart?

- A. It is a hollow muscular organ
- B. It is four chambered having three auricles and one ventricle.
- C. It has different chambers to prevent O_2 rich blood from mixing with the blood containing CO_2
- D. Both A & C

4. Study the table below and select the row that has correct information.

- A. Blood = Plasma + RBC + WBC + Platelets
- B. Plasma = Blood – RBC
- C. Lymph = Plasma + RBC
- D. Serum = Plasma + RBC + WBC

V. Our body needs to remove the wastes that build up from cell activities and from digestion. If these wastes are not removed, then our cells can stop working and we can get very sick. The organs of excretory system consist of a pair of kidneys, a pair of ureters, a urinary bladder and a urethra. Each kidney is made up of nearly one million complex tubular structures called nephrons. The formation of urine involves various processes that

take place in the different parts of the nephrons. Each nephron consists of a cup- shaped upper end called Bowman's capsule containing a bunch of capillaries called glomerulus. Bowman's capsule leads to tubular structure, proximal convoluted tubule, loop of Henle and distal convoluted tubule which ultimately join the collecting tubule.

1. The following substances are the excretory products in animals. Choose the least toxic form.

- A. Urea
- B. Uric acid
- C. Ammonia
- D. All of these

2. Glomerular filtrate is first collected by

- A. Distal convoluted tubule
- B. proximal convoluted tubule
- C. Bowman's capsule space
- D. loop of Henle

3. The outline of principal events of urination is given below in random order.

- I) stretch receptors on the wall of urinary bladder send signals to the CNS.
- II) The bladder fills with urine and become distended.
- III) Micturition (voiding out urine)
- IV) CNS passes on motor messages to initiate the contraction of smooth muscles of bladder and simultaneous relaxation of urethral sphincter.

The correct sequence of the events is

- A. I → II → III → IV
- B. IV → III → II → I
- C. II → I → IV → III
- D. III → II → I → IV

4. Urine formation occurs through

- A. Ultrafiltration, reabsorption, secretion.
- B. Secretion, osmosis, ultrafiltration and reabsorption.
- C. Only filtration and absorption.
- D. Only osmosis and secretion.

ASSERTION REASON TYPE QUESTIONS

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

- A. Both assertion and reason are true, and reason is the correct explanation of assertion.
- B. Both assertion and reason are true, but reason is not the correct explanation of assertion.
- C. Assertion is true but reason is false.
- D. Assertion is false and reason is true.

1) Assertion: Kidneys perform a dual function in our body.

Reason: Selective reabsorption occurs in the glomerulus.

2) Assertion: Mammals and birds have four chambered hearts.

Reason: Mammals and birds are warm blooded.

3) Assertion: Mammals has double circulation.

Reason: Higher energy need due to endothermy (warm blooded).

4) Assertion: Veins have valves.

Reason: The pressure for the flow is far lesser compared to arteries.

5) Assertion: Kidneys purify blood.

Reason: Renal vein has more Oxygen than renal artery.

- 6) Assertion: Arteries always carry oxygenated blood.
Reason: Arteries transport blood from the heart to different parts of the body.
- 7) Assertion: The left atrium and left ventricle are completely separated from the right atrium and the right ventricle.
Reason: Oxygenated and deoxygenated blood never mix with each other inside the heart.
- 8) Assertion: In plants gaseous exchange takes place by the opening and closing of guard cells.
Reason: The exchange of gases occurs across the surface of stem, roots and leaves.
- 9) Assertion: The Alveoli provide a surface where exchange of gases takes place.
Reason: The Alveolar blood vessels transport oxygenated blood to all the cells of the body.
- 10) Assertion: Tracheal cartilage is present in the throat.
Reason: The larynx plays an important role in human speech.
- 11) Assertion: Bread tastes sweet on chewing.
Reason: Salivary amylase converts starch into sugar.
- 12) Assertion: At high altitudes the pressure of oxygen falls, inside lungs.
Reason: Oxygen is absorbed very quickly from alveoli to increase breathing rate.
- 13) Assertion: Anaerobic respiration requires more energy as compared to aerobic respiration.
Reason: Mitochondria is the power house of the cell
- 14) Assertion: Chyme is the food which enters into the intestine from stomach.
Reason: Chyme is acidic in nature.
- 15) Assertion: During transpiration the evaporating water carries away heat energy.
Reason: Due to water loss the osmotic pressure inside leaves increases.
- 16) Assertion: Herbivores have longer intestine to allow cellulose to get digested.
Reason: Carnivores have shorter intestine to allow meat to get digested.
- 17) Assertion: Lipase helps in the digestion of proteins.
Reason: Digestion of proteins in small intestine needs basic medium
- 18) Assertion: Respiration is opposite of Photosynthesis.
Reason: In Photosynthesis food is made from energy and in Respiration food is converted to energy.
- 19) Assertion: Aerobic respiration evolves less energy as compared to anaerobic respiration.
Reason: Mitochondria are the power house of the cell.
- 20) Assertion: A plant closes its stomata when it does not need carbon dioxide for photosynthesis
Reason: Large amount of water can be lost as vapour through the stomata.
- 21) Assertion: The opening and closing of the pore is a function of the guard cells.
Reason: Stomatal pores are the site for exchange of gases by diffusion.
- 22) Assertion: In a healthy adult, the initial filtrate in the kidneys is about 180 L daily, but the actual volume excreted is only a litre a day.
Reason: Most of the filtrate is lost from the body in the form of sweat.
- 23) Assertion: The four chambered heart does not mix oxygenated and deoxygenated blood.
Reason: Four chambered heart is found in mammals with advanced body functions.

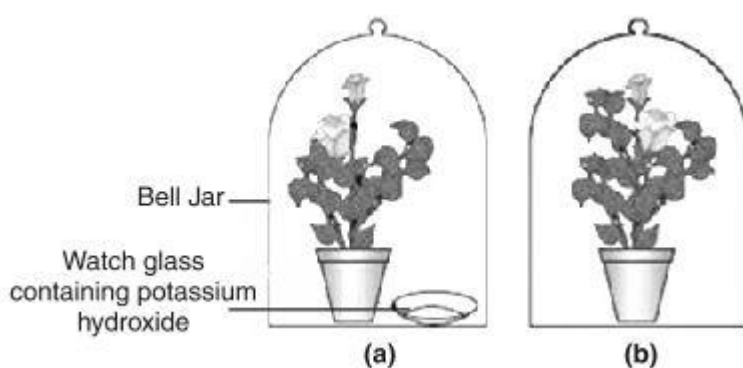
ANSWERS OF ARQ

1. C	2. A	3. A.	4.A	5.C	6. A
7. A	8.B	9.A	10.B	11.A	12.A
13.D	14.A	15.C	16.B	17. D	18. A
19. D	20. B	21. B	22. C	23. B	

THREE MARKS QUESTIONS:

1. Observe the experimental set up and answer the questions given below.

Note that the bell jars are inverted over the plants after the plants are kept in dark for 72 hours. Also, the set-up is air tight. The set-up is kept in sunlight for a few hours and then starch test is done on leaves of both plants.

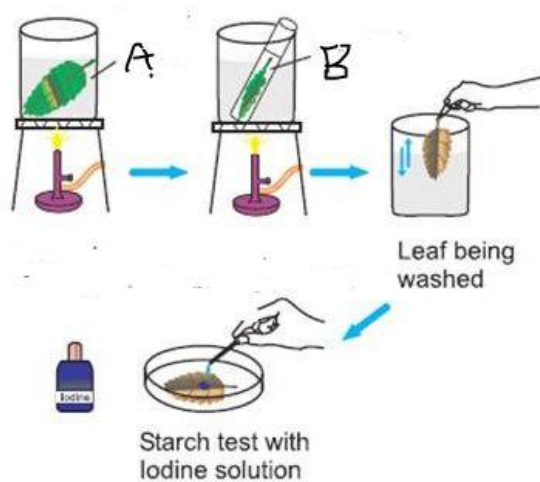


- What is the aim of this experiment?
- Why are the plants to be kept in the dark for 72 hours?
- What is the role of KOH in this experiment?

Answer:

- To show that CO_2 is necessary for photosynthesis.
- To destarch the plant
- To absorb CO_2 from the air inside the bell jar.

2. Observe the experimental setup given below and answer the following questions.



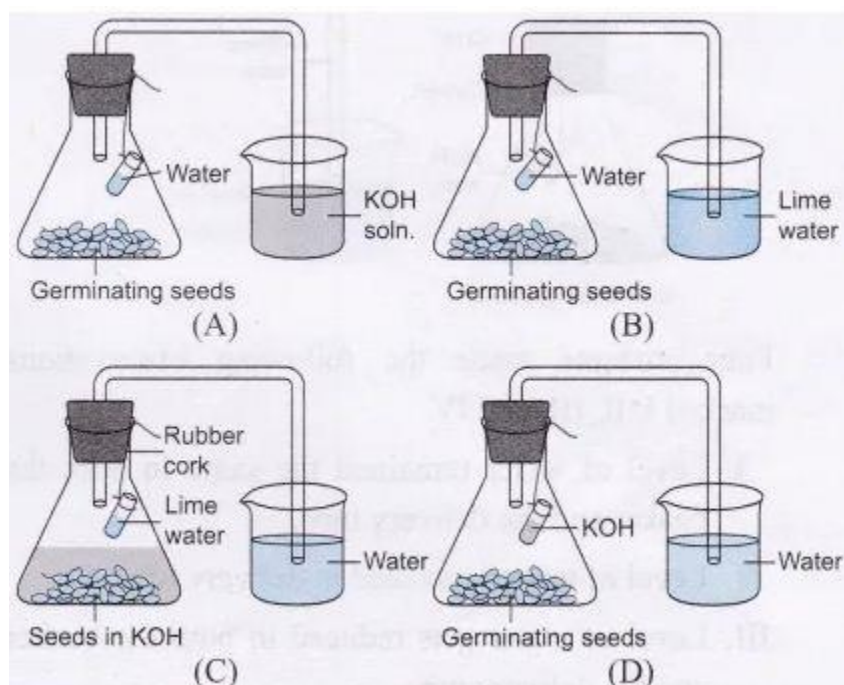
- Identify the liquids labelled as A and B.
- Why is the leaf supposed to be first boiled in A and then in B?
- Can the leaf be boiled in B directly over the flame of the burner? Give reason.

Answer:

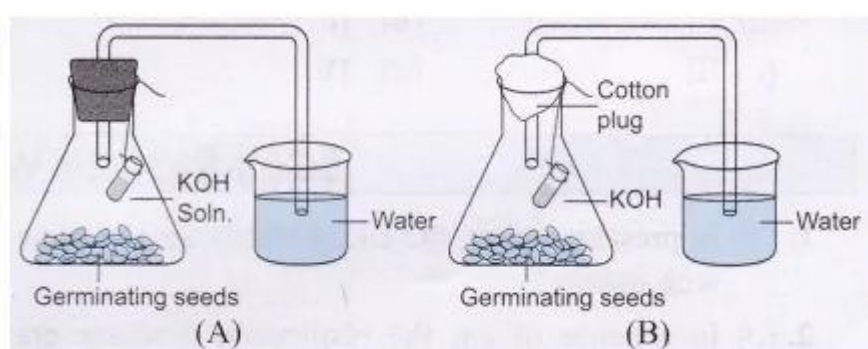
- A- water; B- alcohol.
- Boiling in water is to soften the tissues. Boiling in alcohol is for the chlorophyll to be removed from the leaf.
- B being alcohol is highly flammable and so, would catch fire and burn

3. Students conducted the experiment to show that germinating seeds give out CO_2 during respiration. They noted down their observations and also drew the diagram of the experimental set up used for the experiment.

- Identify the correctly labelled experimental setup.



(ii) In the 2 experimental set ups as shown below, after two hours, rise in water level will be observed in



(iii) What would be the observation if non-germinating seeds are used in the activity instead of germinating seeds? Why?

Answer:

(i) Figure D.

(ii) A.

(iii) No change with non-germinating seeds, as they do not respire.

4. List the three steps in photosynthesis.

Answer:

(i) Absorption of sun's energy by Chlorophyll

(ii) Conversion of light energy into chemical energy; and, splitting of water into hydrogen and oxygen using the light energy.

(iii) Reduction of carbon dioxide into carbohydrates like glucose using the chemical energy.

5. What are the functions of saliva? (Any 3 points)

Answer:

(i) Saliva moistens the food, making it easy to be chewed.

(ii) The taste buds are able to sense the taste of food only as the finer particles of food mix into the saliva and get into the taste pores of the taste buds.

(iii) Moistening of food by saliva helps swallow the food as well.

(iv) The enzyme salivary amylase in saliva starts digestion of starch in the buccal cavity.

(v) Saliva also kills some of the microbes entering with food.

6. What is the significance of Small Intestine in our body? (Any 3 points)

Answer:

Significance of SI:

(i) The secretions of liver and pancreas are brought to the duodenum of SI. The hepatic duct from liver and the pancreatic duct from pancreas join forming hepato-pancreatic duct bring the secretions of both glands to duodenum where these help in digestion of food.

(ii) There are some intestinal glands also in the first part of SI, which also secrete enzymes. The process of digestion of food is completed here.

- (iii) The fine finger like structures called “Intestinal Villi” increase the surface area for absorption of digestive end products.
- (iv) The length of the SI ensures that food remains in it for a long time as it travels through SI, thereby making it possible for maximum amount of nutrients to be absorbed.

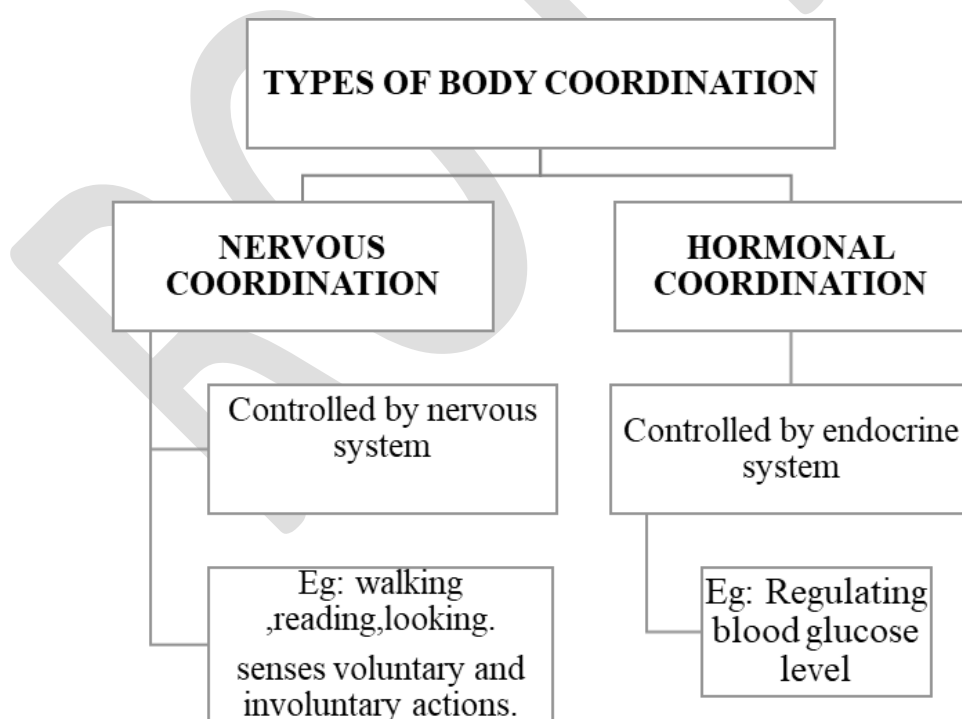
7. List any 3 functions of the major circulatory fluid of our body.

Answer:

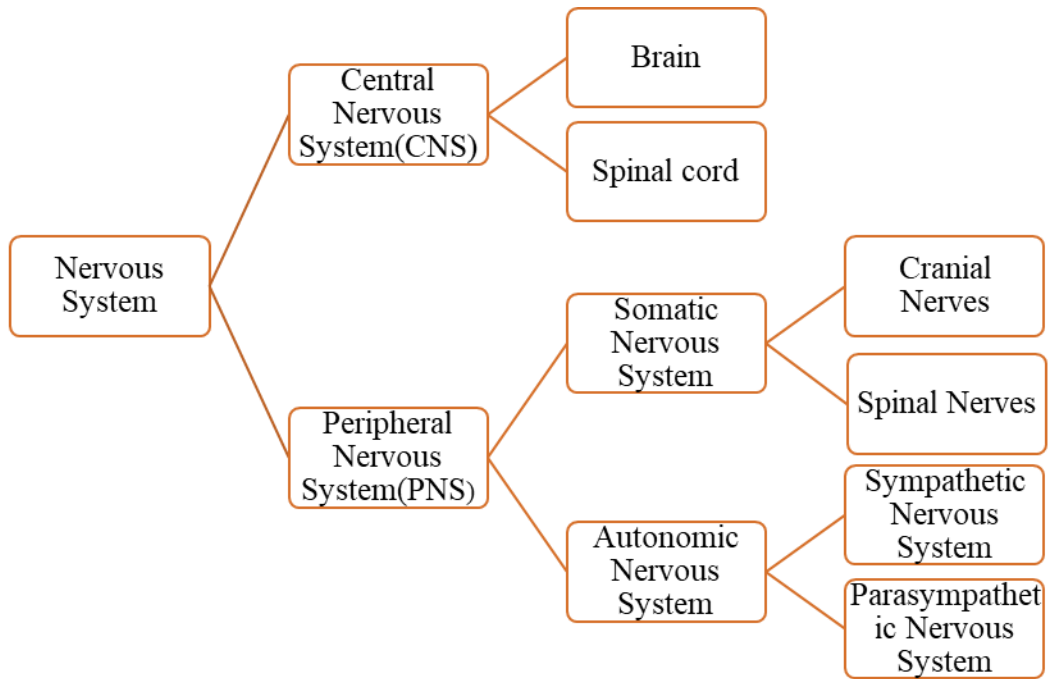
- (i) Transport of O₂ (from lungs to different parts of the body) and CO₂ (from tissues/ organs, back to lungs).
- (ii) Transport of digested food (glucose, amino acids, etc.) from Small Intestine to various parts of the body.
- (iii) Transport hormones from their site of production (endocrine organs) to the site of action (target organs or tissues in different parts of the body).
- (iv) Carry nitrogenous wastes of metabolism from various tissues/ organs, to kidneys, to be removed as urine.
- (v) Harmful substances or toxins are transported to the liver for detoxification.
- (vi) Antibodies produced by the leucocytes provide immunity to the body.
- (vii) Help maintain body temperature (thermoregulation) by the process of sweating (perspiration)

Chapter 7:

CONTROL AND COORDINATION



HUMAN NERVOUS SYSTEM



Coordination:-The working together of various organs to produce appropriate reaction to a stimulus is called coordination.

Stimulus:-The change in the environment to which an organism respond and react is called stimulus.

Response : The reaction of our body to a stimulus.

Control & coordination in animals:- done by (i) Nervous system & (ii) Endocrine system

Parts of Nervous system :-a) Brain b) Spinal cord c) Nerves (group of Neurons)

Receptors: Receptors are the specialized tips of the nerve cell that collect the information to be conducted by the nerves.

Receptors are present in the sense organs of the animals. These are classified as follows:

- ❖ **Phono-receptors:** Present in inner ear. The main functions are hearing and balance of the body.
- ❖ **Photo-receptors:** Present in the eye. These are responsible for visual stimulus.
- ❖ **Thermo-receptors:** Present in skin. These receptors are responsible for pain, touch and heat stimuli.
- ❖ **Olfactory-receptors:** Present in nose. These receptors receive smell.
- ❖ **Gustatory-receptors:** Present in the tongue. These helps in taste detection.

Neuron :-Is the structural and functional unit of Nervous system

Parts of Neuron:- (i) Dendrites (ii) Cell body (iii) Axon (iv) Nerve ending

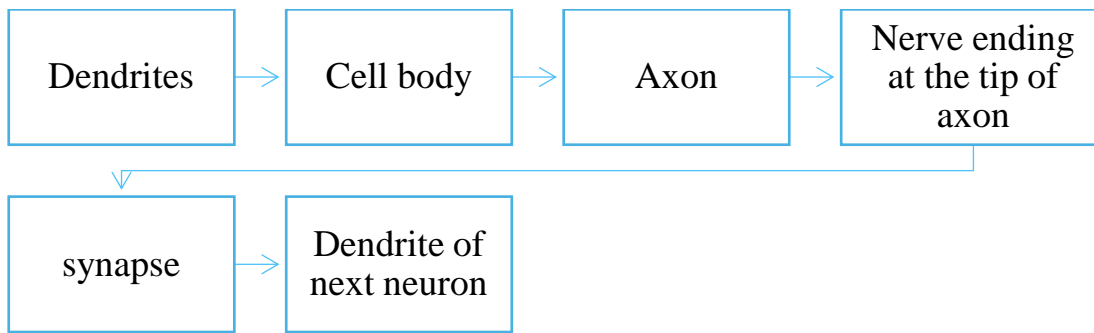
Synapse- Space/junction between two adjacent nerves is called Synapse.

Neuromuscular junction : refers to the synaptic gap between a motor nerve and an effector muscle (skeletal muscle). This connects and conveys messages from the nervous system to the muscular system

Function of Neuron:-

The information, acquired at the end of the dendritic tip of a nerve cell sets off a chemical reaction that creates an electrical impulse. This impulse travels from the dendrite to the cell body, and then along the axon to its end. At the end of the axon, the electrical impulse sets off the release of some chemicals. These chemicals cross the synapse, and start a similar electrical impulse in a dendrite of the next neuron. A similar synapse finally allows delivery of such impulses from neurons to other cells, such as muscles cells or gland.

Transmission of nerve impulse: Nerve impulses travel in the following manner from one neuron to the next :



Passing of information takes place –(i) By Electric impulse (inside the neuron) and (ii) In the form of chemicals (At synapse)

Types of neuron

- ❖ Sensory neuron: These neurons receive signals from a sense organ.
- ❖ Motor neuron: These neurons send signals to a muscle or a gland.
- ❖ Association or relay neuron: These neurons relay the signals between sensory neuron and motor neuron.

Reflex action- spontaneous, involuntary and automatic response to a stimulus to protect us from harmful situations. E.g. On touching a hot objects unknowingly, we withdraw our hand.

Reflex Arc:- The pathway taken by nerve impulses in a reflex action.

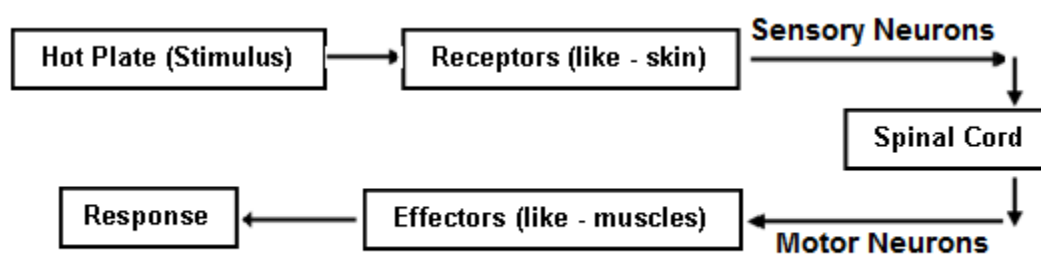


Diagram: Reflex Arc (reflex pathway)

Nervous system- Human nervous system has two parts

- (1) Central Nervous System (CNS)
- (2) Peripheral Nervous System (PNS)

CNS consists of brain and spinal cord.

PNS consists of cranial nerves which arise from brain and spinal nerves which arise from spinal cord.

Human Brain:- Brain is the main coordinating centre of the body. It has three major parts. They are

- ❖ Forebrain
- ❖ Midbrain
- ❖ Hindbrain

Fore brain - Cerebrum- (i) Main thinking and largest part of the brain. (ii) It has 3 main areas -

- a. Sensory area- to receive impulses from sense organs via Receptors
- b. Motor area- control voluntary movements.
- c. Association areas- Reasoning, learning & intelligence.

Thalamus – It relays sensory information to the Cerebrum

Hypothalamus- It forms the link between Nervous system & Endocrine system

Function of forebrain

- ❖ Thinking part of brain
- ❖ Control the voluntary actions
- ❖ Store information (Memory)
- ❖ Receives sensory impulse from various parts of the body.
- ❖ Centre associated with hunger
- ❖ Controls vision and hearing

Mid brain- It connects Fore brain and Hind brain. Controls reflex of eyes & ears

Hind brain- Connects the Fore brain & Hind brain. It has 3 parts

Cerebellum – Controls & coordinates muscular movements, maintaining body posture and equilibrium. (walking in a straight line, riding a bicycle, picking up a pencil)

Pons- Acts as a bridge between brain & spinal cord. Controls involuntary actions, regulation of respiration etc.

Medulla oblongata- Controls involuntary actions like blood pressure, salivation, vomiting, etc.

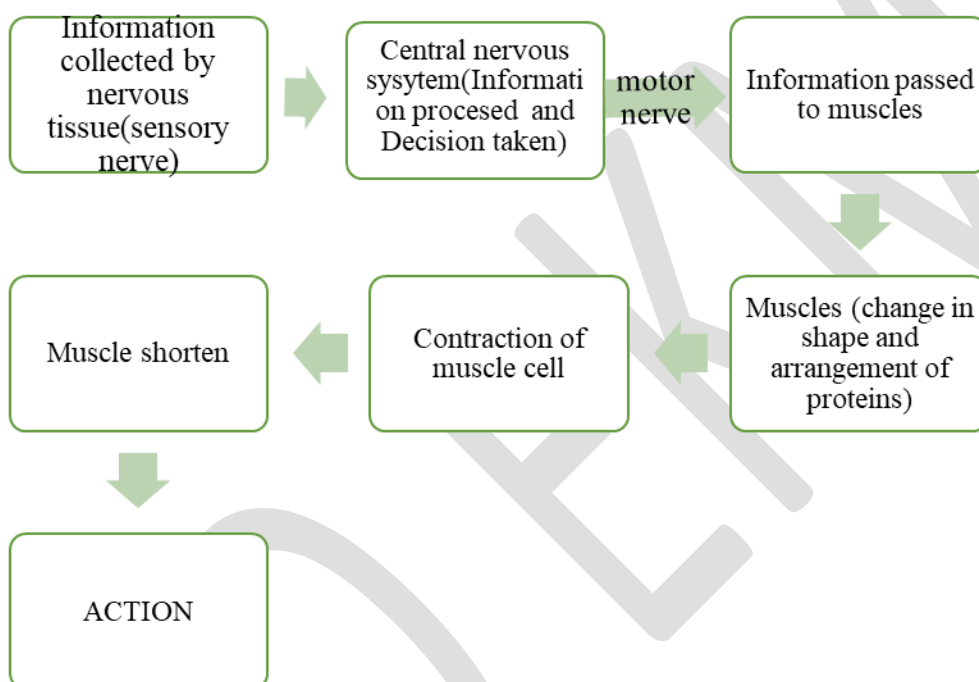
Spinal cord- Cylindrical or tubular structure extending downwards from the Medulla oblongata.

Protection of the brain & the spinal cord-

Brain : is protected by a fluid filled balloon(cerebrospinal fluid) which acts as shock absorber and enclosed in cranium (Brain Box)

Spinal Cord : Spinal Cord is enclosed in Vertebral column.

Action caused by Nervous tissue



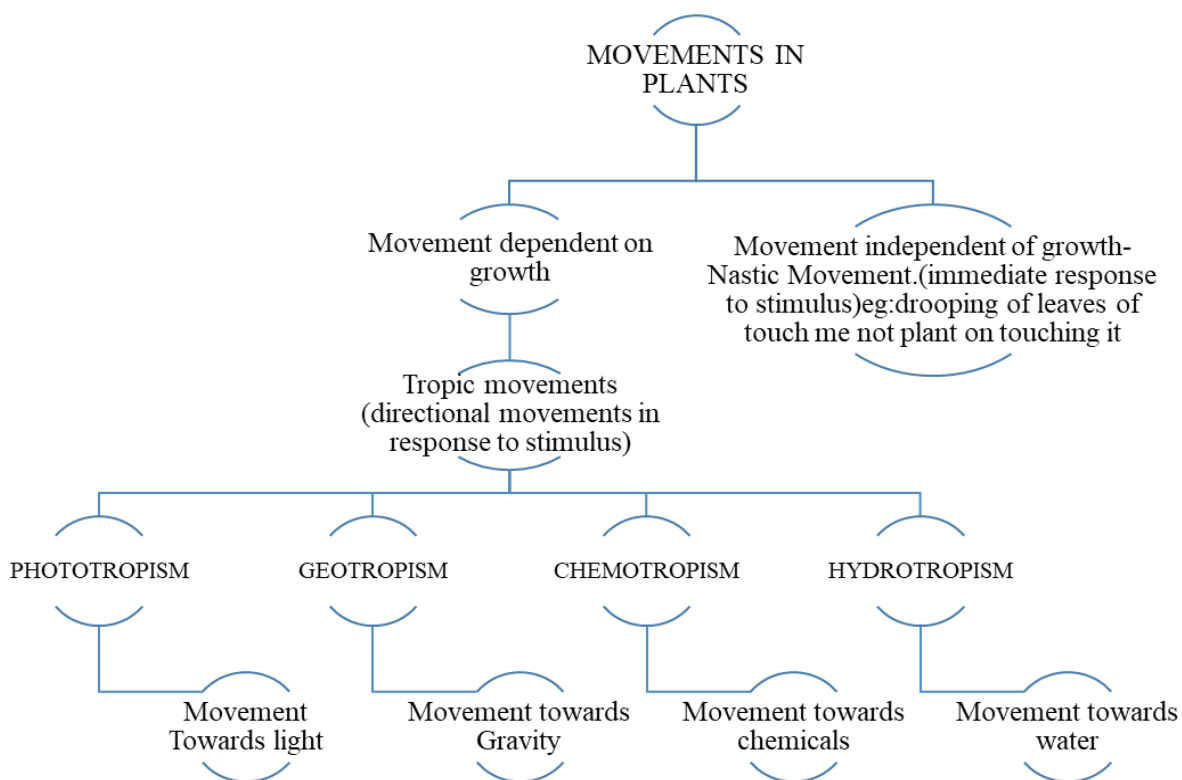
Control and coordination in plants – Plant movements and plant hormones

Coordination in plants- Only chemical coordination is present in plants.

Movement in Plants

Tropic movements- The movements of plants in the direction of stimulus (positive) or away from it (negative) are called tropic movements. E.g. Phototropism, Geotropism. Chemotropism.

Nastic movements -The movements of plants independent of stimuli are called nastic movements. E.g.- Touch me not plant leaves close when touched (Mimosa pudica)



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

Main plant hormones are :

- a) Auxin :- Synthesized at shoot tip
Function : – Helps in growth
Promotes cell enlargement and cell differentiation
- b) Gibberellin :- Helps in the growth of the stem
helps in cell enlargement and cell differentiation
- c) Cytokinin :- Promotes cell division
Help in breaking the dormancy of seeds and buds.
- d) Abscisic acid :-Inhibits growth, cause wilting of leaves
- e) Ethylene : Inhibits growth, flowering and fruit ripening

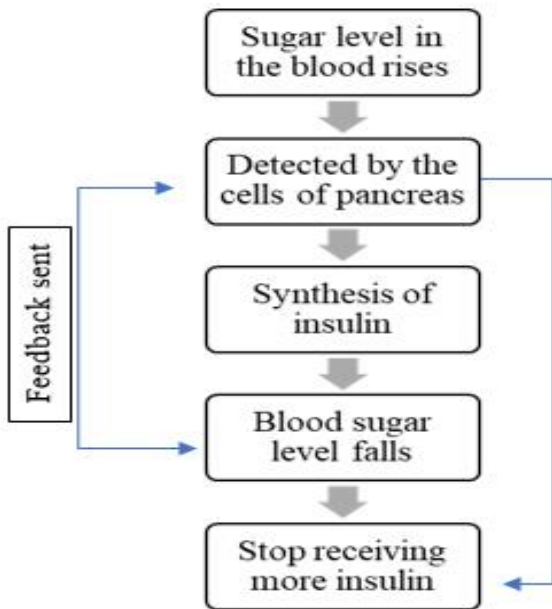
Hormones in animals:

Sl No	Gland	Hormone	Location	Function	Target site
1.	Hypothalamus	i)Releasing hormone(RH) ii)Inhibiting hormones (IH)	Part of forebrain	Regulates secretion of pituitary hormones.	Pituitary gland
2.	Pituitary Gland	i) Growth hormone (GH) ii) Tropic hormones	Part of forebrain	-Controls growth-dwarfism & gigantism Controls other organs	-Most tissues
3.	Thyroid Gland	i) Thyroxin	Neck/Throat region	Regulates carbohydrate, protein and fat metabolism	-Body tissues
4.	Adrenal Gland	i) Adrenaline	Above the kidney	Prepares the body for emergency situations and hence is also	-Body tissues

				called 'Fight and flight' hormone.	
5.	Pancreas	i) Insulin	Below the stomach	Regulates blood sugar level.	-Tissues
6.	Testis	i) Testosterone	Genital/ Lower abdominal area	-helps in the development of male reproductive organs & secondary sexual characters. - influence male sexual behaviour.	Male body tissue
7.	Ovary	i) Oestrogen	Genital/ Lower abdominal area	helps in the development of female reproductive organs, secondary sexual characters & female secondary sexual behaviour.	Female body tissue

Feedback Mechanism

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



DIAGRAMS

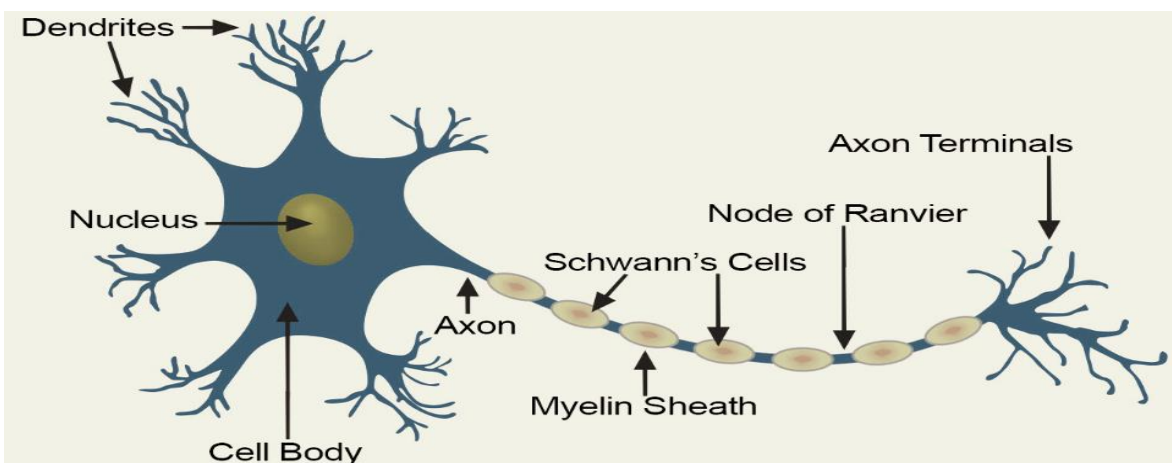


FIG 1. STRUCTURE OF NEURON

Neuromuscular Junction

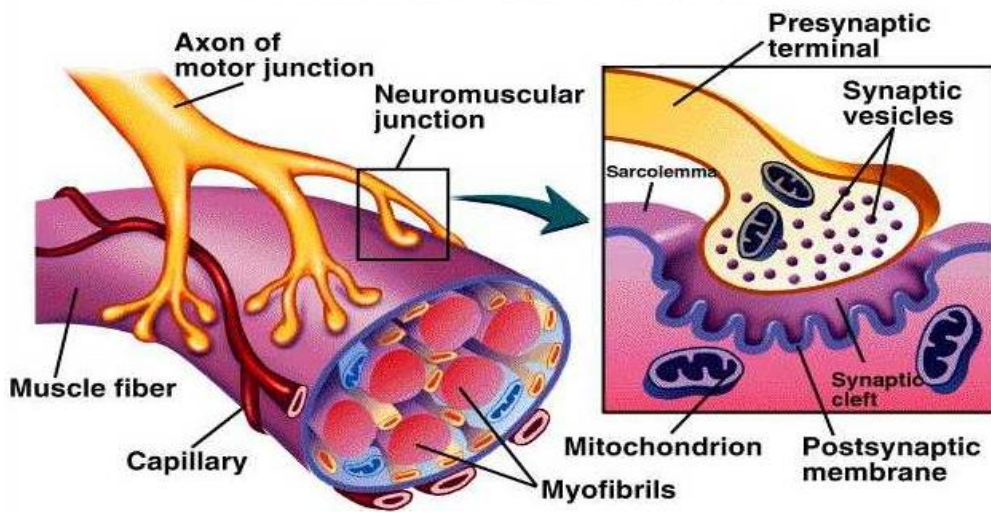


FIG.2 NEUROMUSCULAR JUNCTION

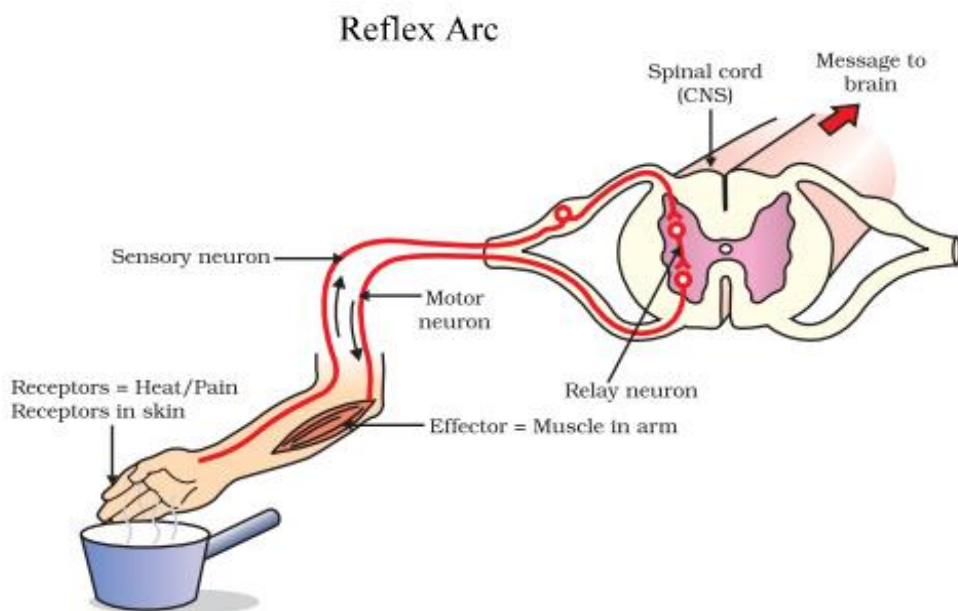


FIG 3 – REFLEX ARC

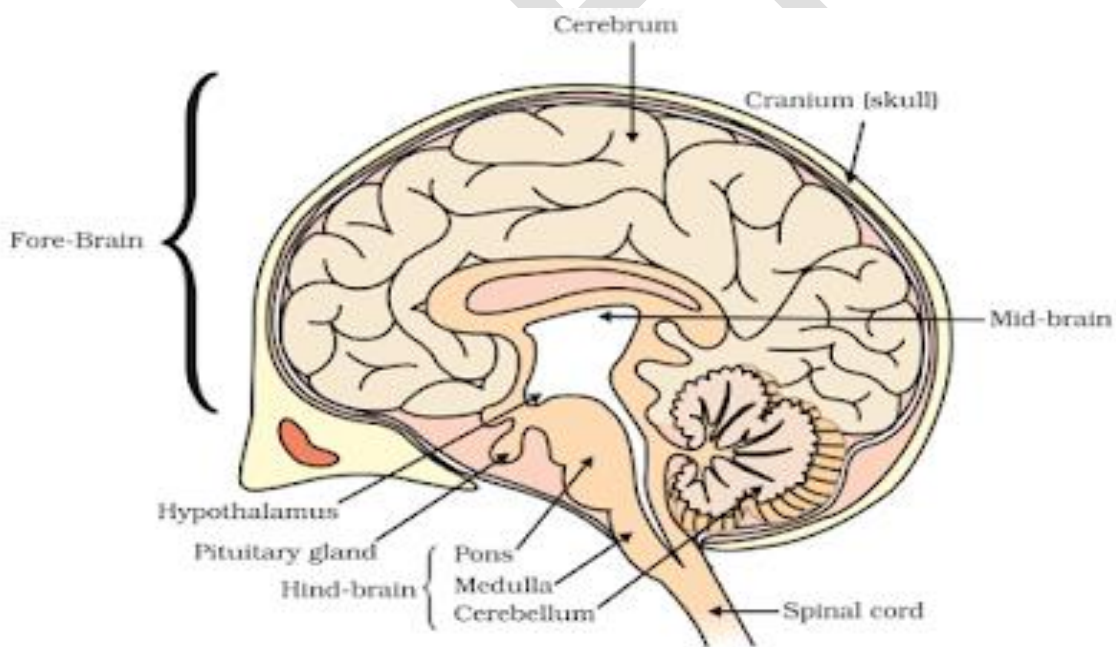


FIG 4 – STRUCTURE OF BRAIN

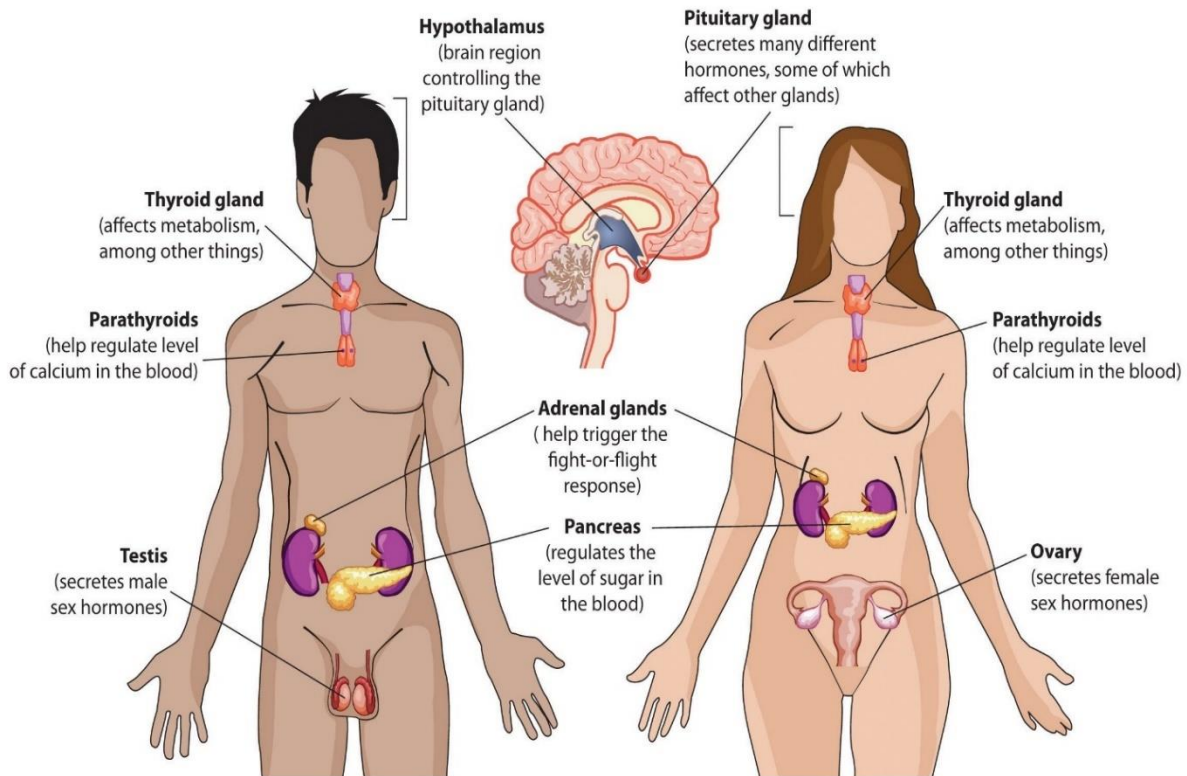


FIG 5 – ENDOCRINE GLANDS IN HUMAN BEINGS

QUESTION BANK

SECTION 1 – MCQ (1 MARK)

- In humans, the life processes are controlled and regulated by
 - Reproductive System and endocrine systems
 - Respiratory System and nervous systems
 - Endocrine System and digestive systems
 - Nervous System and endocrine systems
- Nerves throughout the body other than Brain and spinal cord form _____.
 - CNS
 - PNS
 - ANS
 - AAS
- The growth of pollen tubes towards ovules is due to _____.
 - hydrotropism
 - phototropism
 - chemotropism
 - geotropism
- Which of the following endocrine glands is unpaired?
 - Adrenal
 - Testes
 - Pituitary
 - Ovary
- Learning is related to
 - Hypothalamus
 - Thalamus
 - Cerebellum
 - Cerebrum
- In reflex action, the reflex arc is formed by
 - Muscles - receptor – brain
 - Muscles - effector – brain

- c. Receptor - spinal cord – muscles
d. Spinal cord - receptor – muscles
7. Which of the following statements are true about brain?
- The main thinking part of brain is hind brain
 - Centers of hearing, smell, memory, sight etc. are located in fore brain
 - Involuntary actions like salivation, vomiting, blood pressure are controlled by the medulla in the hind brain
 - Cerebellum does not control posture and balance of the body
- A. (i) and (ii)
B. (i), (ii) and (iii)
C. (ii) and (iii)
D. (iii) and (iv)
8. Damage of cerebellum will mostly affect the career of :
- architect
 - teacher
 - librarian
 - athlete
9. The nervous system is divided into the ____ and the ____; the former consists of ____ and the latter consists of ____.
- CNS, PNS, the brain and spinal cord; nerves around the body
 - CNS, PNS, the nerves around the body; the ventricles
 - ANS, PNS, the nerves around the body; the ventricles
 - ANS, CNS, the nerves around the body; the brain and spinal cord
10. The substance that triggers the fall of mature leaves and fruits from plants is due to
- Auxin
 - Gibberellins
 - Cytokinin
 - Absciscic acid
11. Which of the following statements is correct about receptors?
- Gustatory receptors detect taste while olfactory receptors detect smell
 - Both gustatory and olfactory receptors detect smell
 - Auditory receptors detect smell and olfactory receptors detect taste
 - Olfactory receptors detect taste and gustatory receptors smell
12. The plant hormone which is essential for cell division is
- Ethylene
 - Auxin
 - Gibberellin
 - Cytokinin
13. Electrical impulse travels in neuron from:
- Dendrite→axon→axon end→cell body
 - Cell body→Dendrite→axon→axon end
 - Dendrite→cell body→axon→axon end
 - Axon end→axon→cell body→Dendrite
14. The gap between two neurons is known as ____.
- synapse

- (B) synopsis
(C) impulse
(D) synaptic node
15. Artificial ripening of fruit is carried out by
(A) Auxins
(B) Ethylene
(C) Abscisic acid (ABA)
(D) Gibberellins
16. The substance that accelerates the growth in the stem is _____.
A. auxin
B. cytokinin
C. enzyme
D. vitamin
17. Chemical messengers secreted by ductless glands are called _____.
A) Lymph
B) Platelets
C) Plasma
D) Hormones
18. _____ are also known as ductless gland
A. Salivary gland
B. Endocrine gland
C. Exocrine gland
D. Both B & C
19. The endocrine gland also known master glands _____.
A. hypothalamus
B. pituitary
C. pancreas
D. adrenal
20. Growth hormone is produced in _____.
A. hypothalamus
B. pituitary
C. pancreas
D. thyroid
21. An example of a sex hormone is _____.
A. testosterone
B. Insulin
C. Thyroxin
D. thymosin
22. Cerebellum is situated in _____.
A. fore brain
B. mid brain
C. hind brain
D. partly in A and B each

23. Dwarfism results due to ____.
- Excess secretion of thyroxin
 - Less secretion of growth hormone
 - Less secretion of adrenaline
 - Excess secretion of growth hormone
24. A doctor advised a person to take an injection of insulin because—--.
- His blood pressure was low
 - His heart was beating slowly
 - He was suffering from goitre
 - His sugar level in blood was high
25. The gland that plays a role in fight or flight response is _____.
- pancreas
 - pituitary
 - adrenal
 - thyroid
26. Unconditioned reflex is controlled by the _____.
- Brain
 - spinal cord
 - both a and b
 - the autonomic nervous system
27. The box enclosing the brain is called the _____.
- Skull
 - Head
 - Cranium
 - vertebral column
28. In a synapse, chemical signal is transmitted from
- dendritic end of one neuron to axonal end of another neuron
 - axon to cell body of the same neuron
 - cell body to axonal end of the same neuron
 - axonal end of one neuron to dendritic end of another neuron
29. Spinal cord originates from
- cerebrum
 - medulla
 - pons
 - cerebellum
30. Iodine is necessary for the synthesis of which hormone?
- Adrenaline
 - Thyroxin
 - Auxin
 - Insulin

ANSWERS TO SECTION 1 - MCQ

1	2	3	4	5	6	7	8	9	10
D	B	C	C	D	C	C	D	A	D
11	12	13	14	15	16	17	18	19	20
A	D	C	A	B	A	D	B	B	B

21	22	23	24	25	26	27	28	29	30
A	C	B	D	C	B	C	D	B	B

SECTION 2 – AR TYPE QUESTIONS

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

- Both A and R are true and R is the correct explanation of A.
 - Both A and R are true but R is not the correct explanation of A.
 - A is true but R is false.
 - A is false but R is true.
- Assertion(A)** : Animals can react to stimuli in different ways.
Reason (R) : All animals have a nervous system and an endocrine system involving hormones.
 - Assertion(A)** : The brain is also known as the central nervous system.
Reason (R) : Central nervous system controls and regulates the voluntary actions.
 - Assertion(A)** : Phototropism is a directional growth movement.
Reason (R) : It occurs in the direction of light
 - Assertion(A)** : Plants lack a nervous system, but they do coordinate.
Reason (R) : It is so because of hormones
 - Assertion(A)**: impulse travels from dendrite to cell body and then along the axon to its end.
Reason (R) :information acquired at the end of the dendrite tip of a nerve cell sets of an electric impulse.
 - Assertion(A)**: A growing plant appears to bend towards the direction of light
Reason (R) : The plant hormone auxin diffuses towards the shady side of the root.
 - Assertion(A)**: A neuron transmit messages in both the direction.
Reason (R) : The response is slow and produced by all cells of target tissue.
 - Assertion(A)**: The effect of auxin hormone on the growth of root is exactly opposite to that on a stem.
Reason (R) : Auxin hormone increases the rate of growth in root and decreases the rate of growth in stem
 - Assertion(A)**: A receptor is a specialized group of cells in a sense organ that perceive a particular type of stimulus.
Reason (R) : Different sense organs have different receptors for detecting stimuli.
 - Assertion(A)** : The use of iodised salt prevents risk of goitre.
Reason (R) : Iodised salt provides iodine needed by thyroid gland to make sufficient thyroxin for our body.

ANSWERS TO SECTION 2 – AR TYPE

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

SECTION 3 – VERY SHORT QUESTIONS (2 MARKS)

- Name, the two main organs of our central nervous system. Which one of them plays a major role in sending command to muscles to act without involving thinking process? Name the phenomenon involved.
- Write the name and functions of any two parts of the human hind-brain.
- What is synapse ? In a neuron cell how is an electrical impulse created and what is the role of synapse in this context ?
- Which organ secretes a hormone when blood sugar rises in our body? Name the hormone and name one enzyme released by this organ.
- Why are some patients of diabetes treated by giving injections of insulin?
- How does a touch – me – not plant respond on touching? What is this movement called?
- Why is it advised to use iodised salt in our diet?
- (a) Which plant hormone is present in greater concentration in the areas of rapid cell division?

(b) Give one example of a plant growth promoter and a plant growth inhibitor.

9. (a) Distinguish between voluntary and involuntary actions of our body.

(b) Choose involuntary actions, amongst the following :

Reading, Beating of heart, Salivation in the mouth on viewing tasty food, Talking.

10. Explain the cause of shoots of the plant bending towards light ?

ANSWERS TO SECTION 3 – VERY SHORT QUESTIONS (2 MARKS)

1. The two main organs of CNS are brain and spinal cord.

Spinal cord plays a major role in sending command to muscles to act without involving thinking process. This phenomenon is called reflex action.

2. Two parts of human hind-brain with their functions are as follows:

(i) Cerebellum: Controls & coordinates muscular movements, maintaining body posture and equilibrium.

(ii) Medulla oblongata: which regulates the centre of swallowing, coughing, sneezing, salivation and vomiting.

3. A synapse is the gap between the two neurons.

Here the axon terminal of one neuron is in close proximity to the dendrite of the second neuron. When a nerve impulse reaches the knob like nerve ending of an axon, a tiny amount of a chemical substance is released in the synapse. At synapse the electrical signals converted into chemicals, that can easily cross over the gap and pass on to the next neurons where it again converted into electrical signals.

4. Pancreas secretes a hormone when blood sugar rises in our body. Insulin is the hormone released by this organ and the name of the enzyme is trypsin present in pancreatic juice.

5. Insulin is a hormone which is secreted by pancreas regulates the levels of sugar in the blood. In diabetic patients if it is not secreted in required amount the blood sugar level rises and causes various harmful effects. So, to prevent these effects some patients of diabetes are treated by giving injections of insulin.

6. Touch – me – not plant folds its leaflets on touching. This type of movement is called Growth independent movement (nastic movement)

7. Iodine stimulates the thyroid gland to produce thyroxin hormone. Deficiency of this hormone results in the enlargement of the thyroid gland. This can lead to goitre.

8. (a) Cytokinin is present in greater concentration in the areas of rapid cell division.

(b) An example of a plant growth promoter is gibberellins and example of a plant growth inhibitor is abscisic acid.

9.

Voluntary Actions	Involuntary Actions
1. The voluntary actions are under control of Cerebrum (Forebrain).	1. The involuntary actions are under control of Hind brain, Spinal cord
2 These actions are slow when compared to involuntary actions	2. These actions are rapid.

3. Activities. They are connected with the functioning of external organs.	3. They are connected with the functioning of internal organs.
4. Playing game, reading are examples of voluntary action.	4. Breathing is an example of the Involuntary action.

(b) Beating of heart, salivation in the mouth on viewing of tasty food.

10. Stems are positively phototropic and bend towards the direction of light. The movement is due to occurrence of more auxin on the darker side and lesser auxin on the illuminated side. As a result, there is more growth on the darker side which causes the stem to bend towards light.

SECTION 4 – SHORT QUESTIONS (3 MARKS)

1. (a) Draw the structure of neuron and label its part.

(b) Name the part of neuron:

(i) where information is acquired

(ii) through which information travels as an electrical impulse.

2. Write one example each of the following tropic movements :

(i) Positive phototropism (ii) Negative phototropism

(iii) Positive geotropism (iv) Negative geotropism

(v) Hydrotropism (vi) Chemotropism

3. What is chemotropism? Give one example. Name any two plant hormones and mention their functions.

4. What is 'hydrotropism'? Describe an experiment to demonstrate 'hydrotropism'.

5. List the components of reflex arc in correct sequence. State in brief the role of brain in reflex action.

ANSWERS TO SECTION 4 – SHORT QUESTIONS (3 MARKS)

1. a) Refer diagram given in the study material. (FIG.1)

b) i. Dendrites

ii. cell body and axon

2. (i) Positive phototropism: shoots growing towards light.

(ii) Negative phototropism: roots growing away from light towards ground.

(iii) Positive geotropism: growth of roots towards earth due to the pull of the earth.

(iv) Negative geotropism: shoots growing away from the earth.

(v) Hydrotropism: roots growing towards the source of water.

(vi) Chemotropism: growth of pollen tubes towards the ovules.

3. Chemotropism is the movement of a part of the plant in response to a chemical stimulus.

It can be positive chemotropism or negative chemotropism. Example: The growth of pollen tube towards a chemical which is produced by an ovule during the process of fertilisation in a flower.

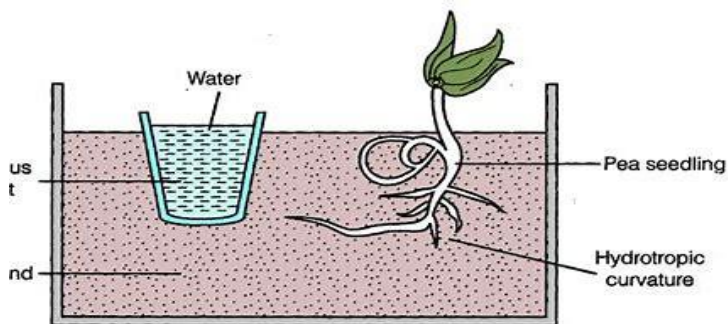
Two plant hormones with their functions are as follows:

Auxins promote growth, cell elongation, cell differentiation, root formation.

Gibberellins stimulate stem elongation, seed germination.

4. 'Hydrotropism' is the directional growth of a plant part in response to water. For example, roots show hydrotropism as they grow towards water in the soil and are positively hydrotropic.

An experiment to demonstrate hydrotropism is as follows:



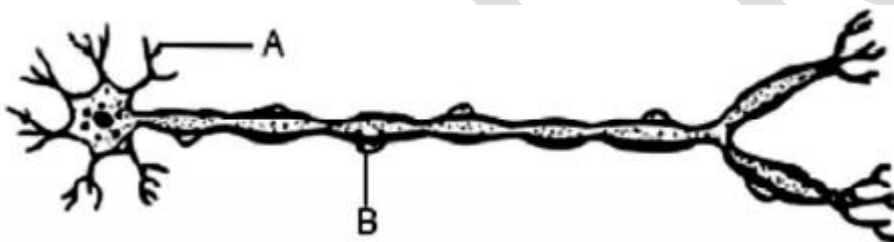
- A porous pot filled with water is taken and inserted in a tub filled with dry sand.
- A freshly germinated pea seedling is sown in the sand.
- As water is not available in sand, the root growing will bend towards the porous pot filled with water.
- A hydrotropic curvature of the root is observed as it grows towards water.
- This bending of root shows the movement in response towards water.

5. Refer reflex arc pathway given in study material FIG 3

The Reflex arc does not involve brain. It minimises the overloading of brain

SECTION 5 – LONG QUESTIONS (5 MARKS)

1.



- (i) Name the parts labelled A and B in the neuron drawn above.
- (ii) Which part acquires the information in the neuron?
- (iii) Through which part does the information travel?
- (iv) In what form does this information travel?
- (v) Where is the impulse converted into a chemical signal for onward transmission?

(b) How does nervous tissues cause action?

2. a) Name chemical messenger of endocrine glands responsible for changes taking place in the body

b) Mention the gland which produces adrenalin and write its function

c) Name two phytohormones

3. Mention one function for each of these hormones.

- i) Thyroxine
- ii) Insulin
- iii) Estrogen
- iv) Growth hormone
- v) Testosterone.

4. Smita's father was complaining about frequent urination, pain in legs and a frequent weight loss to Smita's mother and she discussed the things with her daughter when Smita returned from school. Listening to this Smita told her mother that her father should go and visit a doctor immediately. The doctor diagnosed that Smita's father was having an

elevated level of blood glucose. He should take care of his diet and should exercise regularly to maintain his normal glucose level.

On the basis of the text, answer the following questions:

- (i) Name the disease he is suffering from and name the hormone whose deficiency causes it.
- (ii) Identify the gland that secretes it and mention the function of this hormone.
- (iii) Explain how the time and amount of secretion of this hormone is regulated in human system.

ANSWERS TO SECTION 5 – LONG QUESTIONS (5 MARKS)

1. (a) (i) A – Dendrite, B – Axon

(ii) The information in the neuron is acquired at the end of the dendrite tip.

(iii) The information travels from the dendrite to the cell body and then along the axon to its end.

(iv) The information travels in the form of an impulse.

(v) The impulse is converted into a chemical signal at the end of the axon.

(b) Refer flow chart given in study material

2. a) Hormone

b) Adrenal gland

During the situation of fight or flight, secretion of this hormone causes -

- i. increases the blood pressure.
- ii. increases heart beat rate.
- iii. increases breathing rate.
- iv. diverts blood to essential organs including the heart, brain and skeletal muscles by dilating their blood vessels and constricting those of less essential organs, such as the skin and digestive system.

c) auxin & gibberrellin

3. (i) **Thyroxin** – Control overall metabolic rate of the body (carbohydrate, protein and fat metabolism)

(ii) **Insulin** – Conversion of glucose to glycogen in liver and muscles, thus decreases blood glucose level.

(iii) **Estrogen** – Development of female sex organ and secondary sexual characteristics like development of breast, pimples, shrill and a higher pitch voice

(iv) **Growth hormone** – Body growth and development of bones.

(v) **Testosterone** – Development of male sex organ and secondary sexual characteristics like moustache, beard & voice.

4. (i) Disease-Diabetes, Hormone: Insulin

(ii) Gland-Pancreas: The blood glucose level is regulated by insulin hormone secreted by the pancreas.

(iii) Feedback Mechanism - Cells of pancreas secrete insulin hormone when level of blood glucose level increases in the blood. Insulin regulates the blood glucose level and its secretion gets reduced when blood glucose level falls down.

SECTION 6 – CCT BASED QUESTIONS (4 MARKS)

A. A brain is displayed at the Allen Institute for Brain Science. The human brain is a 3-pound (1.4-kilogram) mass of jelly-like fats and tissues—yet it's the most complex of all known living structures. The human brain is more complex than any other known structure in the universe. Weighing in at three pounds, on average, this spongy mass of fat and protein is made up of two overarching types of cells—called glia and neurons—and it contains many billions of each. Neurons are notable for their branch-like projections called axons and dendrites, which gather and transmit electrochemical signals. Different types of glial cells provide physical protection to neurons and help keep them, and the brain, healthy. Together, this complex network of cells gives rise to every aspect of our shared humanity. We could not breathe, play, love, or remember without the brain.



1) Animals such as elephants, dolphins, and whales actually have larger brains, but humans have the most developed cerebrum. It's packed to capacity inside our skulls and is highly folded. Why our brain is highly folded?

2) Which among this is not a function of cerebrum?

- a) speech
- b) Learning
- c) Posture
- d) Emotion

3) Which among these protects our brain?

- a) Neurotransmitter
- b) Cerebrospinal fluid
- c) Meninges
- d) Grey matter

i) a, b & c

ii) b & c

iii) c & d

iv) b, c & d

4. Ram was studying in his room. Suddenly he smells something burning and sees smoke in the room. He rushes out of the room immediately. Was Ram's action voluntary or involuntary? Why?

Answer

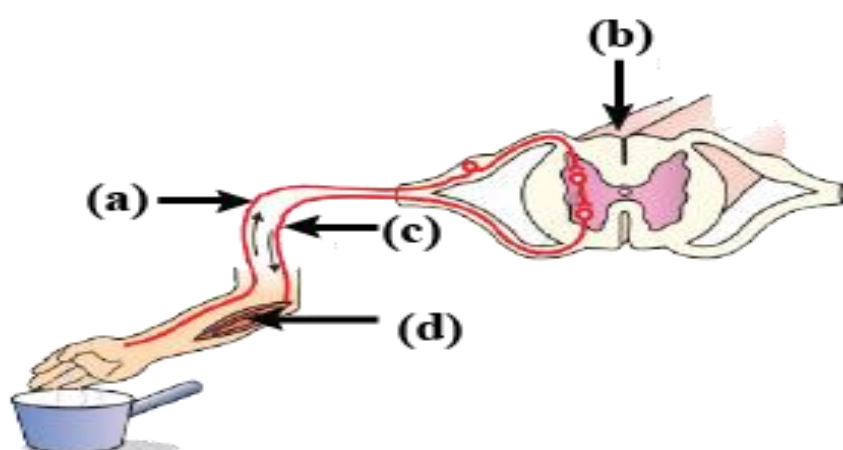
1. To increase the surface area of the brain to receive sensory impulses from various receptors, interpret the sensory information with the information that is stored in the brain and respond accordingly

2. option C

3. option ii

4. Ram's action was voluntary because rushing out of the room was under conscious control. The smoke and smell were perceived by the receptor and sensor and signals are sent to the brain. The brain then sent the signals to effector organs.

B. Study the diagram of reflex arc and answer the following questions



1. Reflex action is controlled by

- a) CNS
- b) PNS
- c) ANS
- d) None of these

2. Which is the correct sequence of the components of a reflex arc?

- a) Receptors → muscles → sensory neuron → motor neuron → spinal cord
- b) Receptors → motor neuron → spinal cord → sensory neuron → muscles
- c) Receptors → spinal cord → sensory neuron → motor neuron → muscles
- d) Receptors → sensory neuron → spinal cord → motor neuron → muscles

3. While studying Rahul slapped his right arm with left hand unknowingly and found a mosquito was dead with tint of blood. The slapping action of Rahul is due to:

- a) Involuntary action
- b) Voluntary action
- c) Reflex action
- d) Automatic action

4. Which of the following is not a function of sensory organ?

- a) Detect all changes in the environment
- b) Send appropriate signal to CNS
- c) Analysis of signal
- d) Receives signal

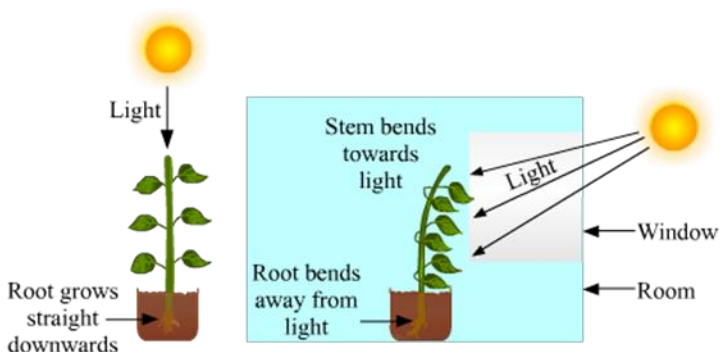
Answer

- 1. option a
- 2. option d
- 3. option c
- 4. option c

C. While playing with her little brother in the garden, Pooja observed a very strange behavior of plants. She saw that the leaves of a creeper are getting closed with the touch. She is amused by this and tried to find out the reason behind this. Next day at the school she asked her science teacher that do plants have nervous system like us? Can they respond to the stimuli? Her teacher explained that:

In the case of plants, they are completely devoid of the nervous system and other special organs. However, plants learn to respond to different stimuli by certain movements. This response may be rapid movements like nastic movement or slow process like tropism.

Pooja's teacher has given few questions to solve. Let's help her to solve the questions.



Observe the diagram and answer the questions following it.

1. In the figure we can see that the plant's growth is affected by a specific stimulus. Both stem and leaves are affected by the stimulus. Below given are possible reasons of it.

- A. Accumulation of auxin in parts of the stem that is away from light
- B. Leaves are rearranged to capture more sunlight
- C. Light doesn't play any role in plant growth

Choose the correct reason;

- a. Option A
- b. Option B
- c. Option C
- d. both option A and B

2. In the figure. We can observe few changes in the root growth. Which situation is explaining the growth perfectly?

- a. The root is showing positive geotropism.
- b. The root is showing positive phototropism.
- c. The root growth is independent of any external stimuli
- d. None of these

3. Unlike us plants do not have any sense organs. They have few chemicals which produce responses. Those chemicals are called as

- a) Pheromones
- b) Phytohormones
- c) Neurons
- d) Nephrons

4. Name the hormone which inhibit growth

- a) auxin
- b) gibberellin
- c) abscisic acid
- d) cytokinin

answer

- 1. Option d. both a and b
- 2. Option a. The root is showing positive geotropism.
- 3. Option b. Phyto Hormones
- 4. Option c. abscisic acid

Chapter 8:

HOW DO ORGANISMS REPRODUCE?

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

Reproduction may be sexual or asexual. Sexual reproduction gives rise to new genetic combinations by fusion of gametes and leads to variation and promotes evolution. **Variations** are useful for the survival of the individual and species over time as well as basis for evolution.

Types of Reproduction

A. Asexual Reproduction

- (a) It involves only one parent.
- (b) There is no formation and fusion of gametes.

- (c) The young ones formed are almost identical to each other as well as to the parent cell.
- (d) Asexual reproduction generally occurs during favourable environmental conditions and when there is an abundance of food.
- (e) It is a faster method of reproduction.

B. Sexual Reproduction

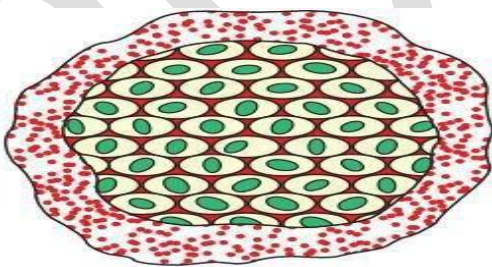
- Two individuals i.e., one male and one female are needed to give rise to new individual.
- Gametic fusion takes place
- Since gametes are derived from two different organisms, it results in a new combination of genes which increases the chances of genetic variations.
 - Sexual reproduction results in the origin of new species.
 - Adopted by higher organisms.
 - Asexual
 - Reproduction
 - Fission

BINARY FISSION IN AMOEBIA

- (i) **Reproduction in amoeba:** When the amoeba cell reaches its maximum size, then first the nucleus of amoeba lengthen and divide into two parts following the division of cytoplasm of parent to form two smaller daughter cells.

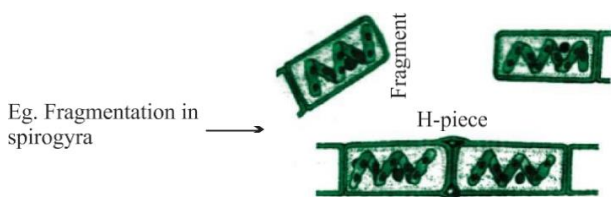


Multiple fission: When fission results in many daughter cells, it is called multiple. For example - Plasmodium.



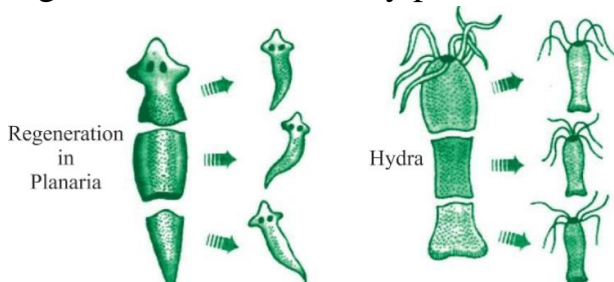
Multiple fission in Plasmodium

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



Fragmentation in Spirogyra

- (iii) **Regeneration:** In this, a few organisms may give rise to new individual organisms from their body parts. For example - Hydra and Planaria..



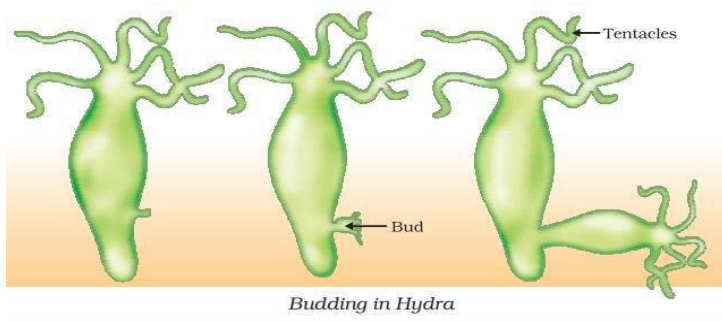
Regeneration in Planaria and Hydra

BUDDING

Budding: In some organisms, a bud is formed which develops into tiny individual.

It detaches from parent body upon maturation and develops into a new individual.

For example: Hydra



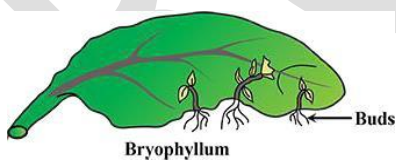
VEGETATIVE PROPAGATION

Vegetative Propagation: Method by which plants reproduce by their vegetative parts such as roots, stems, and leaves.

Types of Vegetative Propagation: It is two types

- Natural vegetative propagation.
- Artificial vegetative propagation (Tissue culture).

Mint reproduces naturally by roots. Sugarcane, jasmine by stems and Bryophyllum by leaves. In bryophyllum buds are produced in the notches along the leaf margins and when they fall on the soil, they develop into new plants.



Importance of Vegetative Propagation

- Plants are genetically almost similar to the parent plant..
- Plants which have lost the ability to produce viable seeds can also reproduce by vegetative propagation.
- All plants can bear flowers and fruits earlier
- Seedless varieties of plants can be obtained.
- The property of vegetative propagation is used by horticulturists in developing methods like layering, grafting to grow many plants like sugarcane, roses, or grapes.

Spore Formation:

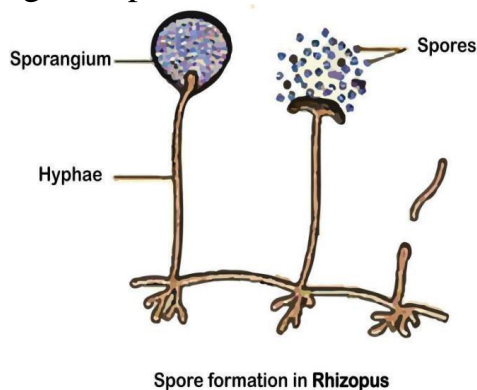
Spores are reproductive cells, capable of developing into an individual without fusion with another reproductive cell. Spores are agents of asexual reproduction, whereas gametes are agents of sexual reproduction. Spores are produced by bacteria, fungi, algae and Plants.

Rhizopus (Bread mould) grows as filamentous, branched

structure. The filamentous structure that grows above it is called *Hyphae*, which are not the reproductive parts. Hyphae give rise to a Globular structure called *Sporangia*, which contains spores. The

spores are covered by thick wall (cyst) that protect them from any adverse conditions.

Spores are lighter so they get dispersed easily. It will provide better chances for them to survive and grow up.



MULTIPLE CHOICE QUESTIONS

1) Reproduction is essential for living organisms in order to

- a) Keep the individual organism alive
- b) Fulfill their energy requirement
- c) Maintain growth
- d) Continue the species generation after generation

Types of Asexual Reproduction

- 2) Variations occur as a result of
 - Fission**
 - Budding**
 - Regeneration**
 - Spore formation**
 - Fragmentation**
 - Vegetative Propagation**
- 3) The number of chromosomes in parents and offspring of a particular species remains constant due to

- a. Doubling of chromosomes after zygote formation
- b. Halved chromosomes during gamete formation
- c. Doubling of chromosomes after gamete formation
- d. Halving of chromosomes after gamete formation

4) How do spores develop into Rhizopus?

- a. spores divide and grow into new individual
- b. spores combine with other spores and grow
- c. spores enlarge in size for the growth of new individual
- d. spores land on other organisms and increase with their growth in size

5) Cloning is a mode of :

- a) Sexual reproduction
- b) Asexual reproduction
- c) Both a and b
- d) none

6) Vegetative propagation refers to formation of new plants from _____.

- a) stem, roots, flowers

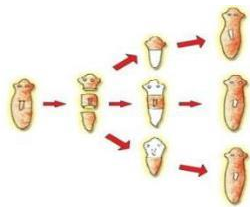
- b) stem,roots,leaves
 c) stem,flowers,fruit
 d) stem,leaves,flowers
- 7) The ability of a cell to divide into several cells during reproduction in Plasmodium is called
- a) budding
 b) reduction division
 c) binary fission
 d) multiple fission
- 8) A feature of reproduction that is common to Amoeba, leishmania and Spirogyra is that
- a) they reproduce asexually
 b) they are all unicellular
 c) they reproduce only sexually
 d) they are all multicellular
- 9) Identify the organism that can divide in only one plane
- a) Plasmodium
 b) Leishmania
 c) Amoeba
 d) Spirogyra
- 10) Bryophyllum can be propagated vegetatively by the
- (a) stem
 (b) leaf
 (c) root
 (d) flower
- 11) When an animal is cut into pieces and each piece grows into a complex organism. What is the process?
- a) Budding
 b) Fragmentation
 c) Spore formation
 d) Regeneration
- 12) Hydra usually reproduces by:
- a) fragmentation and budding
 b) regeneration and budding
 c) multiple fission and fragmentation
 d) Regeneration
- 13) In the list of organisms given below, those that reproduce by the asexual method are
- I. banana
 II. cat
 III. spirogyra
 IV. Amoeba
- a) (ii) and (iv)
 b) (i), (iii) and (iv)
 c) (i) and (iv)
 d) (ii), (iii) and (iv)
- 14) Offspring formed by asexual method of reproduction have greater similarity among themselves because
- (i) asexual reproduction involves only one parent

- (ii) asexual reproduction does not involve gametes
- (iii) asexual reproduction occurs before sexual reproduction
- (iv) asexual reproduction occurs after sexual reproduction

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

- 15)** In Spirogyra, asexual reproduction takes place by
- (a) breaking up of filaments into smaller bits
 - (b) division of a cell into two cells
 - (c) division of a cell into many cells
 - (d) formation of young cells from older cells.

- 16)** Identify the type of reproduction shown in picture



- a) Regeneration
 - b) Fission
 - c) Spore formation
 - d) Vegetative propagation
- 17)** Which among the following does not reproduce by spore formation:
- a) Penicillium fungus
 - b) Yeast fungus
 - c) Mucor fungus
 - d) Rhizopus fungus
- 18)** In a potato, vegetative propagation takes place by:
- a) Root
 - b) Leaf
 - c) Stem tuber
 - d) grafting

Answer key

1) d, 2) C, 3) b, 4) a 5) b, 6) b 7) d, 8) a, 9) b, 10) b, 11) d, 12) b
 13) b 14) a, 15) a, 16) a, 17) b, 18) C,

ASSERTION AND REASON

- (a) Both A and R are true and R is the correct explanation of A.
- (b) Both A and R are true but R is not the correct explanation of A.
- (c) A is true but R is false.
- (d) A is false but R is true.

- 19)** Assertion : clones of an organism are formed by asexual reproduction
 Reason: Clones have exact copies of genes as parental organism.

20) Assertion : Asexual reproduction is a type of reproduction in primitive organisms

Reason : Asexual reproduction is a simple process involving only one parent.

21) Assertion : Variations are prominent in sexual reproduction

Reason : in sexual reproduction the offsprings are exactly similar to parents.

22) Assertion: Regeneration is a process of reproduction in certain organisms

Reason: Spirogyra reproduces by regeneration

Answer key

19) b 20) a 21) c 22) c

DESCRIPTIVE QUESTIONS:

23) What is the importance of variation in the survival of individuals?

24) List the advantages of vegetative propagation

25) What are the limitations of the asexual mode of reproduction?

Differentiate between asexual reproduction and sexual reproduction.

26) Explain various steps of budding in yeast.

27) Newly formed DNA copies may not be identical at times. Give one reason.

28) Define reproduction. How does it help in providing stability to the population of species?

29) Name the method by which Spirogyra reproduces under favourable conditions. Is this method sexual or asexual?

30) How does Plasmodium reproduce. Is this method sexual or asexual?

31) Name the part of Bryophyllum where the buds are produced for vegetative propagation.

32) Name the causative agent of the disease “kala-azar” and its mode of asexual reproduction

33) How do Plasmodium and Leishmania reproduce? Write one difference in their mode of reproduction.

34) Name an organism which reproduces by spore formation. List three conditions favourable for spores to germinate and grow

35) Name the mode of reproduction of the following organisms and state the important feature of each mode :

I. Planaria

II. Hydra

III. Rhizopus

a) We can develop new plants from the leaves of Bryophyllum. Comment.

b) List two advantages of vegetative propagation over other modes of reproduction. (2020)

ANSWER KEY

23) Variations help in survival of the organism by many different ways-

(i) It helps a species to survive

(ii) It also helps organisms to adapt to their environment as well as to changes which do occur in the environment.

(iii) It also helps a species to emerge strongly favoured by natural selection.

(iv) Variation helps a species to be resistant to diseases.

24) The advantages of vegetative propagation are as follows

• It helps in the easy propagation of non-flowering plants.

- It helps in producing hybrids of various plants, with improved qualities.
- It helps in the propagation of a large number of populations in a very short duration.
- It helps in the propagation of plants that do not produce seeds or produce them in very small quantities.

25) In asexual reproduction very little variation occurs within a generation. Asexual reproduction has a lesser significance for evolution of species. Asexual reproduction involves only a single individual. It does not require two sexes.

Sexual reproduction involves two different individuals, male and female sexes.

The offspring is produced due to fission of male and female gametes.

26) Budding is a form of asexual reproduction usually observed in yeast.

- During this process, a small protrusion appears on the upper portion of the body of the organism. This bulge is called a bud.
- The bud gradually grows in size and forms an individual cell.
- From this newly budded cell, another bud appears at the tip.
- This process continues and many chains of buds are formed

27) When a cell reproduces, DNA replication occurs which results in formation of two similar copies of DNA. The process of copying the DNA leads to some variations each time. As a result, the DNA copies produced are similar to each other but sometimes may not be identical.

28) The production of new organisms by the existing organisms of the same species is known as reproduction. It is linked to the stability of population of a species. DNA replication during reproduction ensures transfer of specific characters or body design features that is essential for an individual of a population to live and use that particular niche. Some variations present in a few individuals of population caused due to reproduction which also helps in their survival at changing niches.

29) The method by which Spirogyra reproduces under favorable conditions is fragmentation. This is an asexual mode of reproduction.

30) Plasmodium reproduces through multiple fission method. In this method, the parent organism splits to form many new organisms at the same time. This is an asexual method of reproduction.

31) Bryophyllum propagates vegetatively by the buds produced at the margins of leaves.

32) Causative agent of the disease Kala-azar is Leishmania. It reproduces asexually by binary fission.

33) Plasmodium and Leishmania reproduce by the process of fission which is an asexual mode of reproduction. Plasmodium reproduces by multiple fission. About 1000 daughter cells are produced by the multiple fission of a Plasmodium. Leishmania reproduces by the process of binary fission. In Leishmania, the splitting of parent cell takes place in a definite plane (longitudinally) with respect to flagellum at its end to produce two daughter cells.

34) Rhizopus reproduce by the method of spore formation.

The three conditions favourable for spores to germinate and grow are moisture, suitable temperature and food (nutrition).

35) (i) Planaria – Regeneration

Regeneration of organism from its cut body parts occurs by the process of growth and development.

Regeneration is an asexual mode of reproduction common in lower plants and animals.

(ii) Hydra – Budding

In budding, a small part of the body of the parent organism grows out as a bud which on detaching forms a new organism.

Budding occurs in yeast, some protozoans and certain lower animals.

(iii) Rhizopus – Spores

Spores are usually produced in sporangia.

Spore formation is a common method of an asexual reproduction in bacteria and most of the fungi.

a) The leaves of a Bryophyllum have special type of buds in their margins. These buds may get detached from the leaves, fall to ground and then grow to produce new Bryophyllum plants. The buds can also drop to the ground together with the leaf and then grow to produce new plants.

b) Advantages of vegetative propagation are

: It is a quick method of propagation.

The new plants produced by artificial vegetative propagation are exactly like the parent plants.

CASE STUDY BASED QUESTION

I. Read the following and answer the questions:

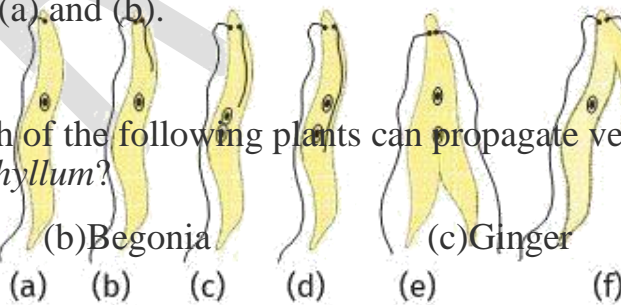
Preeti is very fond of gardening. She has different flowering plants in her garden. One day a few naughty children entered her garden and plucked many leaves of *Bryophyllum* plant and threw them here and there in the garden. After few days, Preeti observed that new *Bryophyllum* plants were coming out from the leaves which fell on the ground.

36) What does the incident cited in the paragraph indicate?

- (a). *Bryophyllum* leaves have special buds that germinate to give rise to new plant.
- (b). *Bryophyllum* can propagate vegetatively through leaves.
- (c). *Bryophyllum* is a flowering plant that reproduces only asexually
- (d). Both (a) and (b).

37) Which of the following plants can propagate vegetatively through leaves like *Bryophyllum*?

- (a) Guava
- (b) Begonia
- (c) Ginger
- (d) Mint



38) Do you think any other vegetative part of *Bryophyllum* can help in propagation? If yes, then which part?

- (a) Roots
- (b) Stems
- (c) Flowers
- (d) Fruits

39) Which of the following plant is artificially propagated (vegetatively) by stem cuttings in horticultural practices?

- (a). Potato
- (b) Snakeplant
- (c) Rose
- (d) Water hyacinth

II. Observe the diagram and answer the questions

- 40) Identify the organism in the picture
- 41) Compare the division of this organism with amoeba and write a statement
- 42) Name the disease caused by this organism
- 43) Is it sexual or asexual mode? Justify

ROEKM

Answer key

36) d

37) b

38) b

39) c

40) Leishmania

41) amoeba and leishmania undergo binary fission, amoeba can divide in any plane leishmania can divide in only one plane.

42) Kala azar

43) it is asexual mode as only one organism is involved and there is no fusion of gametes.

SEXUAL REPRODUCTION IN PLANTS

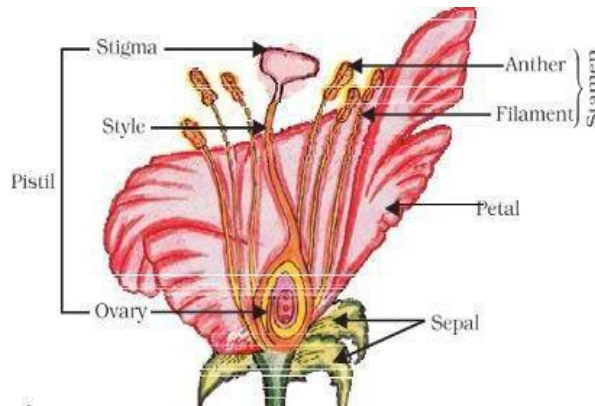
Sexual reproduction in plants happens through flowers.

Unisexual Flowers	Bisexual Flowers
Flowers which have only one sex organ (either stamen or carpel) are known as unisexual flowers.	Flowers which have both sex organs (stamen & carpel) are known as bisexual flowers.
Only Cross pollination takes place in unisexual flowers.	Either cross pollination or self pollination can be possible in bisexual flowers.
e.g. flowers of papaya, watermelon	e.g. flowers of hibiscus, mustard plants

Male reproductive structure is called a stamen and consists of anther and filament. Anther produces haploid pollen grains.

Female reproductive structure is called pistil and consists of stigma, style and ovary.

LONGITUDINAL SECTION OF A FLOWER



Pollination: The process of transfer of pollen grains from an anther to the stigma of the flower is pollination. Two types of pollination are:

- (i) **Self-pollination:** The transfer of pollen grains from the anther to the stigma of the same flower or another flower of the same plant.
- (ii) **Cross-pollination:** The transfer of pollen grains from the anther to the stigma of the flower of a different plant of the same species. It generally takes place with the help of some agents like insects, birds, wind and water.

Fertilization

Fusion of male and female gametes is known as fertilization.

The male germ-cell produced by pollen grain fuses with the female gamete present in the ovule. This fusion of the germ-cells or fertilisation gives the zygote which is capable of growing into a new plant.

After fertilization, ovary becomes fruit and ovules turn into seeds. All other parts wither away.

Post-fertilization changes: After fertilization the following changes take place in the flower. Zygote divides several times and forms an embryo inside the ovule.

The ovule develops a tough coat and changes into the seed. The ovary grows rapidly and ripens to form a fruit.

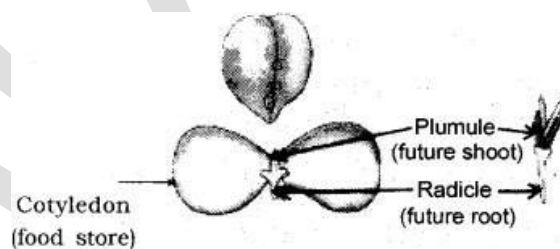
Petals, sepals, stamens, style and stigma shrivel and fall off.

Seed and its parts: The advantage of seed is that it protects the future plant i.e.embryo.

Seed has two parts: Cotyledons and Embryo. Cotyledons store food for the future plant.

Embryo has two parts: plumule and radicle. Plumule develops into shoot and radicle develops into root.

The process of development of a seedling from the embryo under appropriate conditions is known as germination.



SEXUAL REPRODUCTION IN HUMAN BEING

Reproduction in Human Beings

Humans use sexual mode of reproduction

Common in male and female

→ Thick hair growth in armpits and genital area. Skin becomes oily, may result in pimples.

In girls

→ *Breast size begins to increase.

*Girls begin to menstruate.

In boys

*Thick hair growth on face. Voice begins to crack.

* These changes indicate sexual maturity is taking place.

Male Reproductive System

(i) Testes

A pair of testes is located inside scrotum which is present outside the abdominal cavity. Scrotum

has a relatively lower temperature needed for the production of sperms.

Testes release male sex hormone (testosterone).

Function of testes:

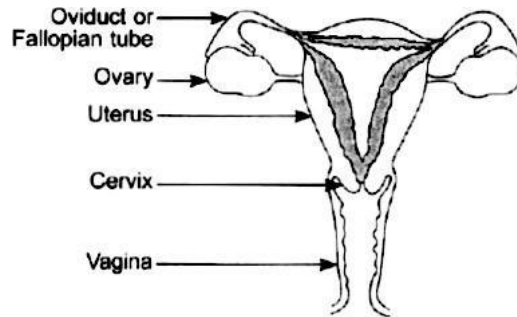
(i) Regulate production of sperms and bring changes at puberty.

(ii) Vas deferens passes sperms from testes up to urethra.

(iii) Urethra

It is a common passage for both sperms and urine. Its outer covering is called penis

FEMALE REPRODUCTIVE SYSTEM



Ovaries: Ovaries produce Ovum. When a girl is born, the ovaries already contain thousands of immature eggs. On reaching puberty, some of these start maturing. One egg is produced every month by one of the ovaries.

Oviduct / Fallopian Tube: The egg is carried from the ovary to the womb (uterus) through a thin oviduct or fallopian tube. It is the site for fertilization.

Uterus: The two oviducts unite into an elastic bag-like structure known as the uterus. The uterus opens into the vagina through the cervix.

The sperms enter through the vaginal passage during sexual intercourse. They travel upwards and reach the oviduct /Fallopian tube where One sperm fuses with the egg.

Implantation: The fertilized egg, the zygote, gets attached to the lining of the uterus, and starts dividing.

Gestation: The period from fertilization to the parturition.

The development of the child inside the mother's body takes approximately nine

months.

Placenta:

The embryo gets nutrition from the mother's blood with the help of a special tissue called placenta.

This is a disc which is embedded in the uterine wall. It contains villi on the embryo's side of the tissue.

On the mother's side are blood spaces, which surround the villi. This provides a large surface area.

1. Transport glucose (nutrients) from them to the embryo.
2. Transport oxygen from the mother's body to the embryo.
3. The developing embryo generate waste substances which are removed by transferring them in to the mother's blood through the placenta.

Parturition: The child is born as a result of rhythmic contractions of the muscles in the uterus.

Menstruation/Menstrual cycle:

If the egg is not fertilized, it lives for about one day.

Since the ovary releases one egg every month, the uterus also prepares itself every month to receive a fertilized egg.

Thus its lining becomes thick and spongy. This would be required for nourishing the embryo if fertilization had taken place.

The lining of the uterus slowly breaks and comes out through the vagina as blood and mucous.

This cycle takes place roughly every month and is known as menstruation. It usually lasts for about two to eight days.

Menarche and menopause:

Menstruation starts in human females at the puberty. The starting of menstruation is called Menarche. Menstruation continues in human females till the age of 45-50. At this age menstruation comes to an end. Stoppage of menstruation is called Menopause.

Reproductive health:

The process of sexual maturation is gradual and takes place along with general body growth. Some degree of sexual maturation does not necessarily mean that the body or the mind is ready for sexual acts or for having and bringing up children.

STDs/STIs/VDs: Diseases transmitted through sexual contact are called Sexually Transmitted Diseases or Sexually Transmitted Infections or Venereal diseases.

Eg: Gonorrhoea and Syphilis (caused by bacteria)
HIV-AIDS. Caused by virus.

Preventing the transmission of such diseases during the sexual

Act Using a covering, called a condom for the penis during sex helps to prevent transmission of many of these infections to some extent.

Contraceptive methods/Birth control methods:

The sexual act always has the potential to lead to pregnancy. Pregnancy will make major demands on the body and the mind of the woman and if she is not ready for it, her health will be adversely affected. Therefore, many ways have been devised to avoid pregnancy.

1. Barrier method/mechanical methods: The creation of a mechanical barrier so that sperm does not reach the egg. Condoms on the penis or similar coverings worn in the vagina can serve this purpose.

2. Chemical method/Hormonal method/Oral Contraceptives: Contraceptives act by changing the hormonal balance of the body so that eggs are not released and fertilisation cannot occur. These drugs commonly need to be taken orally as pills. Oral pills change hormonal balances, they can cause side-effects.

3. IUCDs: Intra-uterine Contraceptive Devices:

Loop or the copper-T are placed in the uterus to prevent pregnancy. They can cause side effects due to irritation of the uterus.

Surgical methods: Surgical methods can be used to create such blocks.

Vasectomy: If the vas deferens in the male is blocked, sperm transfer will be prevented.

Tubectomy: If the fallopian tube in the female is blocked, the egg will not be able to reach the uterus.

In both cases fertilisation will not take place.

While surgical methods are safe in the long run, surgery itself can cause infections and other problems if not performed properly.

4. Abortion: Removal of unwanted pregnancies (Medically guided)/Medical Termination of Pregnancy (MTP)

Pre-natal Sex Determination

Pre-natal sex determination has been prohibited by law. This is due to the misuse of scanning.

Questions-MCQ

1. In a flower, the parts that produce male and female gametes are

- (a) stamen and anther (b) filament and style
- (c) anther and ovary (d) stamen and style

2. Which among the following statements are true for unisexual flowers?

- (i) They possess both stamen and pistil
- (ii) They possess either stamen or pistil
- (iii) They exhibit cross pollination
- (iv) Unisexual flowers possessing only stamens cannot produce fruits

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

3. Which among the following statements are true for sexual reproduction in flowering plants?

- (i) It requires two types of gametes
- (ii) Fertilisation is a compulsory event
- (iii) It always results in formation of zygote
- (iv) Offspring formed are clones

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

4. The transfer of pollen from the anther to stigma is called.....

- (a) Fusion (b) fertilization
- (c) Pollination (d) Vegetative propagation

5. Fruits are formed from

- a. Stamen b. Stigma c. Ovary d. Ovule

6. Which of the following is the correct sequence of events of sexual reproduction in a flower?

- (a) pollination, fertilisation, seedling, embryo

(b) seedling, embryo, fertilisation, pollination

(c) pollination, fertilisation, embryo, seedling

(d) embryo, seedling, pollination, fertilisation

7. Length of pollen tube depends on the distance between

(a) Pollen grain and upper surface of stigma

(b) Pollen grain on upper surface of stigma and ovule

(c) Pollen grain in anther and upper surface of stigma

(d) Upper surface of stigma and lower part of style

8. (i) Female germ cell is large and contains the food-stores

(ii) Male germ cell is smaller and likely to be motile

(a) (i) is true and (ii) is false

(b) (i) is false and (ii) is true

(c) Both (i) and (ii) are true

(d) Both (i) and (ii) are false

9. Offspring formed as a result of sexual reproduction exhibit more variations because

(a) sexual reproduction is a lengthy process

(b) genetic materials comes from two parents of same species

(c) genetic materials comes from two parents of different species (d) genetic material comes from many parents

10. Which among the following are true?

(i) Radicle develops into root

(ii) Radicle develops into shoot

(iii) Plumule develops into root

(iv) Plumule develops into shoot

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

11. Which among the following is not the function of testes at puberty?

(i) formation of germ cells (ii) secretion of testosterone

(iii) development of placenta (iv) secretion of estrogen

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

12. The correct sequence of organs in the male reproductive system for transport of sperm is

(a) testis vas deferens urethra (b)) testis ureter urethra

(c) testis urethra ureter (d) testis vas deferens ureter

13. Which of the following methods of contraception protects from acquiring sexually transmitted diseases?

- (a) Surgery (b) Condoms (c) CopperT (d) Oral pills

14. The embryo in humans get nourishment from mother's blood with the help of special tissue called

- (a) Placenta (b) Villi (c) Uterus (d) Womb

15. The fertilization of human egg by sperm takes place in

- (a) Vagina (b) Uterus (c) Oviduct (d) Ovary

16. The process of release of eggs from the ovary is called

(a)Menstruation (b)Reproduction (c)Ovulation(d)Insemination

17. Which among the following diseases is not sexually transmitted?

(a)Syphilis (b) Hepatitis (c) HIV-AIDS (d)Gonorrhoea

18. In case the ova does not get fertilised which of the following events will take place?

(a) Menstruation (b) Pregnancy (c) Implantation (d) Ovulation

19 Sperms are produced in

(a) Seminal vesicle (b)Prostrate gland (c) Scrotum (d) none of these

20. Placenta helps in transfer of which of the following?

(a) oxygen (b) glucose (c) waste substances (d) all of these

21. Which of the following is not a part of human female reproductive system.

(a) vas deferens (b) fallopian tube (c) ovary (d) uterus.

22. Which of the following sexually transmitted diseases are caused by virus

(i) Syphilis (ii) Warts (iii) AIDS (iv) Gonorrhoea

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

MCQ Answers

1. c 2. b 3. d 4. c 5. c 6. c 8. c 9. b 10. c 11. c 12. a

13. b 14. a 15. c 16. c 17. b 18. a 19. d 20. d 21. a 22. b

DESCRIPTIVE TYPE QUESTIONS

1. Define the terms unisexual and bisexual giving one example of each.

2. Write the difference between male and female germ cell.

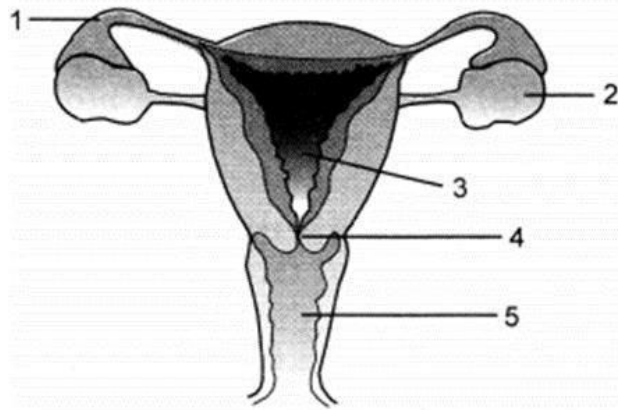
3. In a bisexual flower in spite of the young stamens removed artificially, the flower produces fruit. Provide a suitable explanation for the above situation.
4. Where is the zygote located in the flower after fertilization?
5. In tobacco plant, the male gametes have twenty-four chromosomes (a) What is the number of chromosomes in the female gamete? (b) What is the number of chromosomes in the zygote?
6. Write the importance of sexual reproduction in nature.
7. (a) Draw a diagram showing germination of pollen on the stigma of a flower.
- (b) Label pollen grain, male germ-cells, pollen tube and female germ-cell in the above diagram.
- (c) How is a zygote formed?
8. List any three differences between pollination and fertilisation.
9. Draw a longitudinal section of a flower and label the following parts:
- (i) Part that produces pollen grain.
- (ii) Part that transfers male gametes to the female gametes.
- (iii) Part that is sticky to trap the pollen grain.
- (iv) Part that develops into a fruit.
10. Name the female reproductive part of a flower. Which part of a flower develops into a seed and a fruit? Where are the male germ cell and female gamete present in the flower?
11. Name the male and female gametes in animals. What is fertilization and where does it take place in human female?
12. Surgical methods can be used to create a block in the reproductive system for contraceptive purposes. Name such parts where blocks are created in
- (a) Males and Females.

(b) State any two reasons for using contraceptive devices.

13. What are chromosomes? Explain how in sexually reproducing organisms the number of chromosomes in the progeny is maintained?

14. What is placenta? State its two roles during pregnancy.

15. (a) Name the parts 1 to 5 of human female reproductive system. (b) Name the part in which fertilization takes place in the system



Answers

1. The flowers which contain only the male or female reproductive organs are called unisexual flowers. They are called incomplete flowers. To reproduce they undergo cross-pollination. Examples: Papaya, White mulberry and Watermelon.

The flowers which contain both male and female reproductive organs are known as bisexual flowers. They will self-pollinate as well as cross-pollinate. Examples: Tulip, Sunflower and Lily.

2. Female germ cell, egg, is large and contains the food-stores Male germ cell, sperm, is smaller and likely to be motile

3. In such flowers, the female reproductive part is present and hence these flowers can be cross pollinated to produce fruit.

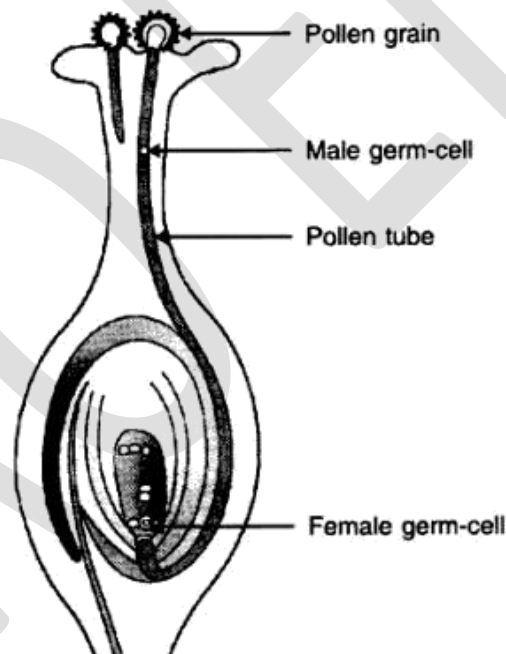
4. Zygote is formed inside an ovule present in the ovary of the carpel.

5. (a) 24 chromosomes: as male and female gametes of a species have same number of chromosomes.

(b) 48 chromosomes: as zygote is formed by the fusion of male and female gametes.

6. Sexual reproduction leads to more genetic variation in the offspring for their successful living in the changing environmental conditions. More variation leads to diversity in the population which help in natural selection.

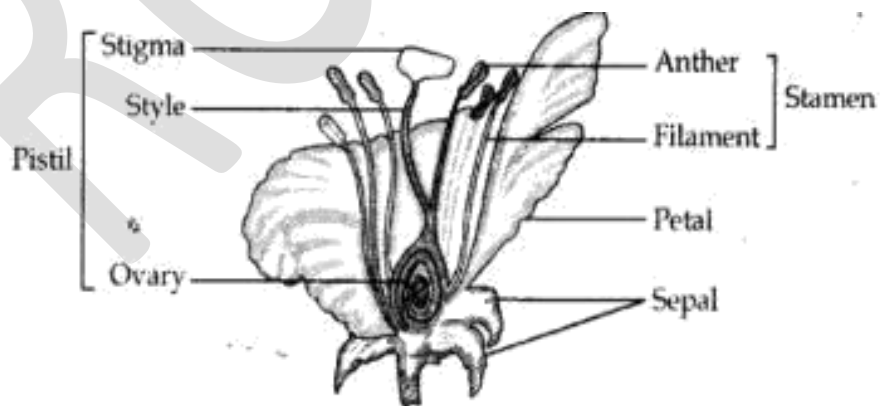
7.



8.

S. No.	Pollination	Fertilization
1.	It is the transfer of pollen grains from anther to stigma of a flower.	It is the process of fusion of male gamete and female gamete resulting in the formation of zygote. [1]
2.	Pollination facilitates formation of pollen tube which carries male gamete to the ovule.	Zygote later develops into embryo. [1]
3.	In this process, carrying agents are needed.	No carrying agents are needed in this process. [1]
4.	Occurs only in higher plants.	Occurs in all sexually reproducing organisms.

9. (i) anther
(ii) pollentube
(iii) stigm
iv) ovary



Longitudinal section of a flower

10. Female reproductive part of a flower is pistil. Ovary develops into fruit and ovule into seed. Male germ cell is present in pollen grain and female germ cell in the ovary.

11. Male gamete in animal – sperm
Female gamete in animal- ovum

Fertilisation- Fusion of male and female gametes to form zygote
Fertilisation takes place in fallopian tube in females

12. a) In males -vasectomy- vas deferens is blocked. In female-tubectomy- fallopian tube is blocked

(b) To prevent ovulation, fertilization and implantation.

13. Chromosomes : Long thread like structures made of DNA

In sexually reproducing organisms gametes are formed which have only half the number of chromosomes or DNA as compared to non-reproducing cells. The gametes fuse to form a zygote resulting a re-establishment of the number of chromosomes in the progeny.

14. Placenta : A specialized tissue embedded in the uterine wall. It contains villi on embryo side and blood spaces which surround villi on the mother's side

Functions : (i) Provides large surface area for nutrients and oxygen to pass from the mother to the embryo

(ii) Wastes generated by foetus are transferred into the mother's blood for their removal

15. i. oviduct 2. ovary 3. uterus 4. cervix 5. vagina

(b) Fallopian tube.

ASSERTION REASON QUESTIONS

For question numbers 1 to 10- two statements are given- one labeled Assertion (A) and the other labeled Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below:

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

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

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

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

1. Assertion (A): Testes lie outside the body.

Reason(R): Sperms require temperature lower than the body temperature for development.

2. Assertion (A) : Unisexual flowers have separate male and female Organs.

Reason(R) : Cucumber, pumpkin and watermelon are example of unisexual flowers.

3. Assertion (A) : Fertilisation will not occur in the absence of pollination.

Reason (R) : Pollination brings male gametes closer to the female reproductive part of the flower.

4. Assertion (A) : Condom is a safe contraceptive method to prevent pregnancy

Reason (R) : Condom prevent transmission of infection during sexual act

5. Assertion : Ovary is a not an organ in the female reproductive system. Reason : Ovary secrete female sex hormones estrogen and progesterone

6. Assertion- Surgical methods are most effective methods of contraception.

Reason-Surgical methods block gametes' transport and hence prevent fertilization.

7. Assertion : Sexual reproduction involves two parents of different sexes, a male and a female

Reason : Male and female gametes fuse to form a zygote in sexual reproduction

8. Assertion : Urethra in human male acts as urino-genital canal.

Reason : Urethra carries only urine while sperms are carried by vas deferens only.

9. Assertion : In internal fertilization male and female gametes fuse inside the female body

Reason : In all fishes fertilization takes place internally

10. Assertion : The size of human population is a cause for concern for many people .

Reason : An expanding population makes it harder to improve everybody's standard of living.

11. Assertion : Warts is a sexually transmitted disease.

Reason : Warts is caused by bacteria.

12. Assertion : Ovary lies at the lower part of the stamen.

Reason : Ovary in the flower produces ovules

Answers

1.a	2.b	3.a	4.a	5.d	6.a
7.b	8.c	9.c	10.a	11.c	12.d

CASE STUDY BASED QUESTION- 1

Germination starts with the rapid intake of water by the seed through its micropyle. The first visible indication of germination is the swelling of the seed with a resultant increase in weight. It is also accompanied by the softening of the seed coat. Absorption of water causes a number of physiological changes in the seed. Germinating seeds exhibit increased respiratory activity. The embryo produces enzymes which convert the food materials stored in the cotyledons into soluble form usable by the growing embryo. Once the food is made available, cell division activity starts in the growing embryo. The growth of the embryonic tissue ruptures the seed coat.

(i) The condition needed for the germination of the seed

- (a) Moisture
- (b) Temperature
- (c) Both (A)and (b)
- (d) None of the above

(ii) Which of the following is a part of seed.

- (a) Embryo
- (b) Radicle
- (c) Plumule
- (d) All of the above

(iii) Which among the following are true

- (i) Radicle develops into root
- (ii) Radicle develops into shoot
- (iii) Plumule develops into root

(iv) Plumule develops into shoot

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

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

(iv) Which of the following is not connected with the germination of seed.

(a) It swells

(b) The seed coat softened

(c) It exhibits photosynthesis

(d) It exhibits respiration

CASE STUDY BASED QUESTION-2

Read the given passage and answer the questions

The growing size of the human population is a cause of concern for all people. The rate of birth and death in a given population will determine its size. Reproduction is the process by which organisms increase their population. The process of sexual maturation for reproduction is gradual and takes place while general body growth is still going on. Some degree of sexual maturation does not necessarily mean that the mind or body is ready for sexual acts or for having and bringing up children. Various contraceptive devices are being used by human beings to control the size of population.

1) What are common signs of sexual maturation in boys?

a) Broadening of shoulders

b) Development of mammary glands

c) Broadening of waist

d) High pitch of voice

- 2) Common sign of sexual maturation in girls is
- a) Low pitch voice
 - b) Appearance of moustache and beard
 - c) Development of mammary glands
 - d) Broadening of shoulders
- 3) Which contraceptive method changes the hormonal balance of the body?
- a) Condoms
 - b) Diaphragms
 - c) Oral pills
 - d) Both a) and b)
- 4) What should be maintained for healthy society?
- a) Rate of birth and death rate
 - b) Male and female sex ratio
 - c) Child sex ratio
 - d) None of these

CASESTUDY QUESTIONS- 3

Read the given passage and answer the questions.

Menstrual cycle is the cycle of events taking place in female reproductive organs under the control of sex hormones, in every 28 days at an interval of 28 days,

a single egg is released from either of two ovaries. Regular menstrual cycle stopped

abruptly in a married women. She got herself tested and was happy to discover that she is pregnant with her first baby.

(i) Why menstruation stops in a pregnant female?

a) The egg gets fertilized so need not to be expelled out of body

(b) Ovulation stops during pregnancy and so does menstruation

(c) Thick uterine lining is needed for proper development of embryo, so that it is retained

(d) All of these

(ii) Select the correct sequence of acts that lead to pregnancy in a female. A. Fertilisation of egg

B. Ovulation

C. Formation

of zygote D.

Implantation

(a) D ⇒ C ⇒ B ⇒ A

(b) B ⇒ A ⇒ C ⇒ D

(c) A ⇒ B ⇒ C ⇒ D

(d) D ⇒ C ⇒ A ⇒ B

(ii) How is a zygote different from embryo?

(a) Zygote is formed by repeated division of embryo

(b) Zygote is formed by fusion of sperm and egg whereas embryo is formed by fusion of zygote with other zygote

(c) Zygote is single celled but embryo is multicellular

(d) Zygote is formed by fertilisation but embryo is formed without fertilisation

(iv) What change takes place in the uterus of a pregnant female?

(a) Uterine lining becomes thick and vascular

(b) Placenta develops which links the embryo to mother through umbilical cord

(c) Uterus lining containing lots of blood capillaries breaks down

(d) Both (a) and (b)

Case based questions4

Read the given passage and answer the questions

For a healthy society, the female-male sex ratio must be maintained. Because of reckless female foeticides, child sex ratio is declining at an alarming rate.in some sections of our society, although prenatal sex determination is prohibited by law. Reproduction is the process by which organisms increase their populations. The rates of birth and death in a given population will determine its size. The size of human population is a cause for concern for many people .This is because an expanding population makes it harder to improve everybody's standard of living .Inequality in society is the main reason for poor standards of living for many people. If we look around us we can identify the most important reason for poor living standards

(i).The primary reason for increase in human population is

- (a) Increase in agricultural production
- (b) The increase in birth rate and the decrease in death rate
- (c)The improvement in medical technology
- (d)All of the above

(ii) Which of the parents is biologically responsible for the sex of the child

- (a)Father
- (b) Mother
- (c)Both the parents
- (d)Supernatural power

(iii)What is the sex ratio?

- (a)The ratio of males to females in a population.
- (b)The ratio of older people to younger people in a population

- (c) The ratio of older people to children in a population
(d) The ratio of male children to female children in a population

(iv) The action of contraceptive is

- (a) prevention of ovulation and fertilization
(b) prevention of ovulation only
(c) Prevention rapid passing of eggs in the oviduct
(d) prevention of ovulation, implantation and fertilization

Answers

- 1.(i) c (ii) d (iii) c (iv) c
2.(i) a (ii) c (iii) c (iv) d
3.(i) d (ii) b (iii) c (iv) d
4.(i) (ii) a (iii) a (iv) d

Heredity

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

Variation

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

Somatic variation

Takes place in the body gametes/ cells.

Neither inherited nor transmitted.

Also known as acquired inherited traits.

Example, boring of pinna, cutting of tails in dogs.

Gametic variation

- Takes place in the Reproductive cells.

- Inherited as well as transmitted.

- Also known as traits.

- Example, human height, skin colour.

Accumulation of Variation during Reproduction

Variations

Asexually

Sexually

- Variations are fewer.
- Occurs due to small over inaccuracies in DNA copying. (**Mutation**)
- Variations are large.
- Occurs due to crossing separation of chromosomes, mutation.

Importance of Variation :

- Depending upon the nature of variations different individuals would have different kinds of advantage.
Example, Bacteria that can withstand heat will survive better in a heat wave.
- Main advantage of variation to species is that it increases the chances of its survival in a changing environment.

Free ear lobes and **attached ear lobes** are two variants found in human populations.

KEY POINTS

Heredity – Transmission of characters from one generation to another or from parents to offspring.

Variation – The occurrence of small differences or changes among the individuals of a species is called variation.

Sexually reproducing individuals have two copies of genes for the same trait.

Traits - characteristic features of an organism, manifested in a physical form that is visible or in a physiological aspect of the organism.

Dominant traits - The traits that express themselves in an organism in every possible combination and can be seen are called Dominant traits.

Recessive traits - A trait which is not expressed in the presence of a dominant allele is known as recessive.

Gene – It is the basic unit of inheritance. It consists of a sequence of DNA, which is the genetic material. Genes can mutate and can take two or more alternative forms.

Alleles – The alternative forms of genes. They affect the same characteristics or traits in alternate forms. They are located on the same place of the chromosome.

Homozygous – Each organism has two alleles for every gene (Each chromosome has one each). In homozygous, both the alleles are same. For Example, “TT” is the homozygous expression for tallness trait.

Heterozygous – If the two alleles are different from each other, then they are heterozygous in nature. For Example, “Tt” is the heterozygous expression for tallness trait.

Chromosomes – These are thread-like structures made up of nucleic acids (DNA) and proteins. They are mostly found in the nucleus of the cells. They carry the hereditary or genetic information in the form of genes.

Genotype – It is the complete heritable genetic identity of an organism. It is the set of alleles that are carried by the organism. It also includes non-expressed alleles.

Phenotype – It is the description of the actual physical characteristics of an organism or the expressed form of the genotype.

Mendel and His Work on Inheritance

- **Gregor Johann Mendel (1822 & 1884)** : Started his experiments on plant breeding and hybridisation. He proposed the laws of inheritance in living organisms.

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

- **Plant selected by Mendel:** *Pisum sativum* (garden pea).

Mendel used a number of contrasting characters for garden pea.

→ (TABLE OF CONTRASTING CHARACTERS. SEVEN PAIRS)

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

Seven pairs of contrasting characters in Garden Pea.

Mendel's Experimental Material : He chose Garden Pea (*Pisum sativum*) as his experiment material because of :

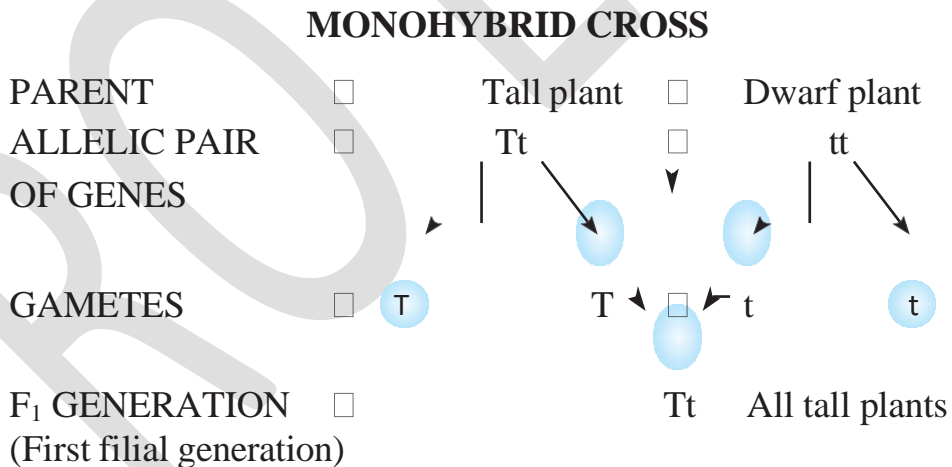
- (i) Availability of detectable contrasting traits of several characters.
- (ii) Short life span of the plant.
- (iii) Normally allows self-fertilisation but cross-fertilisation can also be carried out.
- (iv) Large no. of seeds produced.

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

Monohybrid Cross

Cross between two pea plants with one pair of contrasting characters is called a monohybrid cross.

Example: Cross between a tall and a dwarf plant (short).



SELF POLLINATION
of F₁ gametes

GAMETES

F₂ GENERATION

\square Tt \square Tt



	Gametes \square T t	
\downarrow	TT	Tt
T	tall	tall
t	Tt	tt
	tall	dwarf

Phenotypic ratio \square 3 : 1

Genotypic ratio \square 1 : 2 : 1







Tall :

Dwarf 3 : 1

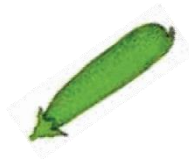
TT : Tt :

tt 1 : 2 :

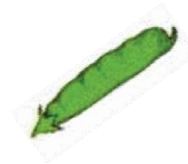
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CHARACTER	DOMINANT TRAIT	RECESSIVE TRAIT
Seed shape	 Round	 Wrinkled
Seed colour	 Yellow	 Green
Flower colour	 Violet	 White

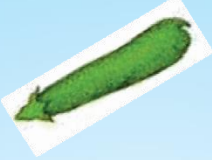
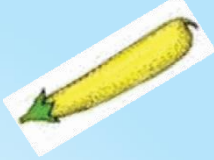




Pod shape



Inflated/full



Constricted

Pod Colour		
	Green	Yellow
Flower		
	Axial	Terminal
Stem		
	Tall	Dwarf

TT] Both dominant traits
 tt] Both recessive alleles

Pure or homozygous condition

Tt] One dominant, one recessive trait

Heterozygous condition – Hybrid

Phenotypic ratio → 3 : 1

Genotypic ratio → 1 : 2 : 1

Phenotype □ Physical appearance [Tall or Short]
Genotype □ Genetic make up [TT, Tt or tt]

Observations of Monohybrid Cross

- (i) All F1 progeny were tall, no medium height plant. (Half way characteristic)
- (ii) F2 progeny $\frac{1}{4}$ were short, $\frac{3}{4}$ were tall.
- (iii) Phenotypic ratio F2 – 3 : 1 (3 tall : 1 short)

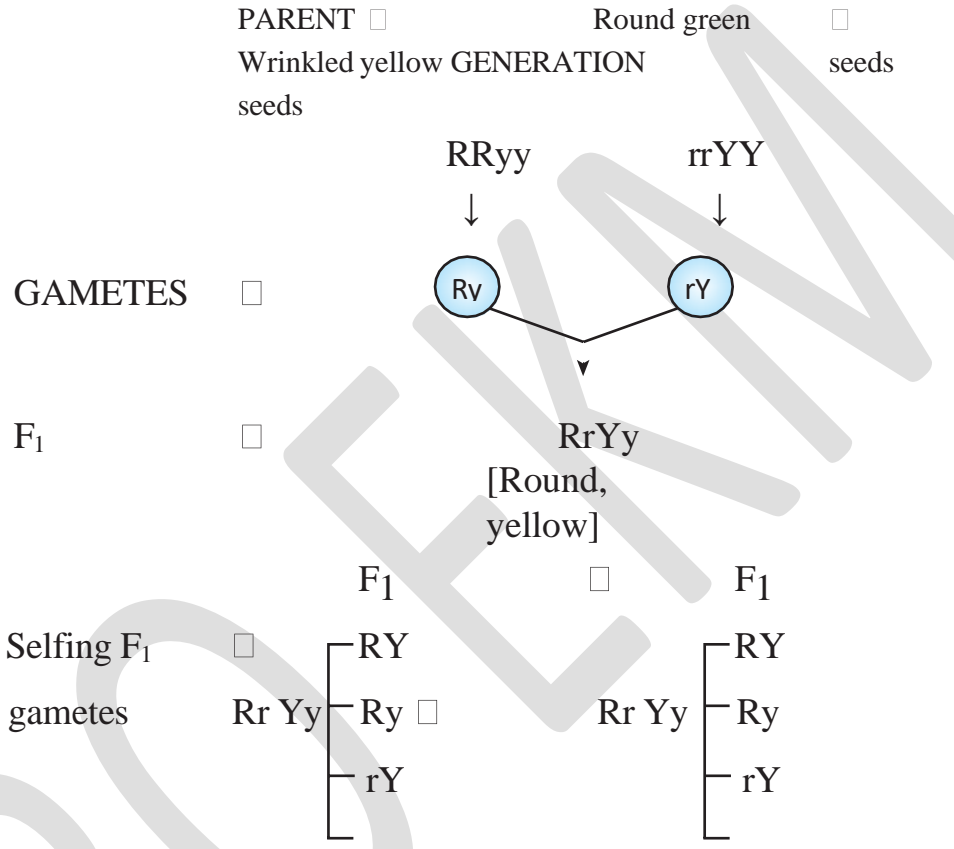
Genotypic ratio F2 – 1 : 2 : 1

Conclusions

1. TT and Tt both are tall plants while tt is a short plant.
2. A single copy of T is enough to make the plant tall, while both copies have to be 't' for the plant to be short.
3. Characters/traits like 'T' are called dominant trait (because it expresses itself) and 't' are recessive trait (because it remains suppressed).

Dihybrid Cross

A cross between two plants having two pairs of contrasting characters is called dihybrid cross.



F_1 gametes

	RY	Ry	rY	ry
RY	RRYY	RRYy	RrYY	RrYy
Ry	RRYy	RRyy	RrYy	Rryy
rY	RrYY	RrYy	rrYY	rrYy
ry	RrYy	Rryy	rrYy	rryy

Phenotypic Ratio

Round, yellow: 9 Round,
 green : 3 Wrinkled,
 yellow : 3 Wrinkled,
 green : 1

Observations

- (i) When RRyy was crossed with rrYY in F1 generation all were Rr Yy round and yellow seeds.
- (ii) Self pollination of F1 plants gave parental phenotype and two mixtures (recombinants round yellow and wrinkled green) seeds plants in the ratio of 9 : 3 : 3 : 1.

9 : 3 : 3 : 1

□ Round □

□ yellow □ □ green □ □ yellow □ green □

Conclusions

1. Round and yellow seeds are Dominant characters.
2. Occurrence of new phenotype combinations show that genes for round and yellow seeds are inherited independently of each other.

MENDEL'S LAWS OF INHERITANCE

Law of Dominance: When parents having pure contrasting characters are crossed then only one character expresses itself in the F1 generation. This character is the dominant character and the character/factor which cannot express itself is called the recessive character.

Law of segregation: The phenomenon of separation of the two alternating factors of one character, during gamete formation so that

one gamete receives only one factor of a character is called as Law of Segregation.

Law of Independent Assortment : When two pairs of traits are combined in a hybrid, segregation of one pair of characters is independent of the other pair of characters'.

How do these traits get expressed

Cellular DNA (Information source)

- For synthesis of Proteins (Enzyme)
- Works efficiently

More Hormone



Produced Tallness of Plant

Therefore, genes control characteristics or trait

SEX DETERMINATION

Determination of sex of an offspring.
FACTORS Responsible for Sex Determination

Environmental

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

Genetic

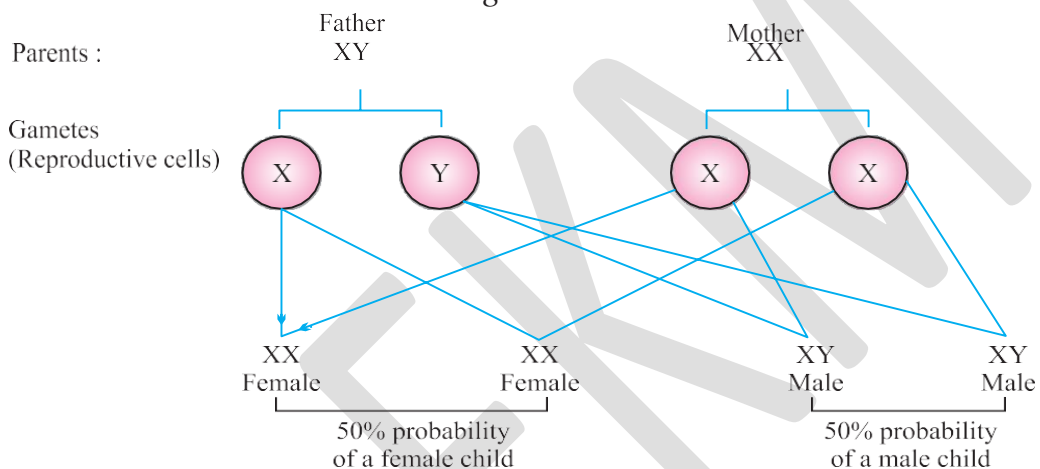
In some animals like humans gender or individual is determined by a pair of chromosomes called sex chromosome.
XX – Female
XY – Male

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

XX – Female

XY – Male

Sex determination in Human Beings



This shows that half the children will be boys and half will be girls. All children will inherit an X chromosome from their mother regardless whether they are boys or girls. Thus, sex of children will be determined by what they inherit from their father, and not from their mother.

Multiple Choice Questions:

1. The process where characteristics are transmitted from parent to offspring is called
 - a) Variation
 - b) Heredity
 - c) Gene
 - d) Allele
2. Exchange of genetic material takes place in
 - a) Vegetative reproduction
 - b) Asexual reproduction
 - c) Sexual reproduction
 - d) budding
3. The following results were obtained by a scientist who crossed the F₁ generation of pure-breeding parents for round and wrinkled seeds.

Dominants trait	Recessive trait	No. of F ₂ offspring
Round seeds	Wrinkled seeds	7524

From these results, it can be concluded that the actual number of round seeds he obtained was:

- a) 1881
 - b) 22572
 - c) 2508
 - d) 5643
4. In peas, a pure tall plant (TT) is crossed with a pure short plant (tt). The ratio of pure tall plants to pure short plants in F₂ generation will be:
 - a) 1 : 3
 - b) 3 : 1
 - c) 1 : 1
 - d) 2 : 1
 5. What will be the number of chromosomes present in each gamete produced by the plants if the palisade cells of a species of plant contain 28 chromosomes in all?
 - a) 56

b) 28

c) 14

d) 4

6. Amongst which of the following animals, sex of the offsprings not genetically determined?

a) Humans

b) Snails

c) Birds

d) Dogs

7. Two pea plants one with round green seeds (RRyy) and another with wrinkled yellow (rrYY) seeds produce F1 progeny that have round, yellow (RrYy) seeds. When F1 plants are selfed, the F2 progeny will have new combination of characters. Choose the new combination from the following:

(i) Round, yellow (ii) Round, green (iii) Wrinkled, yellow (iv) Wrinkled, green

a) (i) and (ii)

b) (i) and (iv)

c) (ii) and (iii)

d) (i) and (iii)

8. A Mendelian experiment consisted of breeding of tall pea plants bearing violet flowers with short pea plants bearing white flowers. The progeny all bore violet flowers but almost half of it were short. This suggests that the genetic make up of tall parent can be depicted as:

a) TTVV

b) TTvv

c) TtVV

d) TtVv

9. The maleness of a child is determined by ____.

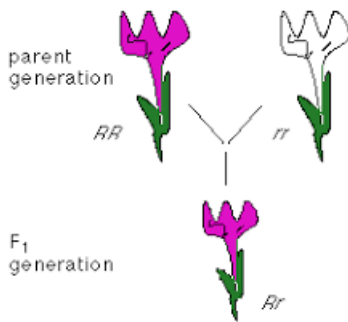
a) X chromosome in zygote

b) Y chromosome in zygote

c) The cytoplasm of germ cells which determines the sex

d) Sex is determined by chance

10. The inheritance of color trait in flower is as shown. R and r denotes two different genes for color. Which law of Mendel can be explained using the image?



- Law of segregation and law of independent assortment
- Only law of segregation
- Law of segregation and law of dominance
- Only law of independent assortment.

Assertion (A) and Reason (R) type questions.

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

- Both A and R are true and R is the correct explanation of A.
- Both A and R are true but R is not the correct explanation of A.
- A is true but R is false.
- A is false but R is true.

1. **Assertion(A)** : Variations are seen in offspring produced by sexual reproduction.

Reason (R) : DNA molecule generated by replication is not exactly identical to original DNA.

2. **Assertion (A)** : When pea plants (pure line) having round yellow seeds are crossed with pure line plants having wrinkled green seeds, then all pea plants obtained in F_1 , generation bear wrinkled green seeds.

Reason (R): Round and yellow seeds are dominant to wrinkled and green seeds.

3. **Assertion (A)**: Selfing of a plant for several generations helps plant breeders to obtain pure breeding varieties.

Reason (R): Pure breeding plants are heterozygous for many traits.

4. **Assertion(A)**: The sex of a child is determined by the mother.

Reason (R): Humans have two types of sex chromosomes: XX and XY.

5. **Assertion (A)**: Mendel chose a number of varieties of garden pea as plant material for his experiments.

Reason(R): Garden pea has well defined characters and is bisexual.

Case study questions

I Read the given information and answer the following questions.

Pea plants can have smooth seeds or wrinkled seeds. One of the phenotypes is completely dominant over the other. A farmer decides to pollinate one flower of a plant with smooth seeds using pollen from plant with wrinkled seeds. The resulting pea pod has all smooth seeds.

- i) Which of the following conclusions can be drawn?**
- (1) The allele for smooth seeds is dominated over that of wrinkled seeds.
 - (2) The plant with smooth seeds is heterozygous.
 - (3) The plant with wrinkled seeds is homozygous.
- (a) 1 only
(b) 1 and 2 only
(c) 1 and 3 only
(d) 1, 2 and 3
- ii) Which of the following crosses will give smooth and wrinkled seeds in same proportion?**
- (a) $RR \times rr$
(b) $Rr \times rr$
(c) $RR \times Rr$
(d) $rr \times rr$
- iii) Which of the following cross can be used to determine the genotype of a plant with dominant phenotype?**
- (a) $RR \times RR$
(b) $Rr \times Rr$
(c) $Rr \times RR$
(d) $RR \times rr$
- iv) On crossing of two heterozygous smooth seeded plants (Rr), a total of 1000 plants were obtained in F_1 generation. What will be the respective number of smooth and wrinkled seeds obtained in F_1 generation?**
- (a) 750, 250
(b) 500, 500
(c) 800, 200
(d) 950, 50

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

- a) What will be the set of genes present in F_1 generation?
- b) Give reason why only tall plants are observed in F_1 progeny.

- c) When F1 plants were self pollinated, a total of 800 plants produced. How many of these would be tall, medium height or short plants? Give the genotype of F2 generation.

Very short answer type questions [1 mark]

1. Name the information source for making proteins in the cells.
2. Differentiate between dominant and recessive traits.
3. Who is known as father of genetics?
4. What is meant by contrasting traits or characters?

Short Answer Type Questions [2 marks]

5. How do Mendel's experiments show that traits may be dominant or recessive?
6. How do Mendel's experiments show that traits are inherited independently?
7. How is the equal genetic contribution of male and female parents ensured in the progeny?
Explain
8. The chromosome number of the sexually reproducing parents and their offspring is same." Justify the statement.
9. Genes controls traits '. Explain this statement with an example.
10. What is DNA copying? State its importance

Short Answer Type Questions [3 marks]

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

(a) List your observations regarding:

- (i) Colour of stem in their F1 progeny
- (ii) Percentage of brown stemmed plants in F2 progeny if F1 plants are self pollinated.
- (iii) Ratio of GG and Gg in the F2 progeny.

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

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.

13. With the help of a flow chart explain in brief how the sex of a newborn is genetically determined in human beings. Which of the two parents, the mother or the father, is responsible for determination of sex of a child?

14. What is variation? How is variation created in a population? What is the importance of variation for survival of a species?

15. Define the following terms.

a. Heredity , b. Gene , c. Alleles

Long Answer Type Questions [5 marks]

16. a) Why did Mendel choose garden pea for his experiments? Write two reasons.

b) 'Different species use different strategies to determine sex of a

newborn individual. It can be environmental cues or genetically

determined.' Explain the statement by giving example for each strategy.

17. If we cross pure-bred tall (dominant) pea plant with pure-bred dwarf (recessive) pea plant we will get pea plants of F₁ generation. If we now self- cross the pea plant of F₁ generation, then we obtain pea plants of F₂ generation.

(a) What do the plants of F₂ generation look like?

(b) State the

ratio of tall plants to dwarf plants in F₂ generation.

(c) State the type of plants

not found in F₂ generation but appeared in F₂ generation, mentioning the reason for the same.

(d) State Mendel's laws of inheritance.

ANSWERS

Multiple Choice Questions

1. b) Heredity
2. c) Sexual reproduction
3. d) 5643
4. c) 1 : 1
5. c) 14

6. b) Snails
7. b) (i) and (iv)
8. c) TtVV
9. b) Y chromosome in zygote
10. c) Law of segregation and law of dominance

Assertion (A) and Reason (R) type questions.

1. A 2. D 3. C 4. D 5. A

Case study questions

I

- i (c) 1 and 3 only
- ii (b) Rr x rr
- iii (d) RR x rr
- iv (a) 750, 250

II

- a) Tt
- b) Tallness is a dominant character and dwarfness is a recessive character.
- c) Out of 800 plants 600 plants will be tall and 200 plants will be small, 1 TT: 2Tt: 1tt

Very short answer type questions [1 mark]

1. **DNA in the nucleus of a cell** is the information source for making proteins.
2. **Dominant traits** - The traits that express themselves in an organism in every possible combination and can be seen are called Dominant traits.
Recessive traits - A trait which is not expressed in the presence of a dominant allele is known as recessive
3. **Gregor Mendel**
4. A trait is generally represented by two forms. When these two forms are opposite to each other they are termed as contrasting trait. For example, contrasting trait for height is tall and dwarf.

Short Answer Type Questions [2 marks]

5. Mendel selected true breeding tall (TT) and dwarf (tt) pea plants. When a tall pea plant is crossed with a short (dwarf) pea plant, all the F1 hybrids are tall. (i.e., in this case, the gene causing tallness is dominant while the gene causing dwarfness is recessive.). The trait expressing itself in the hybrid is the dominant one.

(Mendel's first law of inheritance states that when a pair of contrasting factors is brought in a hybrid, one factor inhibits the appearance of the other. The one which inhibits is the dominant one and which is inhibited is recessive.)

6. Mendel performed an experiment in which he took a tall plant with round seeds and a short plant with wrinkled-seeds. In F1, they were all tall and had round seeds. Tallness and round seeds were thus dominant traits. When, he used these F1 progeny to generate F2 progeny by self-pollination, he found that some F2 progeny were tall plants with round seeds, and some were short plants with wrinkled seeds. At the same time there tall plants, but had wrinkled seeds, while others were short, but had round seeds. Thus, Mendel's experiments show that the tall/short trait and the round seed/wrinkled seed trait are independently inherited.

7. Equal genetic contribution of male and female parents in the progeny is ensured by the equal inheritance of chromosome from each parent. Human possesses 23 pairs of chromosomes, of which 22 pairs are autosomes and 1 pair is the sex chromosomes. The two sex chromosomes in human are X and Y. Females have 2 X chromosomes and males have a X and Y chromosome. During the process of fertilization, a haploid sperm fuses with a haploid ovum to produce a diploid zygote. Zygote receives equal amount of genetic material from each parent and thus, retains the diploid nature on fertilization.

8. In sexually reproducing organisms, male and female gametes / reproductive cells with only half the number of chromosomes (as in the parent cell) are produced. During fertilization, when male and female gametes fuse to give to a zygote, original number of chromosomes are restored.

9. Genes control traits by synthesizing the specific enzyme. Plant height depends on the amount of a particular plant hormone. The amount of plant hormone made will depend on enzyme. If enzyme works efficiently the plant will be tall. If the gene for that enzyme has an alteration that makes enzyme less efficient, the amount of hormone will be less and plant will be short.

10. DNA copying is the process of producing two identical replicas from one original DNA molecule during cell division. DNA is necessary to make all the RNA and proteins needed for cells to carry out necessary reactions and cellular processes in order to survive.

11. (a) (i) Colour of the stem in F1 progeny: All green
(ii) Percentage of brown stem: 25 %

(iii) $GG: Gg$ is 1: 2

Parent: $GG \quad X \quad gg$

Gametes: $G \quad g$

F1: Gg Green stem

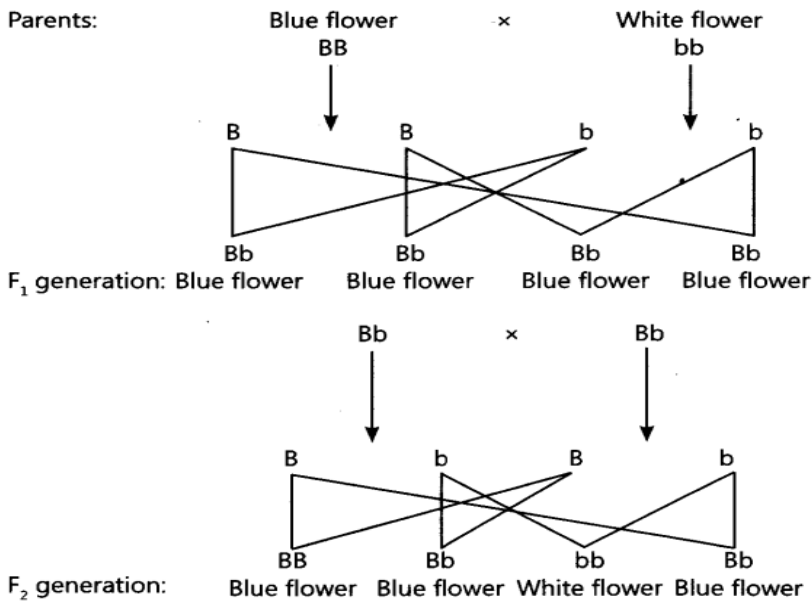
Parents : $Gg \quad X \quad Gg$

Gametes: $G \quad g \quad G \quad g$

F2: $GG \quad Gg \quad Gg \quad gg$

(b) Based on the above cross, it can be concluded that green colour is dominant and get expressed in F1 generation. The brown stem, which does not get express itself in the F1 generation, is the recessive character.

12.

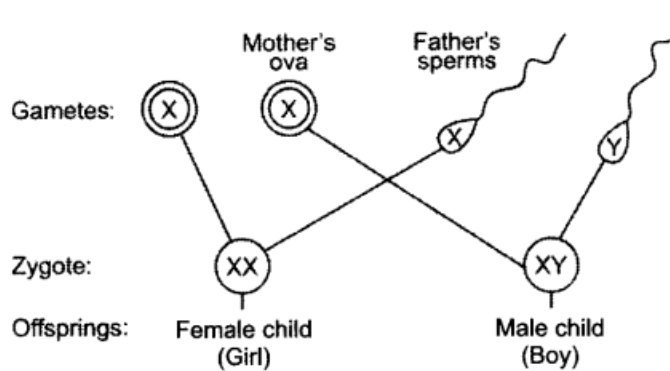


(a) The colour of all the flowers in F₁ generation will be blue.

(b) Percentage of white flower plants in F₂ generation will be 25.

(c) The ratio of genotype BB and Bb in F₂ progeny will be 1 : 2.

13. In human beings, the sex of the individual is genetically determined. Sex chromosome of male is XY and of female is XX . Sex of a child depends on what happens at fertilisation. The woman produces eggs having X chromosome while the man produces 50% sperms having X chromosome and 50% sperms having Y chromosome. Man therefore, actually determines the sex of the new born baby



14. The differences in the traits shown by the individuals of a species and also by the offsprings (siblings) of the same parents are referred to as variation. New variation may arise during the process of DNA copying that already has variations accumulated from previous generations. Species having suitable variations have more chance of survival if there is change in environmental conditions.

15.Heredity – Transmission of characters from one generation to another or from parents to offspring.

Gene – It is the basic unit of inheritance. It consists of a sequence of DNA, which is the genetic material. Genes can mutate and can take two or more alternative forms.

Alleles – The alternative forms of genes. They affect the same characteristics or traits in alternate forms. They are located on the same place of the

Long Answer Type Questions [5 marks]

16.(a) Reasons:

- (i) Pea plant is small and easy to grow.
- (ii) A large number of true breeding varieties of pea plant are available.
- (iii) Both self and cross-pollination can be made possible. Because this plant has a short life cycle, the results may be gathered and evaluated more quickly.
- (iv) The garden pea possesses a number of features that are diametrically opposed to one another.

b) Environmental Cue: (i) In some animals, the temperature at which fertilised eggs are kept determines whether the developing animal in egg is male or female.

(ii) In some animals like snail, individual can change sex.

Genetical Cue: A child who inherits an X-chromosome from her father will be a girl and one who inherits a Y- chromosome from the father will be a boy.

17 a) All plants of F1 generation will be tall plants.

(b) 3:1

(c) Dwarf trait is recessive trait which was not expressed in the F1 generation, the recessive trait gets expressed in the F2 generation after self pollination.

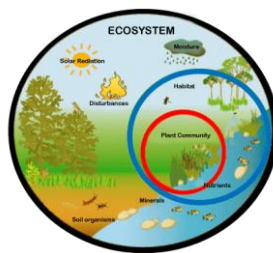
(d) Laws of Mendel

•**Law of Dominance** says that a gene has two contrasting alleles and one always expresses itself in the organism.

•**Law of Segregation** says that traits get segregated completely during the formation of gametes without any mixing of alleles.

•**Law of Independent Assortment** says that the traits can segregate independently of different characters during gamete formation.

Chapter 15 : OUR ENVIRONMENT



ABIOTIC FACTORS *AF

SUNLIGHT, SOIL, →

RAINFALL, WIND etc

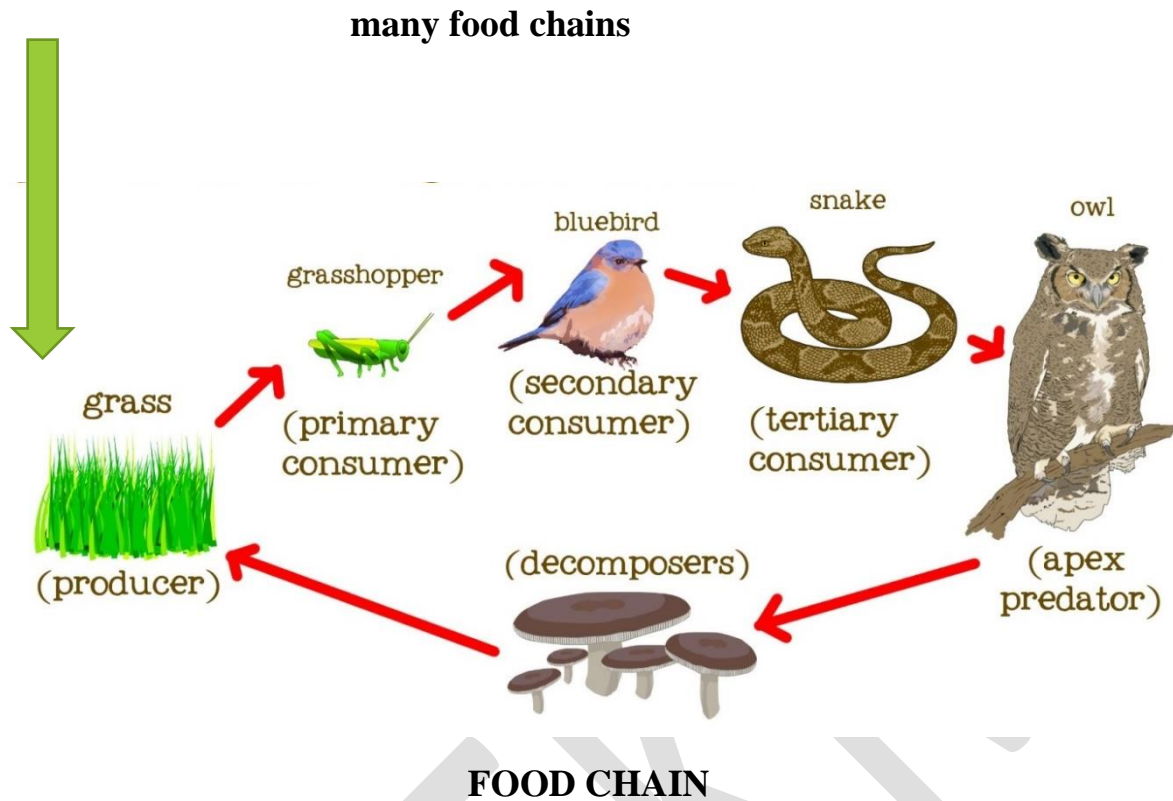
ECOSYSTEM

↑
food webs

BIOTIC FACTORS * BF

← ALL LIVING

ORGANISMS



MULTIPLE CHOICE QUESTIONS

1. Which one of the following belongs to First trophic level

- (i) Sunflower plants
- (ii) Cockroach
- (iii) Neem tree
- (iv) Grasshopper

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

2. Ten percent law was given by

- a. Lindeman
- b. Darwin
- c. Mendel

d. Morgan

3. In the below food chain, 5 J of energy was available to Hawks. How much would have been present in plants

Plants → Rats → Snakes → Hawks

- a. 50 J
- b. 5 J
- c. 500 J
- d. 5000 J

4. Match the column

COLUMN I	COLUMN II
P. Biomagnification	i. Both biotic & abiotic components of environment
q. Ecosystem	ii. A man made ecosystem
r. Garden	iii. Organisms which obtain food from other living organisms.
s. Parasites	iv. Accumulation

- a) p → iv, q → i, r → ii, s → iii
- b) P → ii, q → i, r → iv, s → iii
- c) P → iv, q → ii, r → i, s → iii
- d) P → ii, q → iv, r → i, s → iii

5. Which of the following limits the number of trophic levels in a food chain?

- a. insufficient food supply
- b. Polluted air
- c. water
- d. Decrease in energy at higher trophic levels

6. Amount of energy transferred from one trophic level to the next is

- a. 1%
- b. 10%
- c. 20%

d. 2%

7. What will happen if deer is missing in the food chain given below?

Grass → Deer → Tiger

- a. The population of tiger decreases and the population of grass increases
- b. Tiger will start eating grass
- c. The population of tiger increases
- d. The population of grass decreases

8. Which of the following is not a terrestrial ecosystem?

- a. Forest
- b. Grassland
- c. Desert
- d. Aquarium

9. Which of the statement is incorrect?

- a. Green plants get their food from organic compounds
- b. All green plants and blue green algae are producers
- c. Plants convert solar energy into chemical energy
- d. Producers prepare their own food from inorganic compounds

10. What are the various steps of food chain called

- a. Food chain levels
- b. Tropic levels
- c. Trophic levels
- d. None of these

11. With regard to various food chains operating in an ecosystem, man is a:

- (a) Consumer
- (b) Producer
- (c) Producer and consumer
- (d) Producer and decomposer

12. Food web is constituted by:

- (a) relationship between the organisms and the environment
- (b) relationship between plants and animals
- (c) various interlinked food chains in an ecosystem
- (d) relationship between animals and environment.

ASSERTION AND REASON

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

- (a) Both 'A' and 'R' are true and 'R' is correct explanation of the Assertion.
- (b) Both 'A' and 'R' are true but 'R' is not correct explanation of the Assertion.
- (c) 'A' is true but 'R' is false.
- (d) 'A' is false but 'R' is true.

Q.1. Assertion: Polythene bags and plastic containers are non-biodegradable substances.

Reason: They can be broken down by microorganisms in natural simple harmless substances.

Q.2. Assertion: The concentration of harmful chemicals is least in human beings.

Reason: Man is at the apex of the food chain.

Q.3. Assertion: Ozone is formed in upper atmosphere by O_2 in presence of UV radiations.

Reason: Ozone depletion will lead to UV rays reaching earth which may cause skin cancer.

Q.4. Assertion: Aquarium needs regular cleaning

Reason: There are no microbes to clean water in aquarium, therefore, it needs to be regularly cleaned

Q5. Assertion Aquariums are known as the man made ecosystems

Reason Aquariums are created and maintained by humans

Q6. Assertion Tropical rain forests are disappearing fast from developing countries such as India

Reason No value is attached to these forests because these are poor in biodiversity.

Q7. Assertion Decomposers keep the environment clean.

Reason They recycle matter by breaking down the organic remains and waste products of plants and animals.

Q8. Assertion Biotic components of ecosystem continuously require energy to carry on life processes.

Reason Biotic components are the nonliving components of the ecosystem

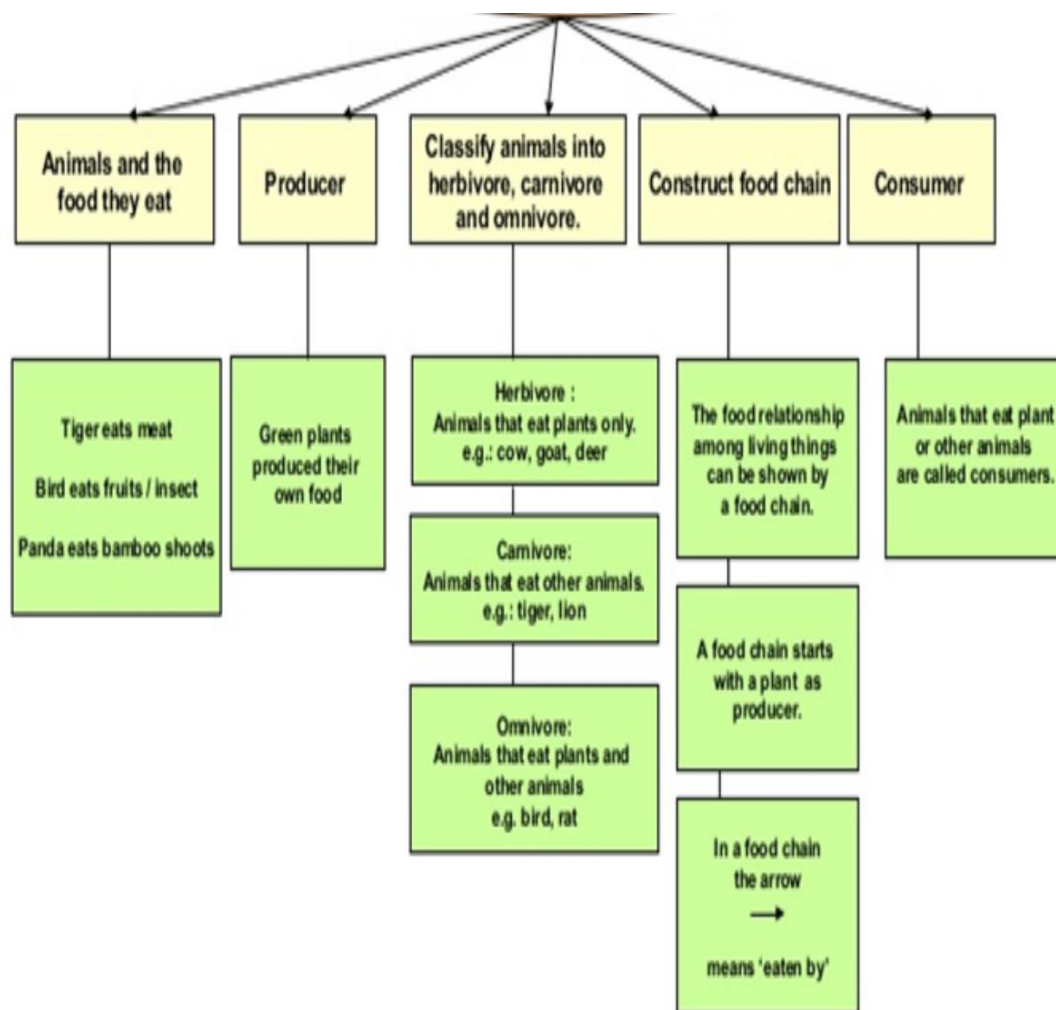
Q9. Assertion First trophic level in a food chain is always a green plant

Reason Green plants are called producers

Q10. Assertion Man is a herbivore.

Reason Omnivores eat both plant food and meat of animals.

FOOD CHAIN



CONCEPT CHART

ECOSYSTEM Interacting Organisms of an area + Non living Constituents



WASTE

TYPES OF ECOSYSTEM:-

a. NATURAL

TERRESTRIAL: Eg Forest, Grasslands.

AQUATIC: Eg Pond, Lakes, Oceans

b. ARTIFICIAL Eg. Crop field ,Garden, Aquarium ,Space craft.

COMPONENTS OF ECOSYSTEM

a. BIOTIC (Living components Eg. Plants, Animals and Microbes)



FLOW OF ENERGY (*from biotic to abiotic and from abiotic to biotic*)

b. ABIOTIC (Non- living components, Physical factors like temperature, rainfall, wind, soil etc).

REPRESENTATION OF RELATION BETWEEN DIFFERENT BIOTIC COMPONENTS.

FOOD CHAIN : A series of organisms feeding on one another taking part at various levels.

FOOD WEB : A network of interconnected food chains.

TROPHIC LEVELS :

* 1 % energy available from the sun to the terrestrial plants is converted into food.

*10 % energy in food is transferred to next level of consumer.

*90% is lost.

*No of steps of food chain is only 3 or 4 as very little energy is available to higher levels. No of organisms decrease as we move up in a food chain.

***Flow of energy in a food chain is unidirectional.**

BIO MAGNIFICATION OF POLLUTANTS: Progressive accumulation of harmful substances like pesticides takes place. It is each step or level of the food chain.

I-TROPHIC LEVEL: Producers Eg green plants, Blue green algae (Cyanobacteria), Phytoplankton's (Microscopic free floating aquatic plants)

II- TROPHIC LEVEL:Primary consumers or herbivores

III- TROPHIC LEVEL:Secondary consumers or small carnivore.

IV- TROPHIC LEVEL:Tertiary consumers or large carnivore

WASTE

TYPES OF WASTE

BIODEGRADABLE Can be broken down by the enzymes of bacteria or fungi Eg. Plant & animal waste, paper, wood.

NON BIODEGRADABLE Can't be broken down by the enzymes of bacteria or fungi (Decomposers) Eg. Plastics.

EFFECT OF WASTE

OZONE DEPLETION: CFC (*chloro fluoro carbon*) damage ozone layer.

PROBLEM OF WASTE DISPOSAL

POLLUTION: Pollution of land, air & water

BIO MAGNIFICATION OF POLLUTANTS: Progressive accumulation of harmful substances like pesticides takes place in a food chain

WASTE MANAGEMENT

LAND FILLS

RECYCLING SEWAGE TREATMENT

INCINERATION

USE OF DISPOSABLE PAPER CUPS

RECYCLING OF PAPER

IMPORTANCE OF REDUCE, REUSE & RECYCLE

SHORT ANSWER QUESTIONS

1. What is meant by biological magnification?
2. Give an example to illustrate that indiscriminate use of pesticides may result in the degradation of the environment
3. What does a trophic level represent in a food chain? State the position of autotrophs and herbivores in a food chain.
4. What is an ecosystem? List any two natural ecosystems.
5. We do not clean ponds or lakes but an aquarium needs to be cleaned regularly. Why?
6. What is a food chain?
7. Why is the flow of energy in an ecosystem unidirectional? Explain briefly.
8. What is the significance of ozone layer?
9. State two methods of effective plastic waste collection
10. Name any two uses of 'single use plastic' in daily life.
11. What will happen if we kill all the organisms in one trophic level?

12. Which compounds are responsible for the depletion of ozone layer?
13. Define 'trophic level'.
14. What are the various steps in a food chain called?
15. What is the important function of presence of ozone in earth's atmosphere?
16. Why is it necessary to conserve our environment?
17. Distinguish between biodegradable and non-biodegradable wastes.
18. Name two decomposers operating in our environment.
19. What is meant by a biodegradable waste?
20. Which class of chemicals is linked to the decrease in the amount of ozone in the upper atmosphere of the earth?
21. Depletion of ozone in the ozone layer is a cause for our worry. Why?
22. What happens when higher energy ultraviolet radiations act on the oxygen at the higher level of the atmosphere?
23. State one harmful effect of depletion of ozone layer on the living organisms of the ecosystem.
24. Why should biodegradable and non-biodegradable wastes be discarded in two separate dustbins?
25. Mention one negative effect of our affluent life style on the environment.
26. What is the function of ozone in the upper atmosphere?
27. What will be the amount of energy available to the organisms of the 2nd trophic level of a food chain, if the energy available at the first trophic level is 10,000 joules?
28. The first trophic level in a food chain is always a green plant. Why?
29. Which of the following are always at the second trophic level of food chains? Carnivores, Autotrophs, Herbivores
30. List two natural ecosystems.
31. Why are green plants called producers?
32. Write one negative effect, on the environment, of affluent lifestyle of few persons of society.
33. In a food chain of frog, grass, insect and snake, assign trophic level of frog.
34. What is an ecosystem?

35. In the following food chain, 100 J of energy is available to the lion. How much energy was available to the producer?
Plants → Deer → Lion
36. What makes the earth's atmosphere a heterogeneous mixture?
37. List any four disadvantages of using fossil fuels for the production of energy.
38. In a food chain, if 10,000 joules of energy is available to the producer, how much energy will be available to the secondary consumer to transfer it to the tertiary consumer?
39. Write the harmful effects of using plastic bags on the environment. Suggest alternatives to plastic bags.
40. Why is the Government of India imposing a ban on the use of polythene bags? Suggest two alternatives to these bags and explain how this ban is likely to improve the environment
41. List two environment friendly practices or habits which need to be followed by every member of a family/community. Explain how these practices will support the "Save the Environment" mission.
42. What are decomposers? List two important roles they play in the environment.
43. List two reasons to show that the existence of decomposers is essential in an ecosystem.
44. State with reason any two possible consequences of elimination of decomposers from the Earth.
45. We often observe domestic waste decomposing in the bylanes of our homes. List four ways to make the residents aware that the improper disposal of wastes is harmful to the environment and also for their own health.

Short Answer Type II

- 1.(a) List any two characteristics of a good fuel.
(b) What are non-renewable resources of energy? Give two examples of such resources.
2. List any two disadvantages of using fossil fuels for the production of energy. Give two examples each of the following:
(i) Renewable sources of energy; (ii) Non-renewable sources of energy.
3. Subhash has started the project of constructing his building. His architect suggested that he should add a system of rain water harvesting in his building. He thought by adopting water harvesting in his project he can solve his water crisis problem in the years to come. Is Subhash correct in his approach? Support your answer.

4. List three problems which arise due to construction of big dams. Suggest a solution for these problems.
5. List the products of combustion of fossil fuels. What are their adverse effects on the environment?
6. (a) What is an ecosystem? List its two main components.
(b) We do not clean ponds or lakes, but an aquarium needs to be cleaned regularly. Explain.
7. State in brief two ways in which non-biodegradable substances would affect the environment. List two methods of safe disposal of the non-biodegradable waste.
8. "Our foodgrains such as wheat and rice, the vegetables and fruits and even meat are found to contain varying amounts of pesticide residues." State the reason to explain how and why it happens?
9. "Energy flow in a food chain is unidirectional." Justify this statement. Explain how the pesticides enter a food chain and subsequently get into our body.
10. After the examinations, Rakesh with his friends went on a picnic to a nearby park. All friends carried cooked food packed in plastic bags or plastic cans. After eating the food some friends collected the leftover food and plastic bags etc. and planned to dispose them off by burning. Rakesh immediately checked them and suggested to segregate the leftover food and peels of fruits from the plastic materials & respectively dispose them off separately in the green and red dustbins placed in the corner of the park. In your opinion, is burning plastic an eco-friendly method of waste disposal? Why? State the advantage of the method suggested by Rakesh.
11. Differentiate between biodegradable and non-biodegradable substances with the help of one example each. List two changes in habit that people must adopt to dispose non-biodegradable waste, for saving the environment.
12. Give reason to justify the following:
(a) The existence of decomposers is essential in a biosphere.
(b) Flow of energy in a food chain is unidirectional.
13. The activities of man had adverse effects on all forms of living organisms in the biosphere. Unlimited exploitation of nature by man disturbed the delicate ecological balance between the living and non-living components of the biosphere. The unfavourable conditions created by man himself threatened the survival not only of himself but also the entire living organisms on the mother earth. One of your classmates is an active member of 'Eco-club' of your school which is creating environmental awareness amongst the school

students, spreading the same in the society and also working hard for preventing environmental degradation of the surroundings.

(a) Why is it necessary to conserve our environment?

(b) State the importance of green and blue dust-bins in the safe disposal of the household waste.

14. A team of Indian researchers went to Antarctica to study the ozone layer. They confirmed the presence of largest ozone hole over Antarctica and it was just short of 27 million sq. km. After a few days of their return, one of the scientists developed rashes, burning sensation and other skin problems which the doctors have confirmed as skin cancer.

(a) What may be the cause of cancer just after return from Antarctica?

(b) What do we learn from this incident?

PROFEKUM

15. Human body is made up of five important components of which water is the main component. Food as well as potable water are essential for every human being. The food is obtained from plants through agriculture. Pesticides are being used extensively for a high yield in the fields. These pesticides are absorbed by the plants from the soil along with water and minerals and from the water bodies these pesticides are taken up by the aquatic animals and plants. As these chemicals are not biodegradable, they get accumulated progressively at each trophic level. The maximum concentration of these chemicals gets accumulated in our bodies and greatly affects the health of our mind and body.

Why is the maximum concentration of pesticides found in human beings?

16. Give one method which could be applied to reduce our intake of pesticides through food to some extent.

17. What is an ecosystem?

18. Why is a lake considered to be a natural ecosystem?

19. In the following food chain, plants provide 500 J of energy to rats. How much energy will be available to hawks from snakes?

Plants → Rats → Snakes → Hawks

20. In the following food chain, 100 J of energy is available to the lion. How much energy was available to the producers?

Plants → Deer → Lion

21. Why do producers always occupy the first trophic level in every food chain?

22. (a) From the following group of organisms create a food chain which is most advantageous for human beings in terms of energy.

Hawk, Rat, Cereal plant, Goat, Snake, Human being

(b) State the possible disadvantage if the cereal plant is growing in soil rich in pesticides.

(c) Construct a food web using the organisms mentioned above.

23. (a) Create a food chain of the following organisms.

Insect, Hawk, Grass, Snake, Frog

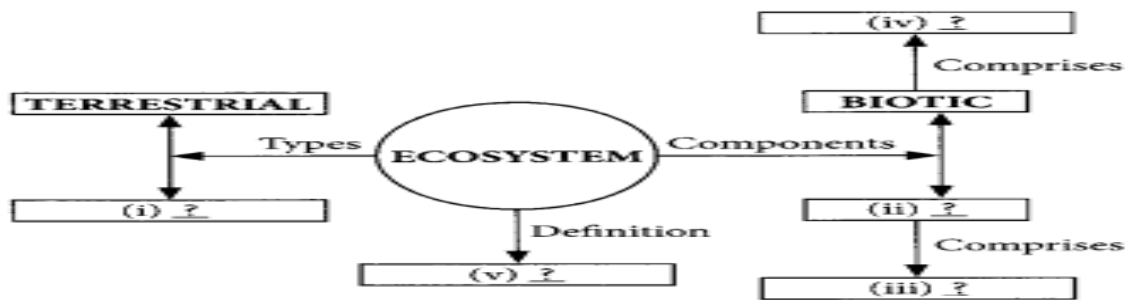
(b) Name the organism at the third trophic level of the created food chain.

(c) Which organism of this food chain will have the highest concentration of non-biodegradable chemicals?

(d) Name the phenomenon associated with it.

(e) If 10,000 Joules of energy is available to frogs, how much energy will be available to snakes in this food chain?

24. Complete the following flow chart based on ecosystem and its components



25. (a) Construct a terrestrial food chain comprising four trophic levels.
 (b) What will happen if we kill all organisms in one trophic level?
 (c) Calculate the amount of energy available to the organisms at the fourth trophic level. If the energy available to the organisms at the second trophic level is 2000 J.
26. Define an ecosystem. Draw a block diagram to show the flow of energy in an ecosystem.
27. “Our food grains such as wheat and rice, the vegetables and fruits and even meat are found to contain varying amounts of pesticide residues.” State the reason to explain how and why it happens.
28. “Industrialisation has adversely deteriorated the environment.” Give four reasons in support of this statement.
29. Why is Government of India imposing a ban on the use of polythene bags? Suggest two alternatives to these bags and explain how this ban is likely to improve the environment.
- 30 We often observe domestic waste decomposing in the bylanes of residential colonies. Suggest ways to make the residents realise that the improper disposal of their waste is harmful to the environment.

CASE STUDY

Food chains are very important for the survival of most species. When only one element is removed from the food chain it can result in extinction of a species in some cases. The foundation of the food chain consists of primary producers. Primary producers or autotrophs, can use either solar energy or chemical energy to create complex organic compounds, whereas species at higher trophic levels cannot and so must consume producers or other life that itself consumes producers. Because the sun's light is necessary for photosynthesis, most life could not exist if the sun disappeared. Even so, it has recently been discovered that there are some forms of life, chemotrophs, that appear to gain all their

metabolic energy from chemosynthesis driven by hydrothermal vents, thus showing that some life may not require solar energy to thrive.

1. If 10,000 J solar energy falls on green plants in a terrestrial ecosystem, what percentage of solar energy will be converted into food energy?

- (a) 10,000 J
- (b) 100 J
- (c) 1000 J
- (d) It will depend on the type of the terrestrial plant

2. Matter and energy are two fundamental inputs of an ecosystem. Movement of

- (a) Energy is by directional and matter is repeatedly circulating
- (b) Energy is repeatedly circulating and matter is unidirectional
- (c) Energy is unidirectional and matter is repeatedly circulating
- (d) Energy is multidirectional and matter is bidirectional

3. Raj is eating curd/yoghurt. For this food intake in a food chain he should be considered as occupying

- (a) First trophic level
- (b) Second trophic level
- (c) Third trophic level
- (d) Fourth trophic level

4. Which of the following, limits the number of trophic levels in a food chain

- (a) Decrease in energy at higher trophic levels
- (b) Less availability of food
- (c) Polluted air
- (d) Water

5. The decomposers are not included in the food chain. The correct reason for the same is because decomposers

- (a) Act at every trophic level at the food chain
- (b) Do not breakdown organic compounds

(c) Convert organic material to inorganic forms

(d) Release enzymes outside their body to convert organic material to inorganic forms

ANSWER KEY

MULTIPLE CHOICE QUESTIONS

1. b 2. a 3. d 4. c 5. d 6. b
7. a 8. d 9. a 10. c 11. a 12. c

ASSERTION AND REASON

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

SHORT QUESTIONS

1. Biological magnification is the increasing concentration of a substance such as a toxic chemical in the tissues of organisms at successively higher levels in a food chain
2. Any suitable example
3. The position of organisms in a food chain or an ecological pyramid is called as a trophic level. Autotrophs are in first trophic level and herbivores are in second trophic level
4. An ecosystem is a structural and functional unit of ecology where the living organisms interact with each other and the surrounding environment. Any suitable example
5. There are no microbes to clean water in aquarium, therefore, it needs to be regularly cleaned
6. The food chain is a linear sequence of organisms where nutrients and energy is transferred from one organism to the other
7. The energy enters the plants from the sun through photosynthesis which is then passed on from one organism to another in a food chain. The flow of energy in an ecosystem is unidirectional because the energy lost as heat from the living organisms of a food chain cannot be reused by plants in photosynthesis.
8. The ozone layer is found in the upper regions of the stratosphere where it protects the earth from the harmful ultraviolet rays of the sun. These radiations can cause skin cancer in humans.

9. Any suitable methods

10. Any two uses

11 It will disturb the food chains and food web, which in turn will decrease the chances of food availability to the succeeding trophic levels and will result in instability of the ecosystem.

12. Chlorofluorocarbons (CFCs) are the chemicals which are responsible for the depletion of ozone.

13. The various steps in a food chain at which the transfer of food (or energy) takes place are called trophic levels. In a food chain, each step representing an organism forms a trophic level.

14. The various steps of a food chain are called trophic levels. These steps are:

- First trophic level consists of producers.
- Second trophic level consists of primary consumers or herbivores.
- Third trophic level consists of secondary consumers or carnivores.

Fourth trophic level consists of tertiary consumers or top carnivores.

15. Ozone layer absorbs the harmful UV radiations of the sunlight, so this layer is very important for the survival and existence of life on earth.

16. Human beings are an important part of the environment. But human activities change the environment and the changes in the environment affect life on earth.

For example: An environmental problem caused by human activities is depletion of ozone layer. If the ozone layer in the atmosphere disappears completely, then all the extremely harmful ultraviolet radiations coming from the Sun would reach the earth and would cause skin cancer and other ailments. Therefore it is necessary to conserve our environment.

17. Difference between biodegradable and non-biodegradable wastes.

Biodegradable waste:

1. Wastes which can be broken down into non-poisonous substances in nature in due course of time by the action of micro-organisms are called bio-degradable wastes.
2. Plastic, glass, etc.

Non-biodegradable waste:

1. Wastes which cannot be broken down into non-poisonous substances in nature are called non-biodegradable wastes.

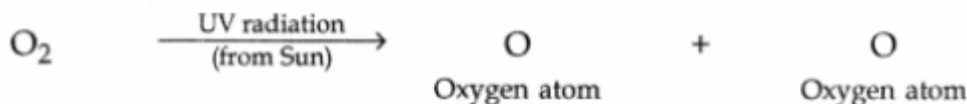
Sewage, peels of fruits and vegetables, etc

18. Bacteria and fungi are the two decomposers operating in our environment.
19. Those waste materials which can be broken down to non-poisonous substances in nature in due course of time by the action of micro-organisms like certain bacteria and fungi are called biodegradable waste.
For example, peels of fruits and vegetables, cattle dung etc.

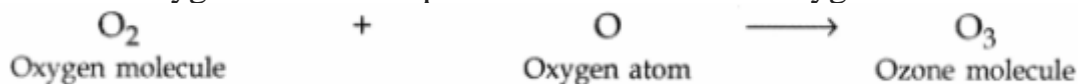
20. The depletion of ozone layer is due to the use of chemicals called chlorofluorocarbons.

21. Depletion of ozone in the ozone layer is a cause for our worry because if the ozone layer in the atmosphere disappears completely, then all the extremely harmful ultraviolet radiation coming from the Sun would reach the earth. These ultraviolet radiations would cause skin cancer and other ailments in men and animals, and also damage the plants.

22. The high energy ultraviolet radiation (UV radiation) coming from the Sun splits oxygen gas into free oxygen atoms



The free oxygen atoms thus produced react with an oxygen molecule to form ozone molecule



23. If the ozone layer in the atmosphere depletes then the extremely harmful ultraviolet radiations coming from the Sun would reach the earth. These uv-radiations would cause skin cancer and other ailments in men, animals and plants.

24. Biodegradable and non-biodegradable wastes should be discarded in two separate dustbins because biodegradable waste is decomposed by the micro-organisms to form simple harmless substances which can be used as manures for the plants (e.g., in the potted plants in our garden/terrace garden). Non- biodegradable waste cannot be broken down naturally.

25. Chlorofluorocarbons (CFCs) are the chemicals which are used in refrigerators and air conditioners as coolant when released into the air react with ozone gas present in the ozone

layer and destroy it gradually. If the ozone layer in the atmosphere disappears completely, then all the extremely harmful ultraviolet radiations coming from the Sun would reach the earth and cause skin cancer and other ailments in humans, animals and plants.

26. Ozone layer is very important for the existence of life on earth. The function of the ozone layer in the upper atmosphere is to absorb most of the harmful ultraviolet radiations coming from the sun and prevent them from reaching the earth's surface.

27. According to 10% law, only 10% of energy entering a particular trophic level of organisms is available for transfer to the next higher trophic level.

Energy available to 1st Trophic level = 10,000 J

1% of this energy = 100 J

So, First Trophic level has energy = 100 J

Energy to 2nd Trophic level = 10% of 100 J = 10 Joules

28. The first trophic level in a food chain is always a green plant because green plants have a mechanism for trapping solar energy with the help of their green pigment called chlorophyll and convert it into chemical energy which is stored as carbohydrates in the plant for the use of the next trophic level.

29. Herbivores are always at the second trophic level of food chains.

30. Two natural ecosystems are Lake and River.

31. Green plants are called producers because green plants synthesize their own food during photosynthesis by taking raw materials from the earth and energy from the Sun.

32. Excessive use of air conditioners which is a part of affluent lifestyle emits a lot of heat in the atmosphere.

Excessive use of packaging materials which are mostly made up of non-biodegradable material are not environment friendly.

Excessive use of petrol in vehicles also causes pollution.

Thus, affluent lifestyle results in the generation of excessive waste materials

33. Food chain. Grass → insect → frog → snake

∴ Frog belongs to 3rd trophic level.

34. Ecosystem is a unit of biosphere where interaction between biotic community and abiotic factors of an area or place takes place with each other.

35. 10,00,000 Joules.

36. Density of various components of the atmosphere is different. Therefore the earth's atmosphere is a heterogeneous mixture, for example, the heavier gases like CO₂, O₂ and N₂ of the atmosphere occupy the lower level (i.e., near the earth's surface) of the atmosphere whereas lighter gases like O₃ occupy the higher level of the atmosphere. So the components of atmosphere are not equally distributed.

37. Disadvantages of fossil fuels:

1. Fossil fuels are non-renewable source of energy.
2. The burning of fossil fuels produces acidic gases such as sulphur dioxide and nitrogen oxides. These acidic gases cause acid rain.
3. The burning of fossil fuels produces smoke which pollutes the air.

The burning of fossil fuels, especially coal, leaves behind a lot of ash.

38. Producer. Energy available = 10,000 J

[∴ Plants are able to synthesize only 1 % of total energy available to them]

∴ Energy produced by producer = 1% of 10,000 = $1/100 \times 10,000 = 100$ J

Primary consumer. Energy available = 100 J

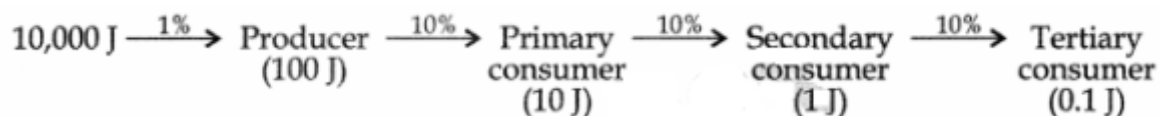
∴ Energy transfer from producer to primary consumer = 10% of 100 J = $10/100 \times 100 = 10$ J

Secondary consumer. Energy available = 10 J

∴ Energy transfer from primary consumer to secondary consumer = 10% of 10 J = $10/100 \times 10 = 1$ J

Tertiary consumer. Energy available = 1 J

∴ Energy transfer from secondary consumer to tertiary consumer = 10% of 1 J = $10/100 \times 1 = 0.1$ J



39. Harmful effects of using plastic bags:

- Plastic is non-biodegradable so it will remain as such and pollute the environment.
- Burning of plastic bags produces toxic gases.
- Plastic bags can block the drainage system.
- Discarded plastic bags when eaten by cows and other stray animals can block their alimentary canal and cause harm to them.

Plastic bags when thrown in the water bodies, can cause water pollution as these do not decompose. Cloth bags and bags made from recycled paper should be used in place of plastic bags.

40. Plastic bags are non-biodegradable which can not be broken down into non-poisonous substances in nature. Plastic bags are the main cause of sewer blockages as plastic bags are not decomposed by micro-organisms. Plastic bags if eaten by stray animals (like cows) can block their alimentary canal.

Two alternatives:

1. We should take our own jute or cloth bags while going for purchasing articles from the market.
2. Disposable paper cups should be used for serving tea in trains instead of plastic cups.
3. Shopkeepers can use paper bags instead of plastic bags.

41. Two environment friendly practices to help save the environment are:

1. Disposal of wastes after separating them into biodegradable and non-biodegradable waste material.
2. Use of unleaded petrol and alternate sources of energy, keeping the car engines properly tuned and serviced and tyres inflated to the right pressure, so that the vehicle runs smoothly.

42. Decomposers are microorganisms that break down complex organic substances (dead remains and waste products of organisms) into simpler inorganic substances that go into the soil and are used up once more by the plants.

Roles:

1. Decomposers play an important role in the cycling of materials in the biosphere.

By decomposing dead bodies of plants and animals they help in cleansing the environment. Example, Bacteria and fungi are examples of decomposers

43. Role of decomposers:

1. Decomposers naturally replenish the nutrients in the soil, air and water.
2. Decomposers help in keeping the environment clean. They play an important role in the cycling of materials in the biosphere.

44. If there were no decomposers, then the dead bodies of plants and animals would keep lying as such and the elements of which plant and animals bodies are made, would never be

returned to their original pools like soil, air and water. In that case, the cycling process of life and death would be disrupted. All the nutrients present in soil, air and water would soon be exhausted and evolution of life would come to an end.

45. The various ways to make residents aware of the harmful effects of improper disposal of wastes are as follows:

- By putting posters and hoardings.
- By distributing pamphlets to the residents.
- By conducting meetings of residents, welfare society, etc.
- By advertisements through TV/radio/cable operators, etc.
- There should be a strict fine imposed by the sanitary officer from the families which throw their domestic wastes on the roads.

Through all these mediums we can make the residents aware of how such waste serves as a breeding ground for mosquitoes, releases harmful gases, reduces soil fertility, etc.

Short Answer Type II ANSWERS

1. a) Characteristics of a good fuel:

- It should have a high calorific value.
- It should burn without giving out any smoke or harmful gases.
- Its ignition temperature should neither be too low nor too high.
- After burning it should not leave much ash behind.

(b) Those sources of energy which have accumulated in nature over a very very long time and cannot be quickly replaced when exhausted, are called non-renewable sources of energy. Example: Fossil fuels (coal, petroleum, natural gas) and nuclear fuels (uranium) are non-renewable sources of energy.

2. (a) Disadvantages of using fossil fuels are:

1. Fossil fuels are non-renewable source of energy.
2. Elements like carbon, nitrogen and sulfur are present in fossil fuels. When fossil fuels are burnt, these elements react with oxygen of air to produce oxides which are acidic in nature. This leads to acid rain which adversely affects the quality of water and soil.
3. CO_2 is a gas which produces greenhouse effect. This leads to global warming.
4. CO produced is a toxic gas that causes respiratory problems.

(b) (i) Examples of renewable sources of energy:

1. Solar energy
2. Tidal energy
3. Hydel power

(ii) Examples of non-renewable sources of energy:

1. Diesel
2. Petrol
3. CNG

3. Rainwater collected on the roof is not allowed to go into the drain. It is allowed to percolate under the ground by a specially made passage so as to recharge the ground-water. This process is called rainwater harvesting.

Advantages of rainwater harvesting:

- Rainwater stored as underground water does not evaporate.
- The water stored in ground does not promote breeding of mosquitoes.
- It is protected from contamination by human and animal waste.
- This water recharges wells.

4. Three problems that arise due to construction of big dams:

1. Social problems. Due to the construction of high rise dams, a large number of human settlements are submerged in the water of large reservoir formed by the dam and many people are rendered homeless.

2. Environmental problems. The construction of high-rise dams leads to deforestation and loss of biodiversity as vast variety of flora and fauna get submerged in the water of large reservoir formed by the dam and disturbs the ecological balance.

3. Economic problems. Some people believe that the construction of high-rise dams involves the spending of huge amounts of public money without the generation of proportionate benefits.

Suggestions for these problems. All the people who are displaced from the dam site should be given adequate compensation by the Government for rehabilitation so as to start their life afresh.

5. When fossil fuels are burnt, the products of combustion are – carbon dioxide, water, sulphur dioxide and nitrogen oxides. If combustion takes place in an insufficient supply of air then carbon monoxide is produced. All these products are harmful and create some adverse effects on the environment.

- Sulphur dioxide dissolves in rainwater making it acidic. The acid rain thus produced damages trees, plants, buildings and metal structures.
- Nitrogen oxide also causes acid rain.
- Carbon monoxide is a greenhouse gas which traps Sun's heat energy falling on the earth. The increased carbon dioxide in the atmosphere causes increased greenhouse effects leading to global warming.

6. (a) An ecosystem is a self-contained unit of living things (plants, animals and decomposers) and their non-living environment (soil, air and water). An ecosystem needs only the input of sunlight energy for its functioning.

The two main components of an ecosystem are:

1. Abiotic component. It includes all non-living components like soil, water, air temperature, light, pressure, etc.
2. Biotic component. It includes all living components like plants, animals, decomposers, etc.

(b) A pond is a self sufficient or independent unit in nature. It contains all the components of the ecosystem. In this ecosystem, producers (hydrophytes) trap the solar energy and then provide the basic food or energy for all other life in the pond. When the producers and consumers die, the decomposers present in the pond act on their dead bodies to return the various elements back to the nutrient pool.

On the other hand, in an aquarium there are not any producers and nutrient pool to trap solar energy, therefore the fishes living in an aquarium need to be nourished. Moreover due to absence of decomposers the excreta of the fishes cannot be decomposed. Therefore the aquarium needs to be cleaned regularly.

7. Non-biodegradable wastes cannot be decomposed into simpler harmless substances by the action of micro-organisms. These substances persist in the environment and cause adverse effects on the environment.

1. The use of pesticides, insecticides has increased agricultural output but the chemicals present in them enter water and food chains. This affects the fertility of the soil and causes water and soil pollution.
2. Plastic bags have changed the modern lifestyle but cause severe problems. They cause blockages in the drainage systems and these plastic bags when eaten by stray animals cause harm to them.

Methods of safe disposal of the non-biodegradable waste. (i) Molten plastic waste mixed with asphalt can be used for making roads, (ii) Solid wastes should be buried in the urban areas as land fills.

8. Pesticides are poisonous chemical substances which are sprayed over crop plants to protect them from pests and diseases. These pesticides mix up with soil and water and are then absorbed by growing plants along with water and other minerals.

Thus pesticides enter the food chain at the producer level (plant level) and in the process of transfer of food through food chains these harmful chemicals get concentrated at each trophic level. These chemicals are non-biodegradable, so they get accumulated at each trophic level. Pesticides present in wheat grains, fruits vegetables and meat cannot always be removed by washing, etc.

9. “Energy flow in a food chain is unidirectional.” In the ecosystem energy flows from one trophic level to the next trophic level of the food chain. Energy flows from producers i.e., green plants to the consumers. It does not flow from the last consumer to its previous consumer and so on. Thus the energy does not flow back from consumers to the producers. So we say that flow of energy in an ecosystem is unidirectional.

Entry of pesticides in a food chain: Some harmful chemicals like pesticides, when absorbed by the plants through soil and water, get transferred from first trophic to the last trophic level of the food chain. As these chemicals are non-degradable, their concentration in the bodies of living organisms at each trophic level progressively increases. Their increase in the concentration of harmful chemicals in the body of living organisms at each trophic level of a food chain is called biological magnification. The level of concentration of chemicals is maximum for human beings as they are at the highest trophic level

10. Burning of plastic is not an eco-friendly method of waste disposal because it produces toxic gases which cause too much air pollution. It has an adverse effect on the health of all types of living organisms including human beings. The method of waste disposal used by Rakesh is advantageous as the leftover food and peels of fruits are biodegradable and can be used as manure. The plastic bags and cans should be disposed off in red dustbins from where they can be sent for recycling, thereby keeping the environment clean.

11. Difference between biodegradable substances and non-biodegradable substances.
Biodegradable waste:

1. Wastes which can be broken down into non-poisonous substances in nature in due course of time by the action of micro-organisms are called bio-degradable wastes.
2. Plastic, glass, etc.

Non-biodegradable waste:

- Wastes which cannot be broken down into non-poisonous substances in nature are called non-biodegradable wastes.
- Sewage, peels of fruits and vegetables, etc.

Habits for disposing non-biodegradable waste:

- Disposal of wastes after separating them into biodegradable and non-biodegradable wastes in separate dustbins and treating wastes properly before dumping in landfills.
- Encourage the use of gunny bags, jute bags and paper bags in place of polythene/plastic bags.
- Recycle the plastic and glass objects after use.

12. (a) Decomposers break down complex organic substances (dead remains and waste products of organisms) into simpler inorganic substances that can be absorbed by the plants. They are essential for the proper functioning of an ecosystem.

- Decomposers play an important role in the cycling of materials in the biosphere.
- By decomposing dead bodies of plants and animals they help in cleaning the environment.
- They replenish the soil naturally.

(b) In the ecosystem energy flows from one trophic level to the next trophic level of the food chain. Energy flows from producers, i.e., green plants to the consumers. It does not flow from the last consumers to its previous consumers and so on. The energy captured by the autotrophs does not go back to the solar input. Thus the energy does not flow back from consumers to the producers. Hence the flow of energy in a food chain is unidirectional.

13. (a) It is necessary to conserve our environment because of the following reasons:

- To save natural resources like air, water and soil from pollution which are essential for our survival.
- To maintain ecological balance in nature.
- The environment provides us fresh air to breathe, a number of useful products such as wood, paper, medicines, etc. The ozone layer of the environment also protects us from harmful ultraviolet radiations from the sun.

(b) Green dustbins are used for biodegradable wastes and blue dustbins are used for non-biodegradable wastes.

Importance of two types of dustbins:

- Disposal of wastes after separating them into biodegradable and non-biodegradable wastes in separate dustbins and treating wastes properly before dumping in landfills.
- Segregation of biodegradable and non-biodegradable wastes occur without wasting time and energy.

14.a) The scientists were exposed to harmful UV-radiations of the sunlight as there was a big hole over Antarctica and this might be the cause of skin cancer. The ozone layer acts as an ozone shield and absorbs the harmful UV-radiations. The UV-radiations have extremely harmful effects on human beings, animals as well as plants.

(b) We learn that the ozone layer is very important for the existence and survival of life on earth. Ozone layer absorbs high energy UV-radiations causing a rise in temperature of the stratosphere. The use of chemicals like CFCs has endangered the ozone layer. CFCs used as refrigerator coolants rise to the stratosphere where these molecules are broken down by UV-rays resulting in attack on the ozone molecules damaging the ozone umbrella of earth.

Due to ozone layer depletion UV-rays reaching the earth cause skin cancer, cataracts, damage immune system, etc. UV-rays also decreases crop yield and certain fish larvae which are important constituents of aquatic food chains. It may also disturb global rainfall causing ecological disturbance. In this way all on the earth would be destroyed gradually.

- 15. The pesticides are not biodegradable, they get accumulated progressively at each trophic level. As human beings occupy the topmost level in food chain, their concentration becomes maximum in our bodies

16. By using biological methods for controlling insects in fields and by washing fruits and vegetables before eating could help to reduce our intake of pesticides through food to some extent.

17. An ecosystem is defined as a structural and functional unit of the biosphere. It comprises of living organisms and their non-living environment that interact by means of food chains and biogeo-chemical cycles resulting in energy-flow, biotic diversity and material cycling to form stable self-supporting system.

18. Lake is an ecosystem where living organisms grow, reproduce and interact among each other as well as with abiotic components and carry out other activities in nature by themselves without any human interference, therefore it is referred to as a natural ecosystem.

19. In an ecosystem, only 10% of energy is transferred from one trophic level to next, i.e. 10 percent law and rest is dissipated into the environment. Therefore, if plants (being producers-1st trophic level)-transfer 500 J of energy to rats (2nd trophic level) then rats would transfer 50 J of energy to snakes (3rd trophic level) which in turn will transfer only 5 J of energy to

hawks (4th or last trophic level) in a food chain.

Plants → Rats → Snakes → Hawks
5000 J 500 J 50 J 5 J

20. As per 10% law of flow of energy in an ecosystem only 10% of energy is received by the next trophic level. Hence, in the given food chain : If 100 .J of energy is available to lion, the plants or producers have 10,000 J of energy available to them.

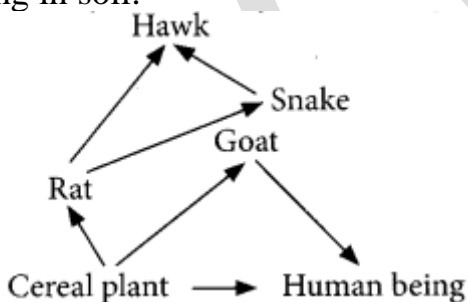
Plants → Deer → Lion
10,000 J 1000 J 100 J

21. Producers are the green plants that can manufacture food using CO₂ and H₂O in the presence of sunlight, i.e., they are autotrophs. They serve as a source of food for all non-producers or consumers directly or indirectly. Hence, producers occupy the first trophic level in a food chain.

22. (a) A food chain which is most advantageous for human beings in terms of energy is:
Cereal plant → Human being

(b) If the cereal plant is growing in soil rich in pesticides, these pesticides are absorbed by growing plants along with water and minerals, when animals eat these cereal plants, these poisonous chemical pesticides go into their bodies through food. This increase in concentration of harmful pesticides in the body of living organisms at each trophic level of a food chain is called biological magnification. Pesticides are lethal to non-target species also. The extensive use of pesticides in agriculture can change the community of microorganisms living in soil.

(c)



23. (a) Grass → Insect → Frog → Snake → Hawk

(b) Frog is present in the above created food chain.

(c) Hawk is the top consumer of the food chain, so, it will have high concentration of non-biodegradable chemicals.

(d) Biological magnification

(e) As per 10% law of flow of energy in an ecosystem, only 10% of energy is received by the next trophic level. Hence, in the given food chain, if 10,000 Joules of energy is available to

frog, then the energy available to snakes will be 1000 Joule.

Grass → Insect → Frog → Snake → Hawk
10,00000 J 10,0000 J 10,000 J 1000 J 100 J

- 24. Aquatic
- Abiotic
- Inorganic substances
- Producers
- Structural and functional unit of biosphere

25. (a) A terrestrial food chain with four trophic levels is :

Grass → Insect → Frog → Eagle

(b) Removal of the organisms of any trophic level will always adversely affect the ecosystem, e.g., the removal of lions and tigers (top carnivores) will cause rapid increase in deer population, which leads to rapid consumption of vegetation resulting in scarcity of vegetation and population crash of deer.

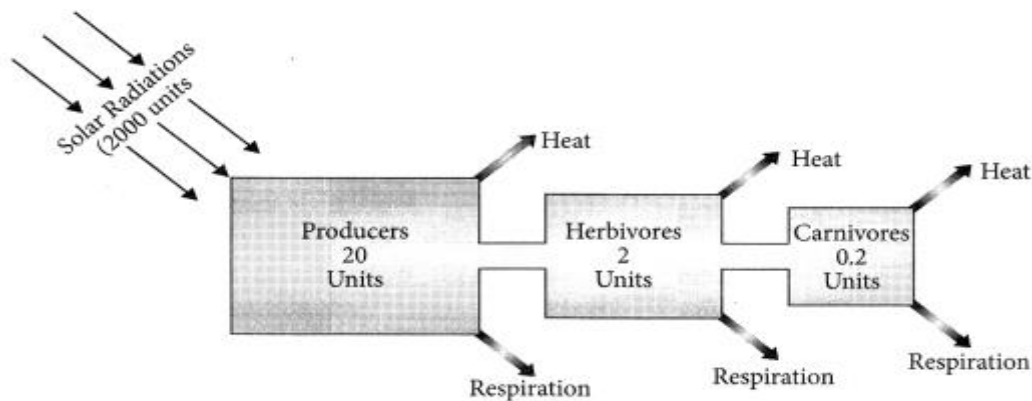
(c) According to ten percent law, only 10% of the energy is received by the next trophic level.

Producers → Primary → Secondary → Tertiary
consumer consumer consumer
T₁ T₂ T₃ T₄
20,000 J 2000 J 200 J 20 J

If the energy available at second trophic level (T₂) is 2000 J, so the 20 J of energy will be at fourth trophic level (T₄).

26. An ecosystem is defined as a structural and functional unit of the biosphere. It comprises of living organisms and their non-living environment that interact by means of food chains and biogeo-chemical cycles resulting in energy-flow, biotic diversity and material cycling to form stable self-supporting system.

Green plants capture about 1% of the solar energy incident on the earth to carry out the process of photosynthesis. A part of this trapped energy is used by plants in performing their metabolic activities and some energy is released as heat into the atmosphere. The remaining energy is chemical energy stored in the plants as photosynthetic products. When these green plants are eaten up by herbivores, the chemical energy stored in the plants is transferred to these animals. These animals (herbivores) utilise some of this energy for metabolic activities and some energy is released as heat while the remaining energy is stored in their body. This process of energy transfer is repeated till top carnivores. In an ecosystem, transfer of energy follows 10 percent law, i.e., only 10 percent of the energy is transferred to each trophic level from the lower trophic level. Nearly 90 percent of energy is lost when it moves from one trophic level to the next. The given block diagram shows unidirectional flow of energy at different trophic levels in a freshwater ecosystem.



27. Pesticides are poisonous chemical substances which are sprayed over crop plants to protect them from pests and diseases. These chemical pesticides mix up with soil and water. From soil and water, these pesticides are absorbed by the growing plants along with water and other minerals. When herbivorous animals feed on these plants the poisonous pesticides enter their bodies through the food chain. Similarly, when the carnivorous animals eat these herbivores, the pesticides get transferred to their bodies. Therefore, the plant products such as food grains, vegetables and fruits as well as meat of animals contain varying amounts of pesticide residues in them depending upon the trophic level they occupy in a food chain.

- ways Abiotic components – Non-living components of ecosystem, e.g., soil, water, air, light, etc.
- Biotic components – Living components of ecosystem, e.g., plants, animals and microbes.

28. Industrialisation has deteriorated our environment in the following:

Rapid industrialisation has increased the demand of more land area for setting up of new factories. This demand is being fulfilled by clearing up of forest area. Deforestation is one of the major causes of ecological imbalance, biodiversity loss and ecosystem instability.

- Industries release various harmful gases in the environment which pollute the air. These gases when inhaled by people around, cause various respiratory diseases in them.
- A lot of effluent and liquid waste is discharged from various industries which is mostly dumped into nearby water bodies. This causes water pollution. Polluted water causes death of various aquatic organisms and consumption of this polluted water causes various diseases in humans.
- The solid waste released from factories is dumped on open land and not treated properly to ensure their proper decomposition. This leads to land pollution that degrades quality of soil and also causes various kinds of diseases in humans and animals.

29. Government of India is imposing a ban on the use of polythene bags because these are non-biodegradable substances which are not acted upon by the microbes. So, they cannot be

decomposed and therefore persist in the environment for a long time thereby causing harm to the ecosystem. Such bags choke drains which results in water logging, that allows breeding of mosquitoes and hence leads to various diseases like malaria, dengue, etc. Jute bags and cloth bags are the alternatives to the polythene bags.

30. Some of the ways to make people realise that the improper disposal of waste is harmful to the environment includes making people aware of negative impacts of waste disposal.

They can be made aware by:

- (i) Conducting seminars about the negative effects of the wastes on environment.
- (ii) Usage of pamphlets and posters for providing information.
- (iii) Forming an eco-club in the society for spreading awareness about the ill effects of waste on the surroundings such as :

- Improper disposal of waste will release harmful gases in the environment that make it unclean and unhygienic for the living organisms.
- The waste will flow to water bodies along with rain water and become a threat to aquatic life and pollute the water bodies.
- It provides space for breeding of the mosquitoes and which results in spread of malaria, filariasis, dengue, etc.
- Hazardous chemicals from wastes get into the soil and can harm the plants when they take up the contamination through their roots. This will affect the health of other animals and humans and will have negative impact on environment.

CASE STUDY

1. b

2. c

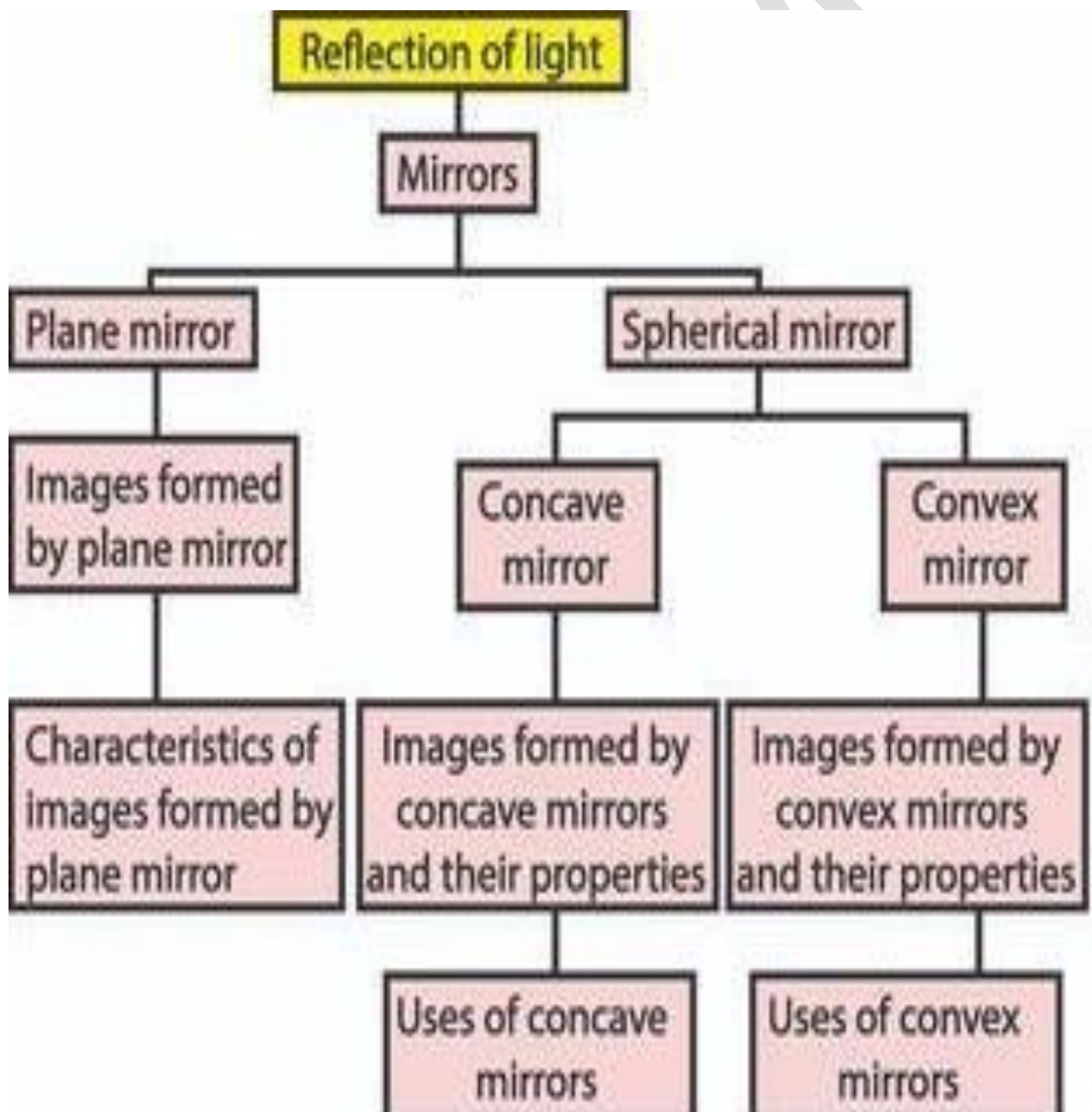
3. C

4. a

5. A

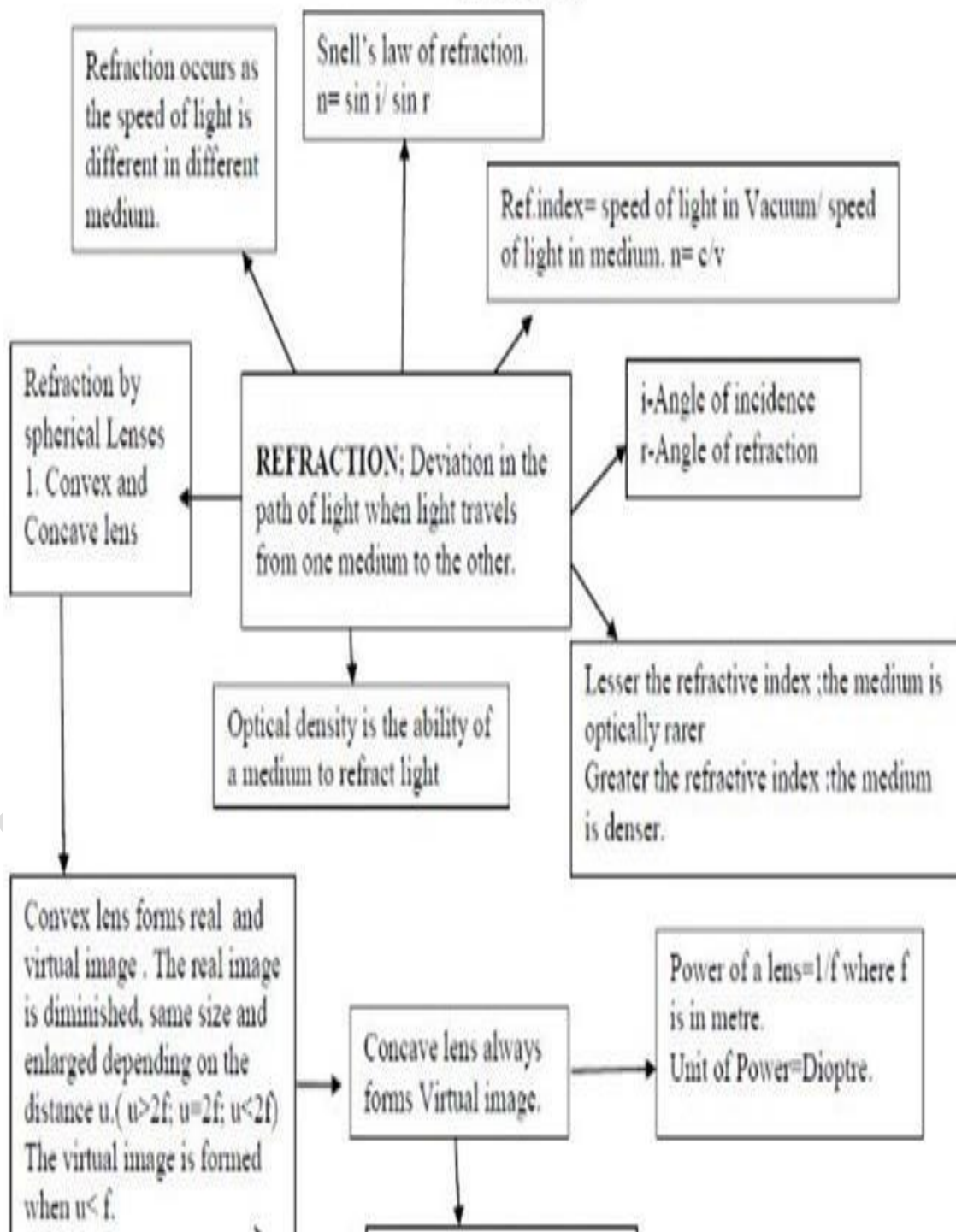
LIGHT

Mind Map



REFRACTION OF LIGHT

MIND MAP



Important Points to

remember REFLECTION OF LIGHT

When light falls on an object it is sent back into the same medium. This is called reflection of light.

LAWS OF REFLECTION OF LIGHT:-

- i) The angle of incidence is equal to the angle of reflection.
- ii) The incident ray, the reflected ray and the normal to the mirror at the point of incidence all lie in the same plane.

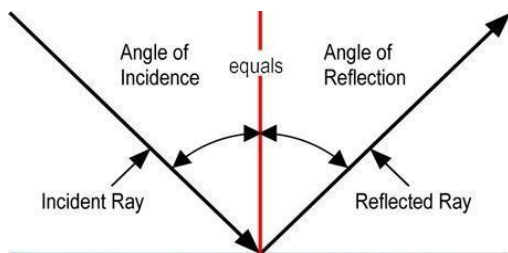


IMAGE FORMATION BY A PLANE MIRROR

- The image is virtual (image cannot be obtained on a screen). And erect.
- The image is the same size as the object.
- The image is at the same distance from the mirror as the object is in front of it.
- The image is laterally inverted.

SPHERICAL MIRRORS:

It is a curved mirror which is a part of a hollow sphere. Spherical mirrors are of two types'concave mirror and convex mirror.

a) Concave mirror (converging mirror):-

- Concave mirror is a spherical mirror whose reflecting surface is curved inwards.
- Rays of light parallel to the principal axis after reflection from a concave mirror meet at a point (converge) on the principal axis.

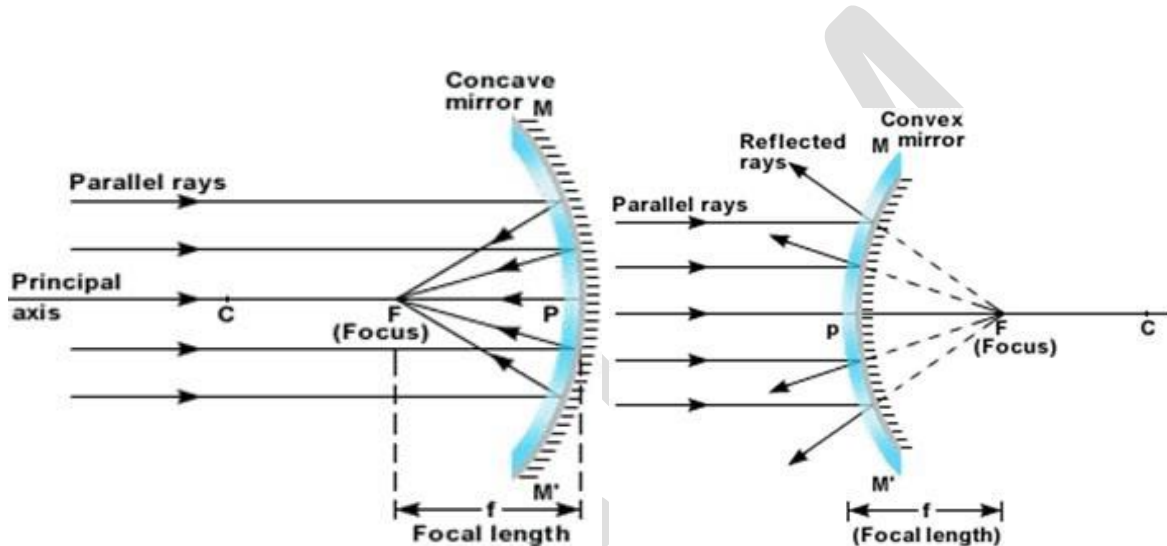
b) Convex mirror (diverging mirror) :-

- It is a spherical mirror whose reflecting surface is curved outwards.
- Rays of light parallel to the principal axis after reflection from a convex mirror get diverged and appear to come from a point behind the mirror.



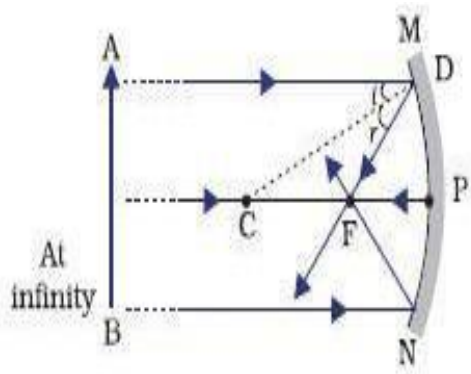
(a) Concave mirror (b) Convex mirror

TERMS USED IN THE STUDY OF SPHERICAL MIRRORS:

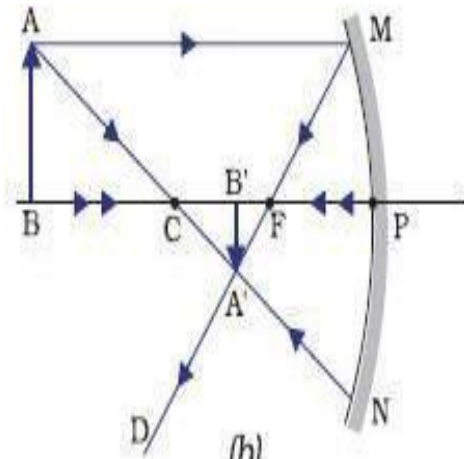


- i) **Centre of curvature (C):** - It is the centre of the sphere of which the mirror is a part.
- ii) **Radius of curvature:** - It is the radius of the sphere of which the mirror is a part (CP).
- iii) **Pole:** - It is the centre of the spherical mirror (P).
- iv) **Principal axis:** - It is the straight line passing through the centre of curvature and the pole.
- v) **Principal focus:** - In a concave mirror, light rays parallel to the principal axis after reflection meet at a point on the principal axis called principal focus (F).
In a convex mirror, rays of light parallel to the principal axis after reflection get diverged and appear to come from a point on the principal axis behind the mirror called principal focus (F).
- vi) **Focal length:** - is the distance between the pole and principal focus
- (f) In a spherical mirror the radius of curvature is twice the focal length. $R = 2f$

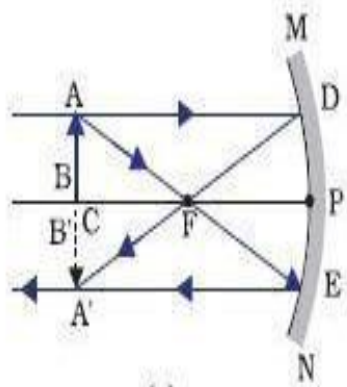
IMAGE FORMATION BY CONCAVE MIRROR



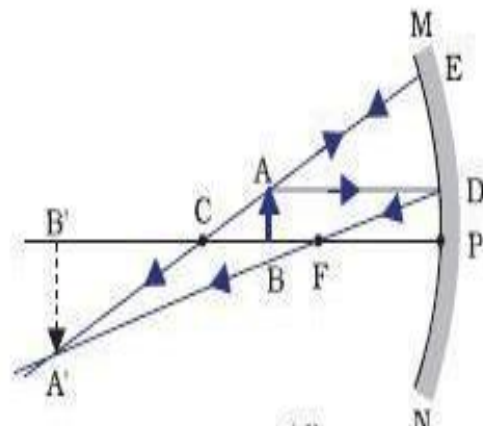
(a)



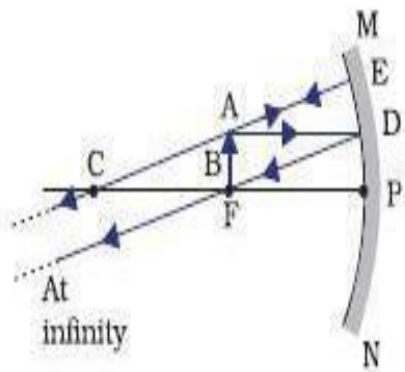
(b)



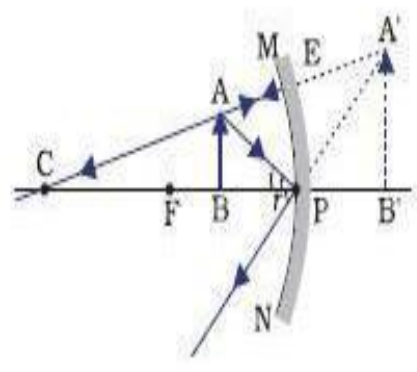
(c)



(d)



(e)

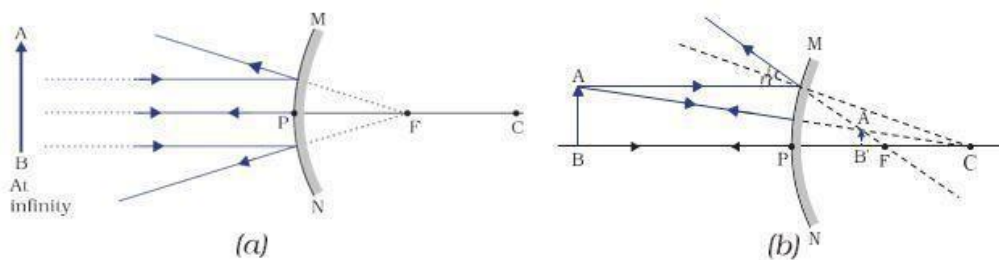


(f)

POSITION OF THE IMAGE FOR VARIOUS POSITIONS OF THE OBJECT FOR A CONCAVE MIRROR

Sno	Position of object	Position of image	Nature of image	uses
1	At infinity	At F	Real, inverted and point sized	Collect solar radiations in solar devices
2	Beyond C	Between C and F	Real, inverted and diminished	
3	At C	At C	Real, inverted and same size	Reflecting mirror for projector lamp
4	Between C and F	Beyond C	Real, inverted and enlarged	
5	At F	At infinity	Real, inverted and highly enlarged	Torches and headlights
6	Between F and P	Behind the mirror	Virtual erect and magnified	Shaving mirror, dentist mirror

IMAGE FORMATION BY CONVEX MIRROR



Images Formed by Convex Mirror

Position of Object: at infinity
Position of Image: at F behind the mirror
Properties of the image: highly diminished, virtual and erect

Position of Object: between infinity and pole
Position of Image: behind the mirror
Properties of the image: diminished, virtual and erect

POSITION OF THE IMAGE FOR VARIOUS POSITIONS OF THE OBJECT FOR A CONVEX MIRROR

S N o	Position of object	Position of image	Nature of image	uses
1	At infinity	At focus F	Virtual erect and point sized	Used as rear view mirror
2	Between infinity and pole	Between F and P	Virtual erect and diminished	Used as rear view mirror

Uses of Spherical Mirrors

Concave mirrors:-

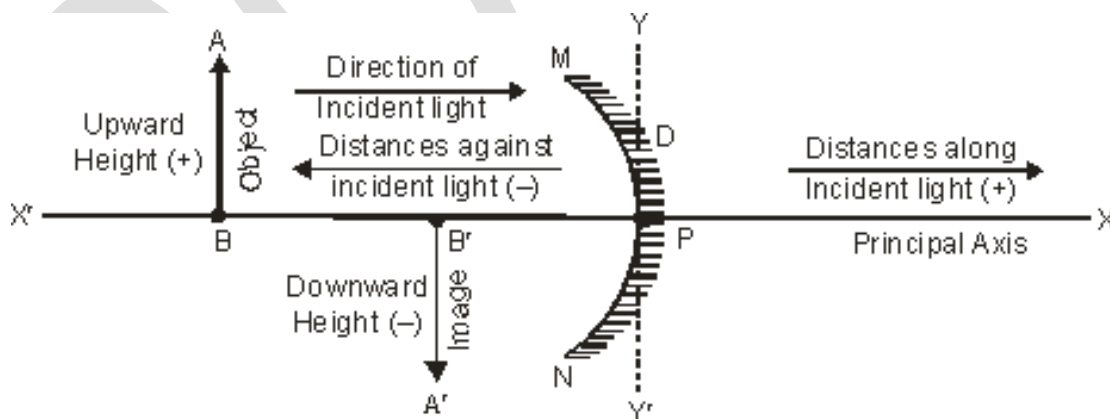
- Concave mirrors are used in torches, search lights and head lights of vehicles to get parallel beams of light.
- They are used as shaving mirrors to see larger image of the face.
- They are used by dentists to see larger images of the teeth.
- Large concave mirrors are used to concentrate sunlight to produce heat in solar furnaces.

Convex mirrors:-

- Convex mirrors are used as rear-view mirrors in vehicles because they form erect diminished images of objects. They also have a wider field of view.

NEW CARTESIAN SIGN CONVENTION FOR SPHERICAL MIRRORS:-

- The object is always placed on the left of the mirror and light from the object falls from the left to the right.
- All distances parallel to the principal axis are measured from the pole.
- All distances measured to the right of the pole are taken as +ve.
- All distances measured to the left of the pole are taken as -ve.
- The height measured upwards perpendicular to the principal axis is taken as +ve.
- The height measured downwards perpendicular to the principal axis is taken as -ve.



MIRROR FORMULA FOR SPHERICAL MIRRORS:-

The mirror formula for spherical mirrors is the relationship between the object distance (u), image distance (v) and focal length (f).

The mirror formula is expressed

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

$$- \quad + \quad - \quad = \quad -$$

$$v \quad u \quad f$$

b) Magnification for spherical mirrors:-

Magnification for spherical mirrors is the ratio of the height of the image to the height of the object.

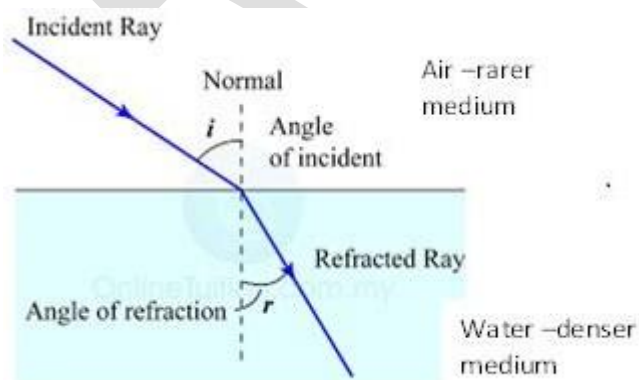
$$\text{Magnification} = \frac{\text{Height image } h_i}{\text{Height object } h_o} = m = -$$

The magnification is also related to the object distance and image distance. It is expressed as :-

$$\text{Magnification } m = \frac{h_i}{h_o} = \frac{v}{u} = -\left(\frac{v}{u}\right)$$

REFRACTION OF LIGHT

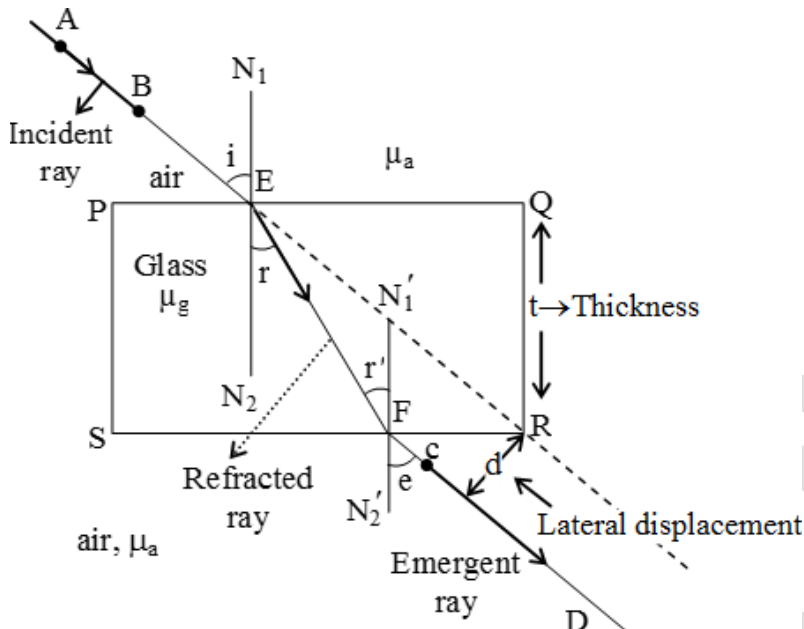
- When light travels **obliquely** from one transparent medium into another it gets bent. This bending of light is called refraction of light.
- When light travels from a rarer medium to a denser medium, it bends towards the normal.
- When light travels from a denser medium to a rarer medium it bends away from the normal.



REFRACTION OF LIGHT THROUGH A GLASS SLAB

When a ray of light passes through a rectangular glass slab, it gets bent twice at the air- glass interface and at the glass- air interface.

The emergent ray is parallel to the incident ray and is displaced through a



distance. This displacement is called the lateral shift.

LAWS OF REFRACTION OF LIGHT:

- i) The incident ray, the refracted ray and the normal to the interface of two transparent media at the point of incidence, all lie in the same plane.
- ii) The ratio of the sine of angle of incidence to the sine of angle of refraction is a constant, for the light of a given colour and for the given pair of media. (This law is also known as Snell's law of refraction.) $\sin i / \sin r = \text{constant}$

Refractive index:-

The absolute refractive index of a medium is the ratio of the speed of light in air or vacuum to the speed of light in a given medium.

Refractive index = $\frac{\text{Speed of light in air or vacuum}}{\text{Speed of light in the medium}}$ Or $n = c/v$

The relative refractive index of a medium 2 with respect to a medium 1 is the ratio of the speed of light in medium 1 to the speed of light in medium 2.

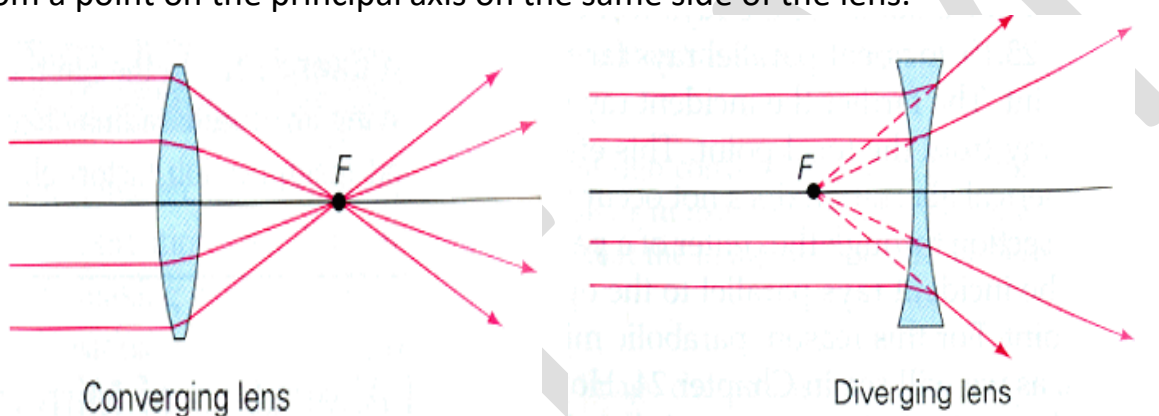
$n_{21} = v_1/v_2$ (refractive index of medium 2 with respect to 1)
 $n_{12} = v_2/v_1$ (refractive index of medium 1 with respect to 2)

SPHERICAL LENS

A spherical lens is a transparent material bounded by two surfaces one or both of which are spherical.

Spherical lenses are of two main types. They are convex and concave lenses.

- i) Convex lens: - It is thicker in the middle and thinner at the edges. Rays of light parallel to the principal axis after refraction through a convex lens meet at a point (converge) on the principal axis.
- ii) Concave lens: - It is thinner in the middle and thicker at the edges. Rays of light parallel to the principal axis after refraction get diverged and appear to diverge from a point on the principal axis on the same side of the lens.



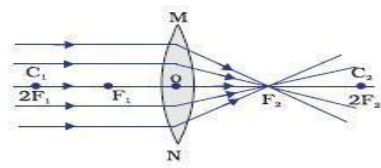
IMPORTANT TERMS RELATED TO SPHERICAL LENSES

- **Optical Centre** : The midpoint or the symmetric centre of a spherical lens is known as its Optical Centre. It is represented by the letter O
- **Aperture**: The diameter of a circular lens is called its aperture of the lens.
- **Principal Axis**: The line passing through the optical centre and the centre of curvature.
- **Centre of curvature (C)**: The centres of the spheres that the spherical lens was a part of. A spherical lens has two centres of curvatures.
- **Focus (F)**: It is the point on the axis of a lens to which parallel rays of light converge or from which they appear to diverge after refraction.
- **Focal length**: Distance between optical centre and focus.

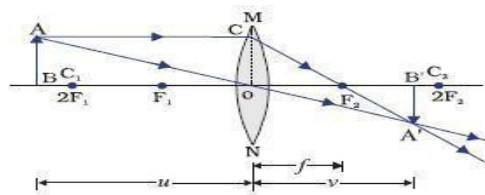
RULES TO DRAW RAY DIAGRAM

- A ray of light parallel to principal axis passes/appears to pass through the focus.
- A light ray passing through the focus after refraction passes parallel to the principal axis.
- A ray passing through the optical centre undergoes zero deviation

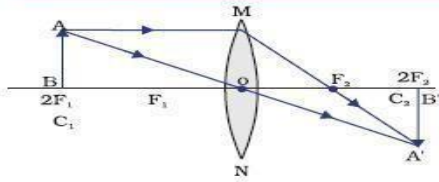
IMAGE FORMATION IN CONVEX LENS



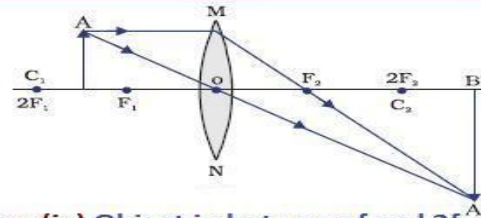
Case (i) Object at infinity



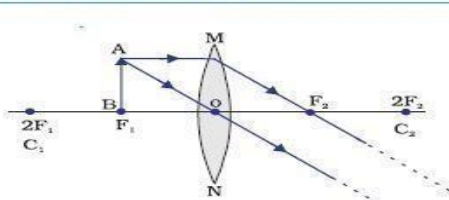
Case (ii) Object at beyond $2f$



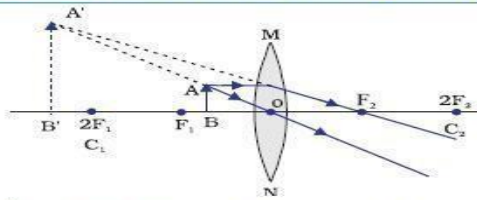
Case (iii) Object at $2f$



Case (iv) Object in between f and $2f$



Case (v) Object at f

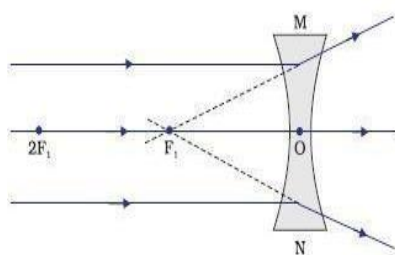


Case (vi) Object distance $< f$

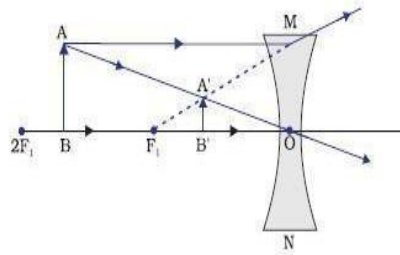
NATURE OF IMAGE FORMED BY A CONVEX LENS

SNo	Position of object	Position of image	Nature of image
1	At infinity	At F_2	Real, inverted and point sized
2	Beyond $2F_1$	Between F_2 and $2F_2$	Real, inverted and diminished
3	At $2F_1$	At $2F_2$	Real, inverted and same size
4	Between F_1 and $2F_1$	Beyond $2F_2$	Real, inverted and enlarged
5	At F_1	At infinity	Real, inverted and highly enlarged
6	Between F_1 and Optical centre O	Same side of the lens as the object	Virtual erect and magnified

IMAGE FORMATION IN CONCAVE LENS



(a)



(b)

NATURE OF IMAGE FORMED BY A CONVEX LENS

SNo	Position of object	Position of image	Nature of image	uses
1	At infinity	At F1	Virtual erect and point sized	Used for correcting Myopia
2	Between infinity and O	Between F1 and O	Virtual erect and diminished	Used for correcting Myopia

LENS FORMULA

The lens formula is expressed as :-

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

b) Magnification for lens :-

Magnification for lens is the ratio of the height of the image to the height of the object.

$$\text{Magnification} = \frac{\text{Height image}}{\text{Height object}} \quad m = \frac{h_i}{h_o}$$

The magnification is also related to the object distance and image distance. It is expressed as :-

$$\text{Magnification } m = \frac{h_i}{h_o} = \frac{v}{u}$$

INTERPRETING NATURE OF IMAGE FORMED

- If the magnification of a lens or mirror is negative, then the image formed is inverted and real.
- If the magnification of a lens is positive, then the image formed is erect and virtual.
- If $m > 1$ image is magnified
 $m = 1$ image is same size as object
 $m < 1$ image is diminished

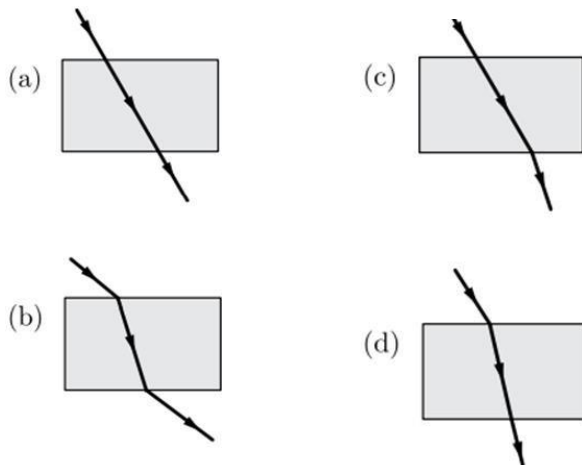
POWER OF LENS

- Power is defined as the degree of convergence or divergence of light rays by a lens. It is represented by 'P'.
- It is the reciprocal of the focal length. Therefore power of convex lens is always positive and that of concave lens is negative
- SI unit of Power is dioptre denoted by (D).
- $P=1/f$ where f is expressed in meters
- 1 dioptre is defined as the power of a lens whose focal length is 1m.
- $1D=1m^{-1}$

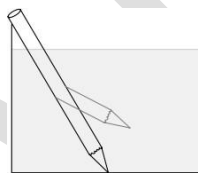
PRACTICE EXERCISES MULTIPLE

CHOICE QUESTIONS

1. A mirror and a lens each have focal length of -15 cm. The mirror and the lens are likely to be-
 - (a) both concave
 - (b) both convex
 - (c) the mirror is concave and the lens is convex
 - (d) the mirror is convex, but the lens is concave
2. No matter how far you stand from a mirror, your image appears erect. The mirror is likely to be
 - (a) Plane
 - (b) Concave
 - (c) Convex
 - (d) Either plane or convex
3. As light travels from a rarer to a denser medium it will have
 - (a) Increased velocity
 - (b) Decreased velocity
 - (c) Decreased wavelength
 - (d) both (b) and (c)
4. The path of a ray of light coming from air passing through a rectangular glass slab traced by four students is shown in figure. Which one of them is correct?

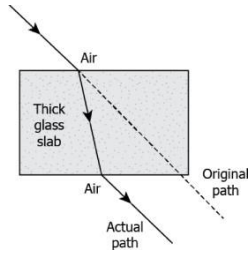


5. When light travels from one medium to another which of the following factor doesnotchanges?
- (a) Wavelength (b) **Frequency**
 (c) Velocity (d) None of these
6. The velocity of light is maximum in a medium of
 (a) glass (b) water (c) **vacuum** (d) diamond
7. Which statement best describes the property of light waves illustrated in



the diagrambelow?

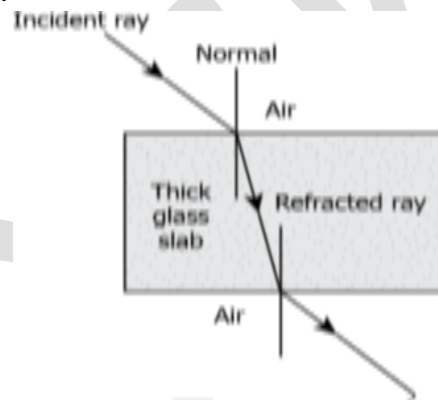
- (a) Some materials absorb light waves.
 (b) Some materials refracted by some materials
 (c) **Light waves are refracted by some materials.**
 (d)Light waves are emitted by some materials
8. A student conducts an activity using a flask of height 15 cm and a concave mirror. Hefinds that the image formed is 45 cm in height. What is the magnification of the image?
 (a) 45 times (b) 1/ 45 times (c) 1/ 3 times (d) **3 times**
09. The image shows the path of light travelling through a glass slab.



What causes the ray of light to deviate from its original path?

- (a) change in the amount of light
- (b) change in the direction of wind flow
- (c) change in the temperature of the air
- (d) change in the density of the medium**

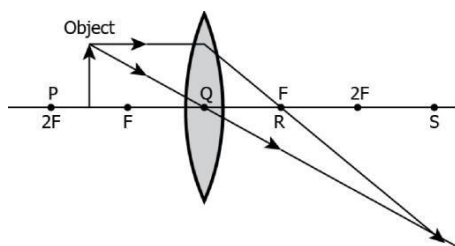
10. A student studies that when a ray of light travels from air into the glass slab, the ray of light bends towards the normal. But as refracted ray emerges out of the glass slab to the vacuum, it bends away from the normal, as shown.



Which option explains the law of refraction of light through the glass slab?

- (a) light always bends towards the normal in a glass slab
- (b) ray of light always travels in a straight path irrespective of change in medium
- (c) the incident ray, the refracted ray, and the normal to the interface always lie on the same plane**
- (d) ray of light travelling in the air is always considered as the incident ray, and the one in the glass is the refracted ray

13.



Where is the image most likely to form?

(a) position P (c) position R (b) position Q **(d) position S**

14. A student conducts an experiment using a convex lens of focal length 20 cm and an object of height 15 cm. He placed the object at 25 cm from the lens. Can the image be formed on a screen?
(a) yes, because a real image will be formed
(b) no, because a virtual image will be formed
(c) yes, because an erect image will be formed
(d) No because the image is inverted
15. A student conducts an experiment using a convex lens. He places the object at a distance of 60 cm in front of the lens and observed that the image is formed at a distance of 30 cm behind the lens. What is the power of the lens?
(a) 0.005 dioptre (b) 0.05 dioptre
(c) 5 dioptre (d) no, because an inverted image will be formed
16. Rakhi conducts an experiment to produce an image of an object on a screen which is placed at 20 cm from the lens. She uses a convex lens of focal length 15 cm for the experiment. Where should she place the object in order to produce the sharpest image?
(a) 8 cm in front of the lens (b) 15 cm in front of the lens
(c) 20 cm in front of the lens **(d) 60 cm in front of the lens**
17. Which of the following can make a parallel beam of light when light from a point source is incident on it?
(a) Concave mirror as well as convex lens
(b) Convex mirror as well as concave lens
(c) Two plane mirrors placed at 90° to each other
(d) Concave mirror as well as concave lens
18. A 10 mm long awl pin is placed vertically in front of a concave mirror. A 5 mm long image of the awl pin is formed at 30 cm in front of the mirror. The focal length of this mirror is
(a) -30 cm **(b) -20 cm** (c) -40 cm (d) -60 cm
19. Under which of the following conditions a concave mirror can form an image real and larger than the actual object?
(a) When the object is kept at a distance equal to its radius of curvature
(b) When object is kept at a distance less than its focal length
(c) When object is placed between the focus and centre of curvature

(d) When object is kept at a distance greater than its radius of curvature

20. Magnification produced by a rear view mirror fitted in vehicles

(a) **is less than one**

(b) is more than one

(c) is equal to one

(d) can be more than or less than one depending upon the position of the object in front of it.

21. Rays from Sun converge at a point 15 cm in front of a concave mirror. Where should an object be placed so that size of its image is equal to the size of the object?

(a) 15 cm in front of the mirror (b) **30 cm in front of the mirror**

(c) between 15 cm and 30 cm in front of the mirror

(d) more than 30 cm in front of the mirror

22. A full length image of a distant tall building can definitely be seen by using

(a) a concave mirror

(b) **a convex mirror**

(c) a plane mirror

(d) both concave as well as plane mirror

23. A child is standing in front of a magic mirror. She finds the image of her head bigger, the middle portion of her body of the same size and that of the legs smaller. The following is the order of combinations for the magic mirror from the top.

(a) Plane, convex and concave

(b) Convex, concave and plane

(c) **Concave, plane and convex**

(d) Convex, plane and concave

SHORT ANSWER TYPE QUESTIONS (2MARKS)

1. Three mirrors, one plane, one concave and one convex are lying on the table.

Identify them without touching them or using any other apparatus or device? Ans. Plane mirror produces the image of same size. Concave mirror produced the magnified image while the convex mirror will produce a diminished image

2. A ray of light travelling in air enters obliquely into water. Does the light ray bend towards or away from the normal? Why?

Ans. The light bends towards the normal on entry into water. It is due to the fact that as compared to air, the water is optically denser medium.

3. The radius of curvature of a spherical mirror is 20 cm. what is its focal length? Ans. Focal length (f) = $R/2 = 20 \text{ cm}/2 = 10 \text{ cm}$.

4. A concave mirror produces three times magnified real image of an object placed 10 cm in front of it. Where is the image located?

Ans. Distance of object from concave mirror (u) = -10 cm.

Magnification (m) = -

$$3m = -v/u$$

$$v = -mu = -(3) \times (-10) = -30 \text{ cm}$$

5. Absolute refractive Index of some of material is tabulated below

Material	Rock salt	Kerosene	Water	Diamond
Refractive	1.54	1.44	1.33	2.42

i) In which of these does light travel fastest and why?

ii) arrange these materials in ascending order of their optical densities. Ans. i) Water due to least refractive index.

ii) Water, Kerosene, Rock salt, diamond

6. A fish under water is viewing obliquely a fisherman standing on the bank of lake. Does the man look taller or shorter?

Ans. As light travels from rarer to denser medium, it bends towards normal and appears to come from greater height. Therefore, to fish under water man looks taller

7. An object 1 cm high produces a real image 1.5 cm high, when placed at a distance of 15 cm from concave mirror. Calculate the position of the image.

Ans. $-v/u = h'/h$, $-v/-15 = -1.5v$
 $1.5v = -15 \times 1.5 = -22.5 \text{ cm}$

8. Which phenomenon occurs when light falls on

(a) highly polished surface

(b) a transparent medium? Ans. (a)

Reflection of light.

(b) Refraction of light.

9. If the speed of light in vacuum is $3 \times 10^8 \text{ ms}^{-1}$, find the speed of light in a medium of absolute refractive index 1.5.

Ans

$$\frac{v_1}{v_2} = \frac{n_2}{n_1} \quad \text{or} \quad \boxed{\frac{v_2}{v_1} = \frac{n_1}{n_2}}$$

Here, $v_1 = 3 \times 10^8 \text{ m/s}$, $n_1 = 1$, $n_2 = 1.5$

$$v_2 = 2 \times 10^8 \text{ m/s}$$

10. An object of height 6 cm is placed perpendicular to the principal axis of a concave lens of focal length 5 cm. Use lens formula to determine the position, size and nature of the image if the distance of the object from the lens is 10 cm.

Ans: $h = 6 \text{ cm}$, $f = -5 \text{ cm}$, $u = -10 \text{ cm}$

$$\begin{aligned} \frac{1}{v} - \frac{1}{u} &= \frac{1}{f} \\ \frac{1}{v} - \frac{1}{-10} &= \frac{1}{-5} \\ \Rightarrow \frac{1}{v} + \frac{1}{10} &= \frac{1}{-5} \Rightarrow \frac{1}{v} = -\frac{1}{5} - \frac{1}{10} \\ &= \frac{-2 - 1}{10} = \frac{-3}{10} \\ \Rightarrow v &= \frac{-10}{3} \text{ cm} \\ \therefore h &= \frac{v}{u} = \frac{\frac{-10}{3}}{-10} = \frac{1}{3} \end{aligned}$$

Image is diminished and erect.

SHORT ANSWER TYPE QUESTIONS (3 MARKS)

1. The absolute refractive indices of glass and water are $3/2$ and $4/3$ respectively. If the speed of light in glass is $2 \times 10^8 \text{ ms}^{-1}$, calculate the speed of light in (i) vacuum and (ii) water.

Ans: Given, $n_g = 3/2$ and $n_w = 4/3$
Speed of light in glass (v_g) = $2 \times 10^8 \text{ ms}^{-1}$

- (i) Speed of light in vacuum, $c = n_g \times v_g = 3/2 \times 2 \times 10^8 = 3 \times 10^8 \text{ ms}^{-1}$

(ii) Speed of light in water, $v_w = c/n_w = 3 \times 10^8 / (4/3) = 2.25 \times 10^8 \text{ ms}^{-1}$

2. A convex lens of focal length 25 cm and a concave lens of focal length 10 cm are placed in closed contact with each other. Calculate the lens power of the combination.

Ans: $f_1 = 25 \text{ cm} = 0.25 \text{ m}$ $f_2 = -10 \text{ cm} = -0.1 \text{ m}$

Power of convex lens, $P_1 = 1/f_1 = 1/0.25 = +4 \text{ D}$

Power of concave lens, $P_2 = 1/f_2 = 1/-0.1 \text{ m} = -10 \text{ D}$

power of combination, $P = P_1 + P_2 = 4 \text{ D} - 10 \text{ D} = -6 \text{ D}$

3. A concave mirror produces a three times magnified (enlarged) real image of an object placed at 10 cm in front of it. Where is the image located?

$$m = \frac{\text{Height of the image}}{\text{Height of the object}} = -\frac{\text{Image Distance}}{\text{Object Distance}}$$

$$m = \frac{h_1}{h_0} = -\frac{v}{u}$$

Let the height of the object, $h_0 = h$

Then, height of the image $h_1 = -3h$ (Image formed is real)

$$-\frac{3h}{h} = -\frac{v}{u}$$

$$\frac{v}{u} = 3$$

Object distance (u) = -10

$$cm \quad v = 3 \times (-10) = -30 \text{ cm}$$

Therefore, the negative sign indicates that an inverted image is formed in front of the given concave mirror at a distance of 30 cm.

4. List two possible ways in which a concave mirror can produce a magnified image of an object placed in front of it. State the difference if any between these two images. Ans: A concave mirror can produce a magnified image of an object when object is placed:

(1) In between its pole and its focus

(2) In between its focus and its centre of curvature. Difference between these two images:

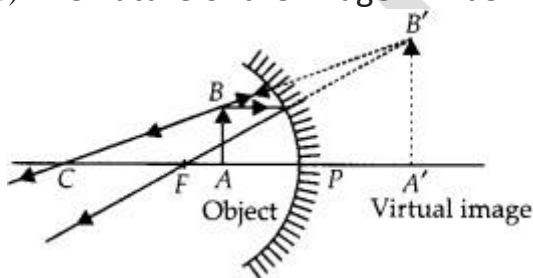
The image produced in first case will be virtual and erect. The image produced in second case will be real and inverted.

5. A concave mirror is used for image formation for different positions of an object. What inferences can be drawn about the following when an object is placed at a distance of 10 cm from the pole of a concave mirror of focal length 15 cm?
- (a) Position of the image (b) Size of the image
- (c) Nature of the image
- (d) Draw a labelled ray diagram to justify your inferences.

Ans: Given, $f = -15$ cm, $u = -10$ cm.

Thus the object is placed between the principal focus and pole of the mirror.

- (a) The position of the image will be behind the mirror.
- (b) The size of the image will be highly enlarged.
- (c) The nature of the image will be virtual and erect.



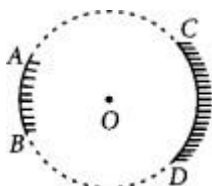
6. An object is placed at a distance of 12 cm in front of a concave mirror of radius of curvature 30 cm. List four characteristics of the image formed by the mirror

Ans: Radius of curvature (R) = 30 cm, object distance is 12 cm in front of the mirror. Thus we can say that object is placed between focus and pole. Four characteristics of the image formed by the given concave mirror when object is placed between pole and focus are:

- (i) Virtual (ii) Erect
- (iii) Enlarged (iv) Image is formed behind the mirror
7. "The magnification produced by a spherical mirror is -3". List all information you obtain from this statement about the mirror/ image.

Ans. Negative sign of magnification indicates that the image is real and inverted. Since the image is real and inverted, the mirror is concave and magnification of -3 indicates that the image is magnified.

8. AB and CD, two spherical mirrors, from parts of a hollow spherical ball with its centre at O as shown in the diagram. If arc AB = $\frac{1}{2}$ arc CD, what is the ratio of their focal lengths? State which of the two mirrors will



always form a virtual image of an object placed in front of it and why?

Ans: Focal length of a mirror is given by $f = R/2$

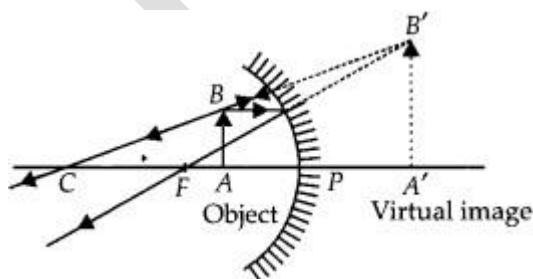
Since both the mirrors have same radius of curvature, therefore focal length of the two mirrors will be same, i.e.,

Since a virtual image is always formed by a convex mirror. The mirror AB will always form a virtual image.

9. The linear magnification produced by a spherical mirror is +3. Analyse this value and state the (i) type of mirror and (ii) position of the object with respect to the pole of the mirror. Draw a ray diagram to show the formation of image in this case.

Ans: Positive value of the magnification indicates that image is virtual and erect.

- (i) Since the image is magnified, the mirror is concave.
 (ii) The object is between pole and focus of the mirror as shown



10. A spherical mirror produces an image of magnification -1 on a screen placed at a distance of 50 cm from the mirror.

- (a) Write the type of mirror.
 (b) Find the distance of the image from the object.
 (c) What is the focal length of the mirror? Answer:
 (a) Concave mirror

$$m = \frac{h'}{h} = \frac{-v}{u} \quad \Rightarrow \quad -1 = \frac{-v}{-50}$$

(b) $m = -1$, $u = -50$ cm,

$\therefore v = -50$ cm

c)

$$\frac{1}{u} + \frac{1}{v} = \frac{1}{f} \quad \Rightarrow \quad \frac{1}{-50} + \frac{1}{-50} = \frac{1}{f}$$

$\therefore f = -25$ cm

11. Define power of a lens. What is its unit? One student uses a lens of focal length 25 cm and another of -25 cm. What is the nature of the lens and its power used by each of them?

Ans: Power of a lens is its ability to converge or diverge the rays of light falling on it. $P = 1/f$ where f is in metre. Its unit is Dioptre. ! Diopter is the power of a lens whose focal length is 1 meter

Lens is convex in the first case as f is positive and concave in the second case as f is negative. $P_1 = 1/0.25 = 4$ D

$P_2 = 1/-0.25 = -4$ D

12. A convex lens of focal length 2.0 m can produce a magnified virtual as well as real image. Is this a correct statement? If yes, where shall the object be placed in each case for obtaining these images?

Ans: Yes, it is correct.

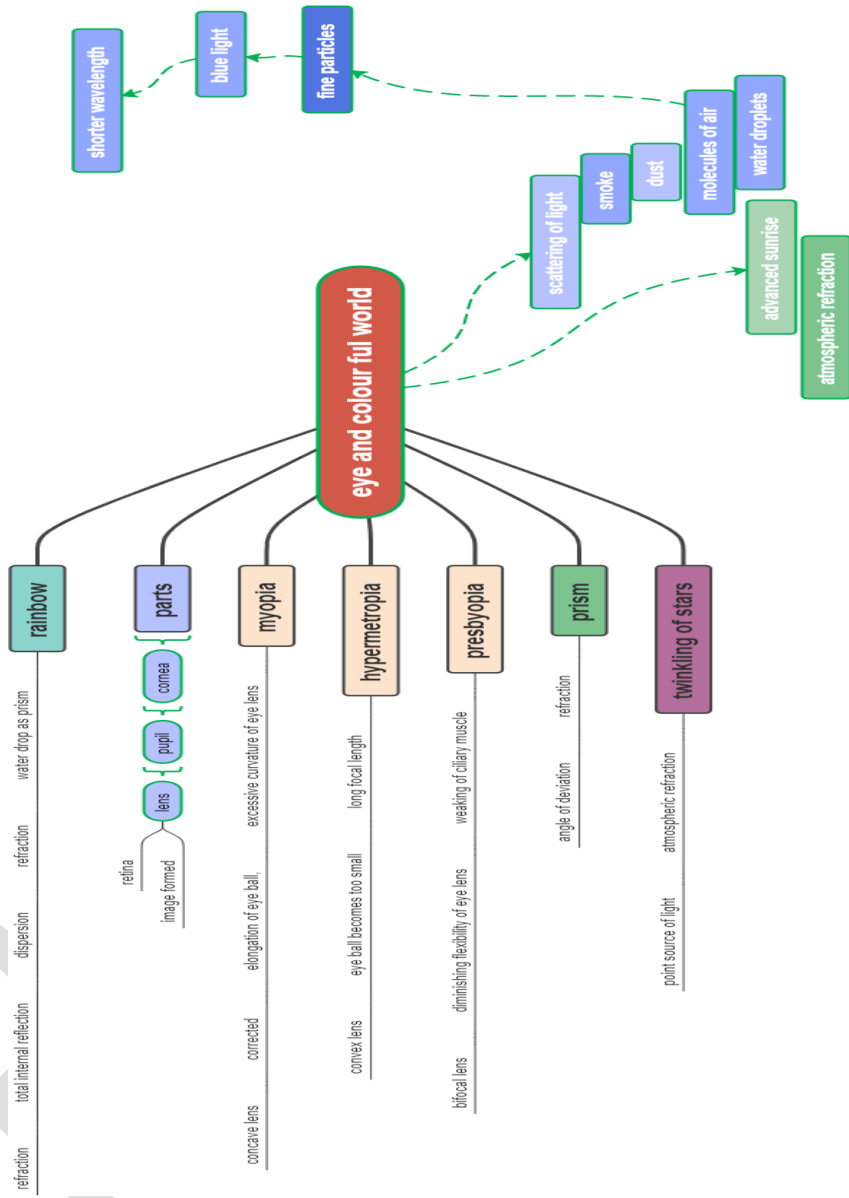
If the object is placed within 2.0 m from the lens in the it forms magnified virtual image Between 2 m and 4 m it will form a real inverted and magnified image.

Case Study Based Questions:

We know that lenses form different types of images when objects are kept at varying positions. When a ray is incident parallel to the principal axis, then after refraction, it passes through the focus or appears to come from the focus. When a ray goes through the optical centre of the lens, it passes without any deviation. If the object is placed between the focus and optical center of the convex lens, erect and magnified image is formed. As the object is brought closer to the convex lens from infinity to focus, the image moves away from the convex lens from focus to infinity. Also the size of the image goes on increasing and the image is always real and inverted. A concave lens always gives a virtual, erect and diminished image irrespective of the position of the object.

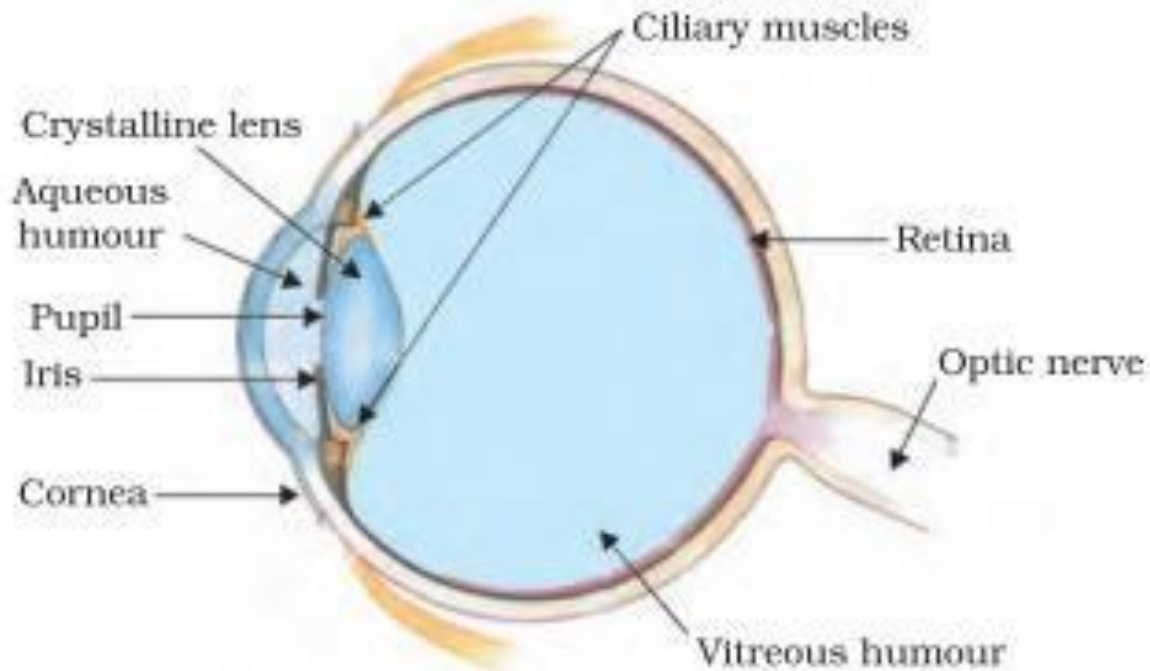
1. The location of image formed by a convex lens when the object is placed at infinity is
(a) **at focus** (b) at 2F (c) at optical center (d) between F and 2F
2. When the object is placed at the focus of concave lens, the image formed is
(a) real and smaller **(b) virtual and smaller**
(c) virtual and inverted (d) real and erect
3. The size of image formed by a convex lens when the object is placed at the focus of convex lens is
(a) **highly magnified** (b) point in size
(c) small (d) same as that of object
4. When the object is placed at 2F in front of convex lens, the location of image is
(a) at F (b) between F and optical center
(c) at infinity **(d) none of the above**

HUMAN EYE AND THE COLOURFUL WORLD



Human Eye

CORNEA- a thin transparent membrane in front of the eye. Most of the refraction for the light rays entering the eye occurs at the outer surface of the cornea.



IRIS - behind the cornea a dark muscular diaphragm that controls the size of the pupil.

PUPIL-regulates and controls the amount of light entering the eye.

Lens- The eye lens is composed of a fibrous, jelly-like material and forms an inverted real image of the object on the retina.

CILIARY MUSCLE-. Muscles attached to the lens on either side which can change the curvature of the lens.

AQUEOUS HUMOUR is a viscous liquid which is filled between the cornea and eye lens. It acts as a convex lens and helps in the refraction of light rays entering the eye.

VITREOUS HUMOUR is a viscous liquid which is filled between eye-lens and retina is called vitreous humour.

OPTIC NERVE are the paths via which electrical signals produced by rods and cones are transmitted to brain.

CHOROID is a membrane inside eye ball behind retina. **SCLERA** The outer hard membrane of the eye ball is called sclera.

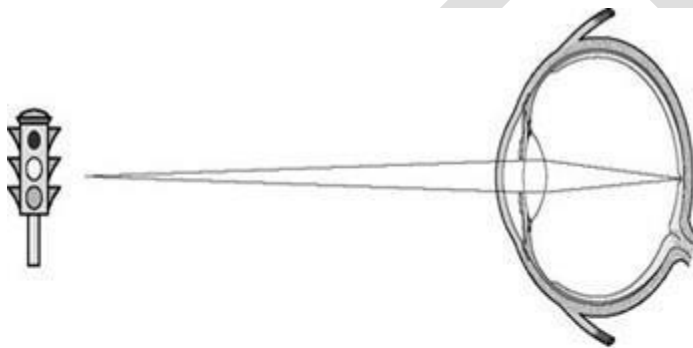
BLIND SPOT It is the region on the retina where the optic nerve enters the eye. It has no nerve endings. An image formed at this point is not sent to brain.

PERSISTENCE OF VISION In human eye the impression of the formed image remains on the retina for about $\frac{1}{16}$ th of a second, even after the removal of the object. This continuance of the sensation of the image in eye is called persistence of vision.

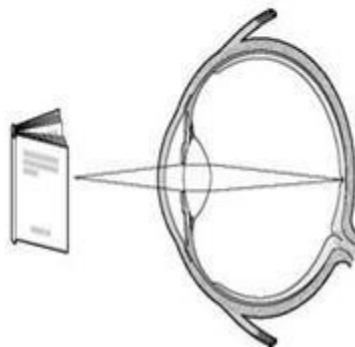
HOW DO WE SEE COLOURS?

Our retina has a large number of light sensitive cells having shapes of rods and cones. The rod shaped cells respond to the intensity of light, with different degree of brightness and darkness. The cone shaped cells of retina responds to various colours and make colour perception possible.

COLOUR BLINDNESS A person having defective cone cells is not able to distinguish between the different colours. This defect is known as color blindness



When the muscles are relaxed, the lens becomes thin. Thus, its focal length increases. This enables us to see



When you are looking at objects closer to the eye, the ciliary muscles contract. This increases the curvature of the eye lens. The eye lens then becomes thicker. Consequently, the focal length of the eye lens decreases. This enables us to see nearby objects clearly.

The ability of the eye lens to adjust its focal length is called accommodation.

The minimum distance, at which objects can be seen most distinctly without strain, is called the least distance of distinct vision. It is also called the near point of the eye which is 25 cms.

A normal eye can see objects clearly that are between 25 cm and infinity.

Retina- is a delicate membrane having enormous number of light-sensitive cells. The light-sensitive cells get activated upon illumination and generate electrical signals. These signals are sent to the brain via the optic nerves. The brain interprets these signals, and finally, processes the information so that we perceive objects as they are.

Cataract

- lens of people at old age becomes milky and cloudy
- causes partial or complete loss of vision
- possible to restore vision through a cataract surgery.

DEFECTS OF VISION AND THEIR CORRECTION

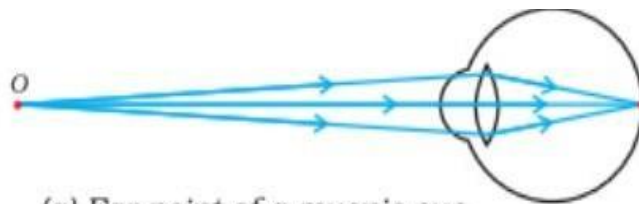
Sometimes, the eye may gradually lose its power of accommodation.

In such conditions, the person cannot see the objects distinctly and comfortably. The vision becomes blurred due to the refractive defects of the eye.

There are mainly three common refractive defects of vision. These are

- myopia** or near-sightedness, (ii) **Hypermetropia** or far-sightedness, and
- Presbyopia**. These defects can be corrected by the use of suitable spherical lenses.

(a) Myopia(near-sightedness)

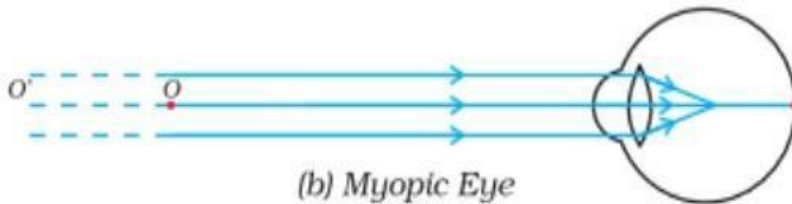


(a) Far point of a myopic eye

can see nearby objects clearly

cannot see distant objects distinctly

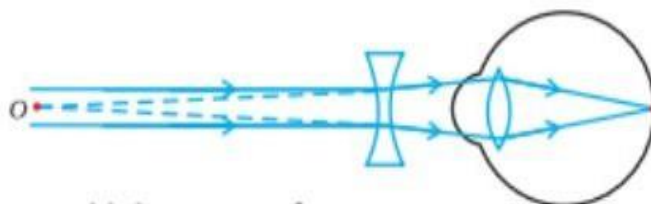
has the far point nearer than infinity



(b) Myopic Eye

the image of a distant object is formed in front of the retina
Concave lens is used to bring image on the retina

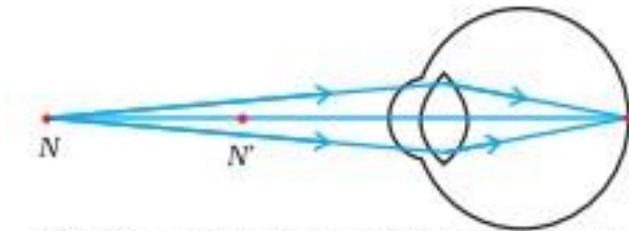
This



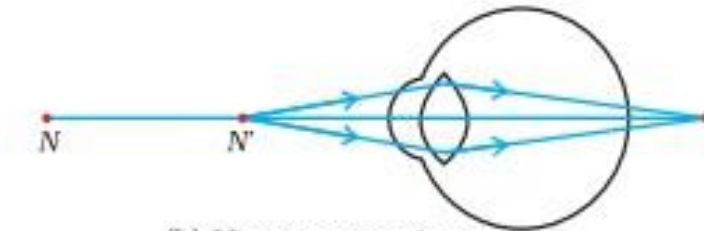
(c) Correction for myopia

This defect can be corrected by using a concave lens of suitable power.

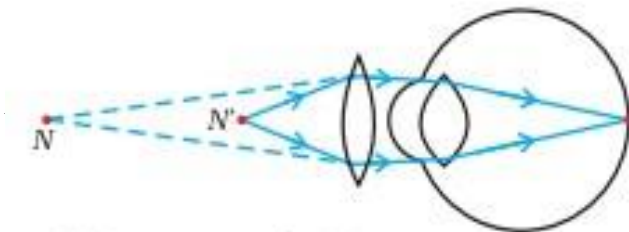
(b) Hypermetropia(far-sightedness)



(a) Near point of a Hypermetropic eye



(b) Hypermetropic eye



(c) Correction for Hypermetropic eye

This is

- (i)
- (ii)

see distant objects clearly cannot see nearby objects distinctly.

near point, for the person, is farther away from the normal near point (25 cm)

the light rays from a close by object are focussed at a point behind the retina.

converging lenses provide the additional focusing power required for forming the image on the retina

it can be corrected by

(c) Presbyopia

The power of accommodation of the eye usually decreases with ageing. For most people, the near point gradually recedes away.

- difficult to see nearby objects comfortably and distinctly without corrective eye-glasses. This defect is called Presbyopia.

Causes

- arises due to the gradual weakening of the ciliary muscles
- diminishing flexibility of the eye lens.

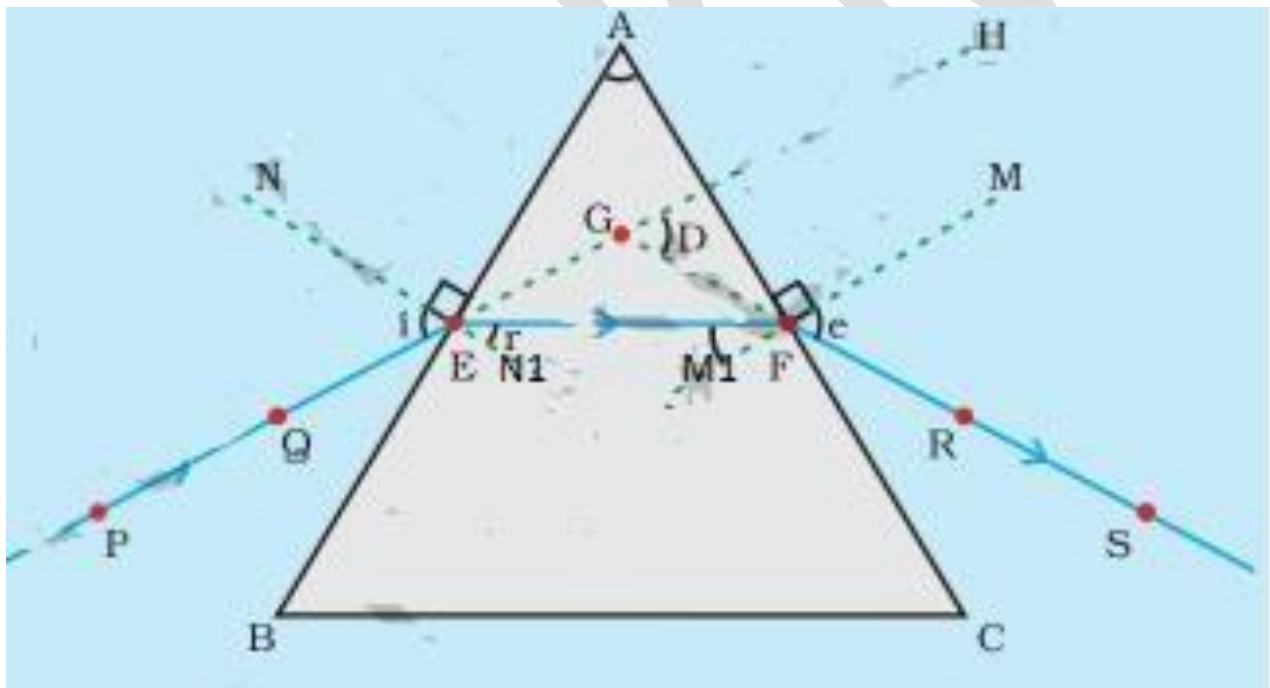
Sometimes, a person may suffer from both myopia and hypermetropia. Such people often require bi-focal lenses. A common type of bi-focal lenses consists of both concave and convex lenses. The upper portion consists of a concave lens. It facilitates distant vision. The lower part is a convex lens. It facilitates near vision.

Prism: A prism is a transparent refracting medium bounded by two plane surfaces, inclined to each other at a certain angle. It has one triangular base and three rectangular lateral surfaces.

Refraction of light through a prism: When a ray of light is incident on a glass prism refraction takes place at the two surfaces and the emergent ray is bent at an angle to the direction of the incident ray.

Angle of Prism: Angle between two lateral faces is called angle of prism.

Angle of Deviation: The angle between the incident ray and the emergent ray.

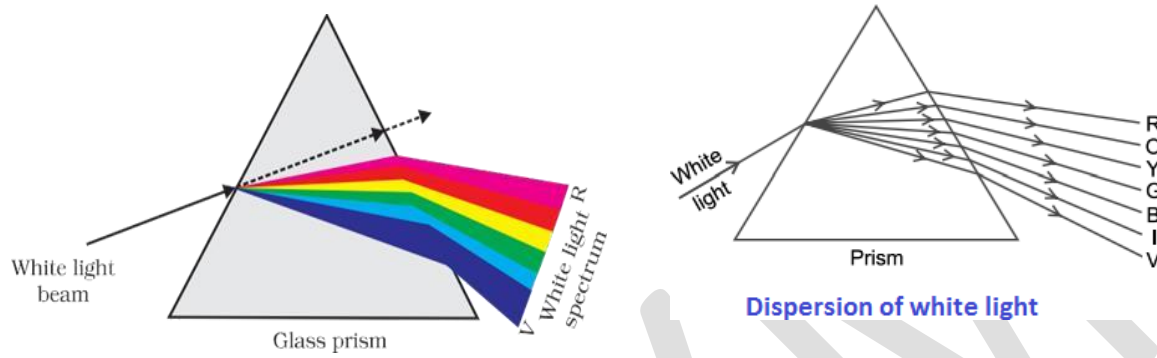


DISPERSION OF WHITE LIGHT BY GLASS PRISM:

Dispersion: Splitting of light into its component colours is called dispersion of light.

Spectrum: When white light undergoes dispersion, it splits into seven colours. The band of seven colours obtained is called a spectrum.

- The seven colours are VIBGYOR-Violet, Indigo, Blue, Green, Yellow, Orange, Red.



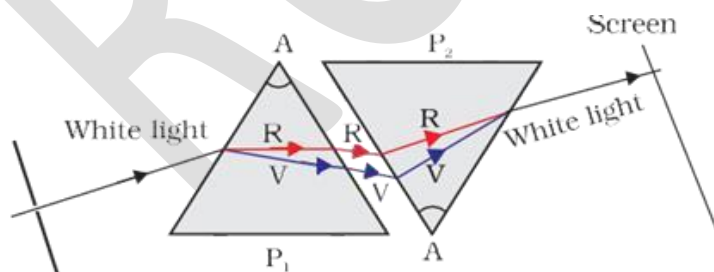
What causes dispersion of light ?

When white light enters into the glass prism and passes through it, different colours of light bend through different angles with respect to the incident ray. The red light bends the least while the violet bends the most. Thus the rays of each colour emerge along different paths and thus become distinct.

- The scientist who first demonstrated dispersion of white light through prism – Isaac Newton

Recombination of spectrum of white light:

When white light is passed through a triangular glass prism, the white light splits into seven colours. If a second identical prism is placed in an inverted position with respect to the first prism, all the colours recombine to form white light. This proves that sunlight /white light is made up of seven colours.



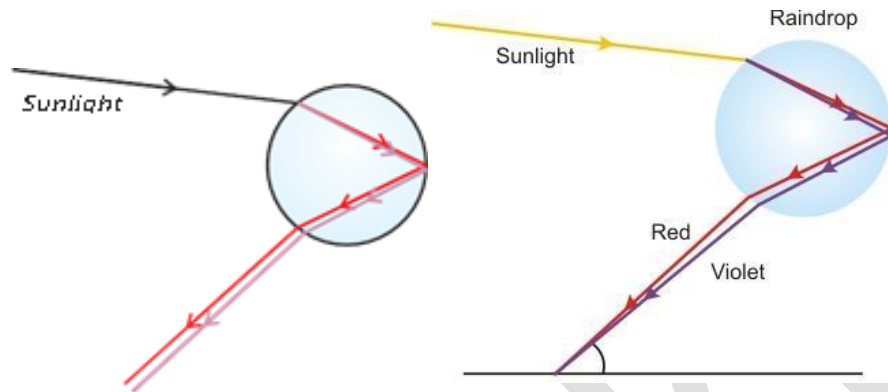
- Any light that gives a spectrum similar to that of sunlight is referred to as white light.

Rainbow formation :

After a rain shower, when sunlight passes through tiny rain drops suspended in the atmosphere, it

undergoes refraction, dispersion, internal reflection, once again refraction and reach the observer's eye. This results in visualizing a rainbow.

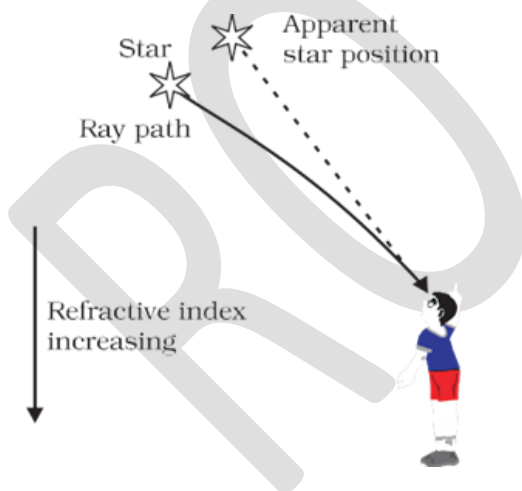
- The water droplets act like small prisms.
- A rainbow is always formed in a direction opposite to that of the Sun.
- Sun should be behind the observer.



:II ATMOSPHERIC REFRACTION

Refraction/bending of light as it passes through different layers of atmosphere having varying optical density.

Twinkling of stars:



- Twinkling of stars is due to atmospheric refraction of starlight.

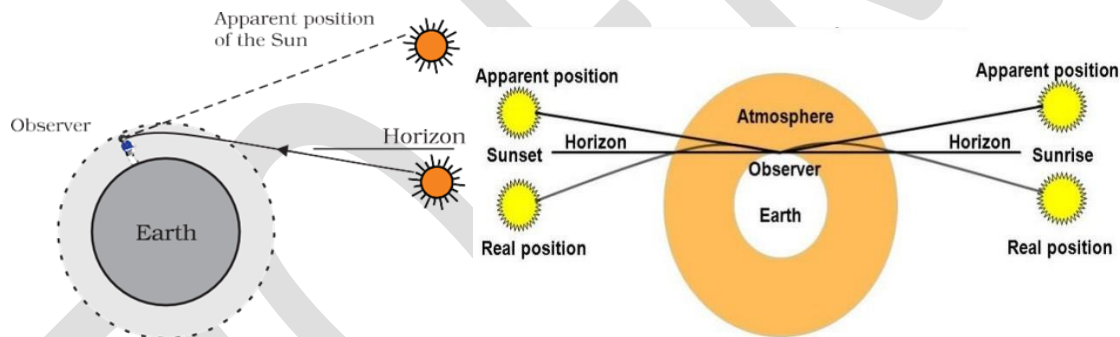
Since the stars are very distant objects, they appear as point-sized sources of light. The starlight, on entering the earth's atmosphere having varying optical density, undergoes continuous refraction. The apparent position of the star is seen slightly higher from its actual position, when viewed near the horizon. This apparent position of the star is not stationary, but keeps on changing slightly, since the physical conditions of the earth's atmosphere are not stationary. As the apparent position of the star fluctuates, the amount of starlight entering the eye flickers. Stars sometimes appear brighter, and some times fainter. This produces a twinkling effect.

Planets do not twinkle:

The planets are much closer to the earth, and are thus seen as extended sources of light. If we consider a planet as a collection of a large number of point-sized sources of light, the total variation in the amount of light entering our eye from all the individual point-sized sources due to atmospheric refraction will average out to zero, thereby nullifying the twinkling effect.

Advance sunrise and delayed sunset:

- The Sun is visible to us about 2 minutes before the actual sunrise, and about 2 minutes after the actual sunset because of atmospheric refraction.



Actual sunrise is actual crossing of the horizon by the Sun. From two minutes well before the actual sunrise, the rays of sun entering the atmosphere of earth undergoes refraction and reach the eye of the observer. So Sun becomes visible at an apparent position with respect to the horizon before actual sun rise.

After the actual sunset, the rays of sun enters the atmosphere of earth undergoes refraction and reach the eye of the observer. So Sun becomes visible at an apparent position with respect to the horizon for two minutes actual sun rise.

- The time difference between actual sunrise and the apparent sunrise is about 2 minutes.
- The time difference between actual sunset and the apparent sunset is about 2 minutes.

III SCATTERING OF LIGHT:

Tyndall effect:

The phenomenon of scattering of light by the colloidal particles is called Tyndalleffect.

Eg:1. When a fine beam of sunlight enters a smoke-filled room through a smallhole, the pathway of light becomes visible due to the scattering of light

2. When sunlight passes through a canopy of a dense forest, the pathway oflight becomes visible due to the scattering of light by tiny mist particles of the atmosphere.

* The colour of the scattered light depends on the size of the scattering particles:Very fine particles-- scatter shorter wavelength, mainly blue light.

Larger-sized particles-- scatter light of longer wavelengths.

- The amount of scattering of light depends on the Wavelength of light—Longer the wavelength—less scattering

Shorter the wavelength --- more scattering

Why is the colour of sky blue?

- Due to scattering of blue light.

When sunlight passes through the atmosphere of earth, the fine particles in air scatter the blue colour (shorter wavelengths) more strongly than red. When thescattered blue light enters our eyes ,sky appears blue.

Why sky appears dark to passengers flying at very high altitudes?

Thickness of air is less at high altitudes. As scattering is not prominent at suchheights, sky appears dark.

Why moon's sky appears to be dark?

Moon has no atmosphere , no scattering of sunlight light takes place there. Somoon' s sky appears dark.

'Danger' signal lights are red in colour. Why?

Red light is the least scattered by fog or smoke. Therefore, it can be seen in thesame colour at a maximum distance..

Sl no	Observation/phenomenon	Reason behind
1.	Rainbow formation	Light when enters tiny raindrops in the atmosphere, undergoes Refraction,dispersion,internal reflection,again refraction
2	Twinkling of stars	Atmospheric refraction
3	Early sunrise, Delayed sunset	Atmospheric refraction
4	Pathway of light visible in a foggy atmosphere or a dusty room/smoke filled room	Tyndall effect/scattering of light
5	Reddening of sun's disc in the early morning and late evening	Scattering away of smaller wavelength of light by particles of atmosphere
6	Sky appears blue	Scattering of sunlight
7	Flattening of sun's disc at sunrise and sunset	Atmospheric refraction

The human eye can focus objects at different distances by adjusting the focallength of the eye lens. This is due to (a) presbyopia (b) accommodation (c) near-sightedness (d) far-sightedness.

Ans:

(b) Human eye can change the focal length of the eye lens to see the objects situated at various distances from the eye. This is possible due to the power of accommodation of the eye lens.

1. The human eye forms the image of an object at its (a) cornea (b) iris (c) pupil (d) retina

Ans:

(d) The human eye forms the image of an object at its retina.

2. The least distance of distinct vision for a young adult with normal vision is about (a) 25 m (b) 2.5 cm (c) 25 cm (d) 2.5 m

Ans:

(c) The least distance of distinct vision is the minimum distance of an object to see clear and distinct image. It is 25 cm for a young adult with normal vision.

3. The change in focal length of an eye lens is caused by the action of the

(a) pupil (b) retina (c) ciliary muscles (d) iris

Ans:

(c) The relaxation or contraction of ciliary muscles changes the curvature of the eye lens. The change in curvature of the eye lens changes the focal length of the eye. Hence, the change in focal length of an eye lens is caused by the action of ciliary muscles.

4. 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) near vision?

Ans:

For distant vision = -0.181 m, for near vision = 0.667 m

The power P of a lens of focal length f is given by the relation

$$P = \frac{1}{f \text{ (in metres)}}$$

□

(i) Power of the lens used for correcting distant vision =

-5.5 D Focal length of the required lens, $f = 1/p = 1/-5.5 = -$

0.181 m

The focal length of the lens for correcting distant vision is -0.181 m.

(ii) Power of the lens used for correcting near vision =

+1.5 D Focal length of the required lens,

$f = 1/P = 1/1.5 = 0.667$ m

The focal length of the lens for correcting near vision is 0.667 m.

5. The far point of a myopic person is 80 cm in front of the eye. What is the nature and power of the lens required to correct the problem?

Ans:

The person is suffering from an eye defect called myopia. In this defect, the image is formed in front of the retina. Hence, a concave lens is used to correct this defect of vision.

Object distance, $u = \text{infinity}$

Image distance, $v = -80$ cm

Focal length = f

According to the lens formula, $1/v - 1/u = 1/f$

$80 - 1/\alpha = 1/f$

$1/f = 1/-$

80

0.8 m

$P = 1/f = -1/-0.8 = -1.25$ D

□

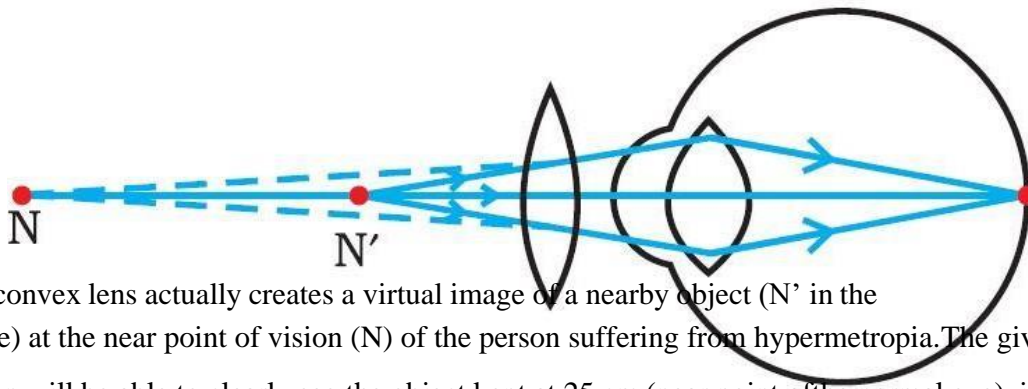
A concave lens of power -1.25 D is required by the person to correct his defect.

6. Make a diagram to show how hypermetropia is corrected.
The near point of a

hypermetropic eye is 1 m. What is the power of the lens required to correct this defect? Assume that the near point of the normal eye is 25 cm.

Ans:

A person suffering from hypermetropia can see distinct objects clearly but faces difficulty in seeing nearby objects clearly. It happens because the eye lens focuses the incoming divergent rays beyond the retina. This defect of vision is corrected by using a convex lens. A convex lens of suitable power converges the incoming light in such a way that the image is formed on the retina,



The convex lens actually creates a virtual image of a nearby object (N' in the figure) at the near point of vision (N) of the person suffering from hypermetropia. The given person will be able to clearly see the object kept at 25 cm (near point of the normal eye), if the image of the object is formed at his near point, which is given as 1 m.

Object distance, $u = -25 \text{ cm}$

Image distance, $v = -1 \text{ m} = -100 \text{ cm}$

Focal length, f

Using the lens formula

$$1/v - 1/u = 1/f$$

$$-1/100 - (-1/25) = 1/f$$

$$1/f = 1/25 - 1/100 = 3/100$$

$$F = 1/3 \text{ m}$$

Power of

lens, $P = 1 \times \frac{3}{1}$

$= 3 \text{ D}$

A convex lens of power $+3.0 \text{ D}$ is required to correct the defect.

7. Why is a normal eye not able to see clearly the objects placed closer than 25 cm ?

Ans:

A normal eye is unable to clearly see the objects placed closer than 25 cm because the ciliary muscles of eyes are unable to contract beyond a certain limit.

If the object is placed at a distance less than 25 cm from the eye, then the object appears blurred and produces strain in the eyes.

8. What happens to the image distance in the eye when we increase the distance of an object from the eye? **Ans:**

Since the size of eyes cannot increase or decrease, the image distance remains constant. When we increase the distance of an object from the eye, the image distance in the eye does not change. The increase in the object distance is compensated by the change in the focal length of the eye lens. The focal length of the eyes changes in such a way that the image is always formed at the retina of the eye.

9. When a monochromatic light having only one wavelength, passes through a prism, will it show dispersion?

Answer:

No, it will not show dispersion. It will only show deviation.

10. Name the component of white light that deviates the least and the component that deviates the most while passing through a glass prism. Answer:

Least deviated component: Red

Most deviated component: Violet

11. What is colour-blindness? What kind of retinal cells are lacking in person suffering from this defect?

Answer:

The defect of the eye due to which a person is unable to distinguish between certain colours, is known as colour blindness. Cone-shaped retinal cells are responsible for making a person differentiate between colours. The colour blind persons do not possess cone cells that respond to certain colours.

CASE STUDY

1. Eyes are organs that allow you to see. They take in light from the world around you and send visual information to your brain. Your eyes can see about 200 degrees in all directions, including in front of you and to the sides (peripheral vision). Parts of your eyes work together to allow you to see images, movement and depth. Your eyes can see millions of colors in varying shades

1. The fluid between the retina and eye is called

- a. vitreous humour
- b. Aqueous humour
- c. Tear
- d. Aqua

2. The change in focal length of the eye to focus the image of objects at varying distances is done by the action of

- A. Iris
- B. Pupil
- C. Ciliary muscle
- D. Cornea

3. The part of the eye where optic nerve enters the eye is

- A. Pupil
- B. Retina
- C. Blind spot
- D. Lens

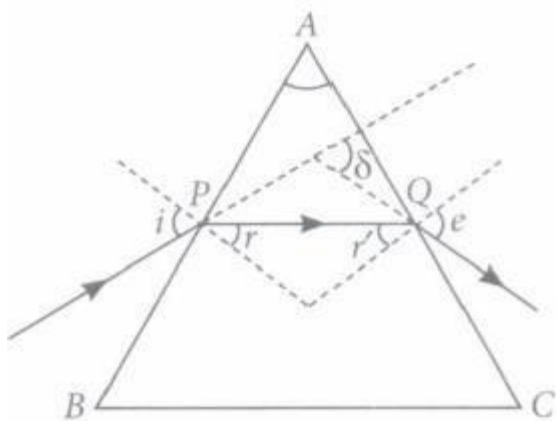
4. The layer of the eye which can be compared to the photographic film in a camera is

- a. Cornea
- b. Sclera
- c. Retina
- d. Iris

ANS 1. a vitreous humour 2.c ciliary muscle 3. c blind spot

4. c retina

2.A prism is a transparent refracting medium bounded by two plane surfaces inclined to each other at a certain angle. The refraction of light through a prism follows the laws of refraction. In the prism, refraction takes place on its refracting surface it means when the light enters the prism and when the light leaves the prism. The refraction through a prism is shown. Here, $\angle A$ is the angle of prism, $\angle i$ is the angle of incidence of the face AB and $\angle e$ is the angle of emergence at other face AC.



The incident ray suffers a deviation or bending through an angle δ due to the refraction through prism. This angle is called angle of deviation as shown in figure.

$$i + e = \delta + A$$

(i) The angle between the two refracting surfaces of a prism is called

- (a) angle of prism
- (b) angle of incidence
- (c) angle of deviation
- (d) angle of emergence

(ii) The angle between the incident ray and the emergent ray is called

- a) angle of emergence
- (b) angle of deviation
- (c) angle of incidence
- (d) none of these

(iii) When a ray is refracted through a prism, then

- (a) $\angle i = \angle e + \angle \delta$
- (b) $\angle i = \angle e + \angle \delta$

(c) $\angle \delta = \angle e$

(d) $\angle i > \angle r$

(iv) The angle of deviation depends on

(a) refractive index of prism

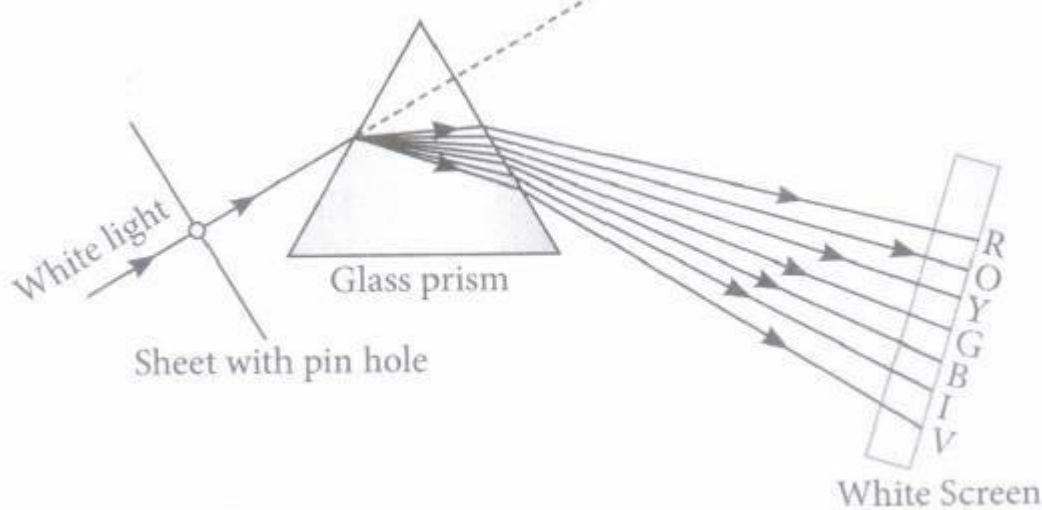
(b) angle of incidence

(c) both (a) and (b)

(d) none of these

- i. a ii. b iii. d iv. c

3. When white light is incident on one refracting surface of the prism, the light splits up into constituent colours violet, indigo, blue, green, yellow, orange and red. The process of splitting of white light into its seven constituent colours is called dispersion. When the dispersed white light is made to fall on a screen, we get the band of seven colours is called the spectrum of white light. Red colour bends the least on passing through the prism and violet colour bends through maximum angle on passing through the prism.



(i) Which property of light is used by prism to form a spectrum?

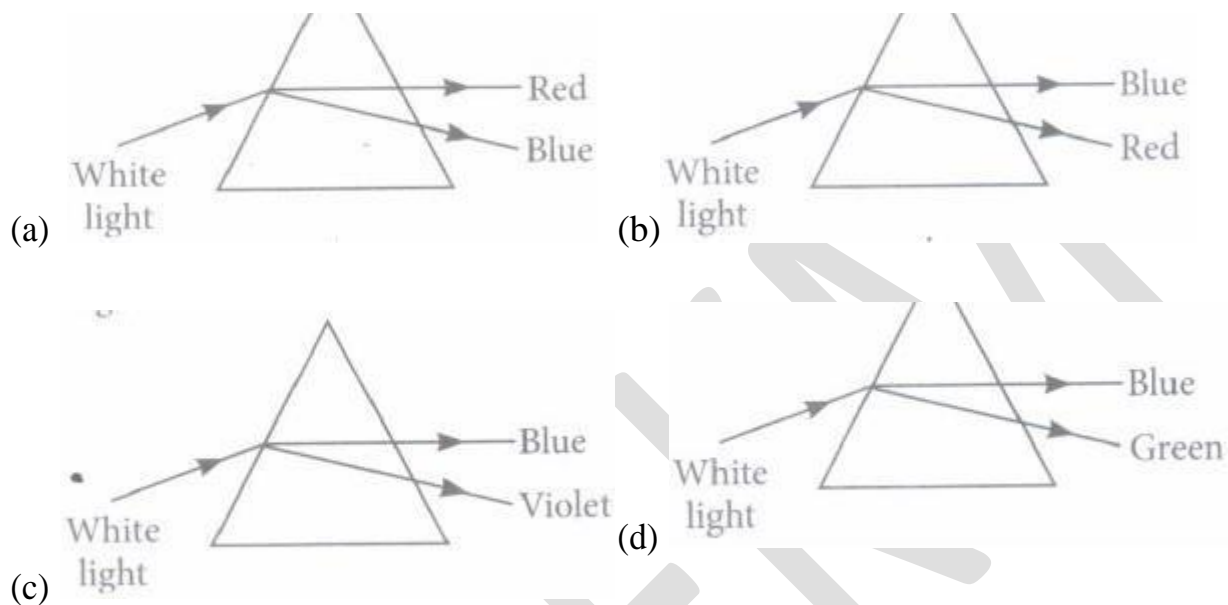
(a) Reflection

(b) Refraction

(c) Dispersion

(d) Scattering

(ii) Which of the following dispersion is correct?



(iii) When a red light passes through a prism, it

- (a) will not split
- (b) will split into seven colours
- (c) will split into white colour
- (d) will split into many different colours.

(iv) The spectrum produced by the white light by a prism is called

- (a) pure spectrum
- (b) impure spectrum
- (c) monochromatic spectrum
- (d) none of these.

i. c ii. a iii.a iv. b

5. Light of all the colour travel at the same speed in vacuum for all wavelengths. But in any transparent medium(glass or water), the light of different colours travel with different speeds for different wavelength that means that the refractive index of a particular medium is different for different wavelength. As there is a difference in their speeds, the light of different colour bend through different angles. The speed of violet colour is maximum and the speed of red colour is minimum in glass so, the red light deviates least and violet colour deviates most. Hence, higher the wavelength of a colour of light, smaller the refractive index and less is the bending of light.
 $\lambda_r > \lambda_v$ and $n_r < n_v$, $v = c/\lambda$.

(i) Which of the following statements is correct regarding the propagation of light of different colours of white light in air?

- (a) Red light moves fastest.
- (b) Blue light moves faster than green light.
- (c) All the colours of the white light move with the same speed.
- (d) Yellow light moves with the mean speed as that of the red and the violet light.

(ii) Which of the following is the correct order of wavelength?

- (a) Red > Green > Yellow
- (b) Red > Violet > Green
- (c) Yellow > Green > Violet
- (d) Red > Yellow > Orange

(iii) Which of the following is the correct order of speed of light in glass?

- (a) Red > Green > Blue
- (b) Blue > Green > Red
- (c) Violet > Red > Green
- (d) Green > Red > Blue

(iv) Which colour which has maximum frequency?

- (a) Red
- (b) Violet
- (c) Blue
- (d) Green

i. c ii. c iii. b iv. b

Assertion Reason type Questions

In the following questions a statement of assertion followed by a statement of reason is given.

Choose the correct answer out of the following choices.

- (A) Both assertion and reason are true and the reason is the correct explanation of assertion.
- (B) Both assertion and reason are true and the reason is not the correct explanation of assertion.
- (C) Assertion is true but the reason is false.
- (D) Assertion is false but reason is true.

1. Assertion-Danger signals are red.

Reason- Red has smallest wave length so can travel more distance.

2. Assertion-Cataract occurs when people are old. Reason- The lens becomes milky and cloudy with age.

3. Assertion-In presbyopia the near point gradually recedes away.

Reason- The defect arises due to weakening of ciliary muscles and diminishing flexibility of eye lens.

4. Assertion-The least distance of distinct vision for a young adult is 25 cms.

Reason- For seeing an object comfortably and distinctly the object should be placed at about 25 cms.

1. C 2. A 3. A 4. D

REVISION QUESTIONS

1. MCQ

1. Which of the following is a natural phenomenon caused by the dispersion of sunlight in the sky?

- (a) Twinkling of stars (b) Stars seem higher than they actually are (c)

)Rainbow(d)Advanced sunrise and delayed sunset

2. Twinkling of stars is due to

- (a) Reflection of light by clouds (b) scattering of light by dust particles
(c) dispersion of light by water drops (d) atmospheric refraction of starlight.

3. Which of the following colours is least scattered by fog, dust or smoke :

- (a) Violet (b) Blue (c) Red (d) Yellow

4. Red light is used as danger signal because red light can travel maximum distance as it

- (a) is the most scattered (b) is the least scattered
(c) undergoes maximum refraction (d) does not undergo refraction

5. A rainbow is observed when the Sun is

- (a) Vertically above the observer (b) Behind the observer
(c) In front of the observer (d) At any position

6. The scattering of light by colloidal particles is called

- (a) Tyndall effect (b) dispersion
(c) atmospheric refraction (d) internal reflection

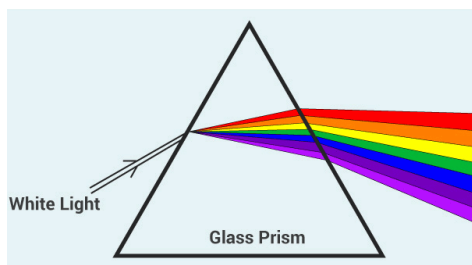
7. When white light passes through a prism, the component colour which undergoes maximum bending is

- (a) red (b) green (c) violet (d) blue

8. During a rainbow formation dispersion of light is done by-----

- (a) glass prism (b) dust particles (c) tiny air molecules (d) tiny rain drops

9. In the given diagram, the white light splits into seven colours by dispersion.



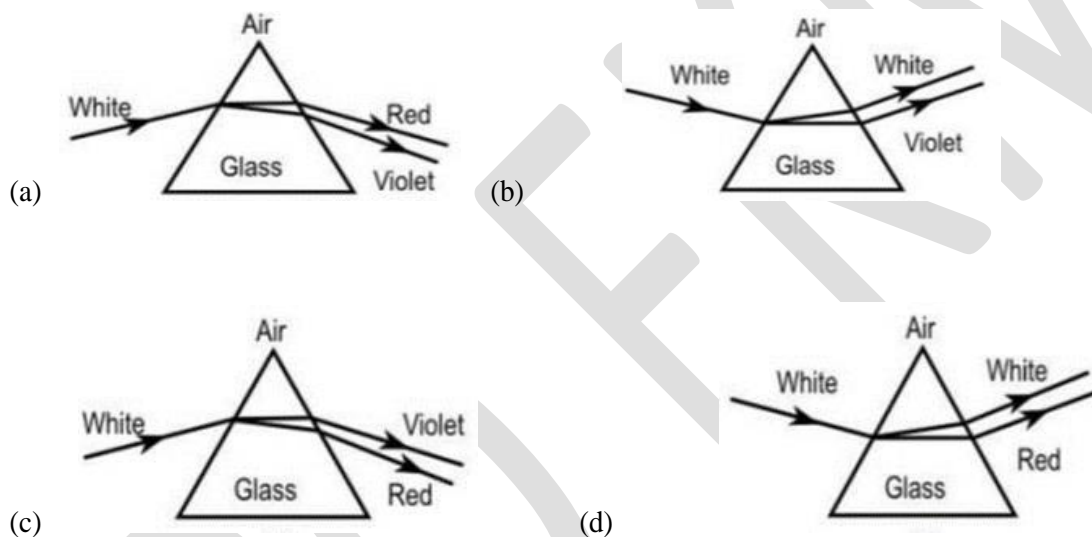
A student kept an optical device on the path way of the dispersed light to get back the white light. The device used by the student for the recombination of seven colours is

- (a) concave lens (b) a smaller prism in the erect position
 (c) glass slab (d) inverted identical prism

10. The sky appears blue due to

- (a) scattering of sunlight (b) dispersion of sunlight
 (c) atmospheric refraction (d) reflection of light by water bodies

11. Choose the correct diagram showing dispersion of white light.



12. Sunlight is passed through a transparent medium having very fine particles. These particles scatter light. Which among the given components of light undergoes more scattering?

- (a) red (b) orange (c) yellow (d) blue

ASSERTION REASON TYPE

Instructions:

A statement of assertion followed by a statement of reason is given. Choose the correct answer out of the following choices.

(A) Both Assertion and Reason are true and the reason is the correct

explanation of assertion.

(B) Both Assertion and Reason are true and the reason is not the correct explanation of assertion.

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

(D) Assertion is false but Reason is true.

1. Assertion: A rainbow is a natural spectrum appearing in the sky after a rain shower.

Reason : A rainbow is always formed in a direction opposite to that of the Sun.

2. Assertion: White light is dispersed into its seven-colour components by a prism.

Reason : Different colours of light bend through different angles with respect to the incident ray, as they pass through a prism.

3. Assertion: When a beam of light strikes fine particles of smoke, the path of the beam becomes visible.

Reason : Fine particles of smoke scatter light.

4. Assertion: The sky appears dark to passengers flying at very high altitudes.

Reason: scattering of light is prominent at such high altitudes.

5. Assertion: When sunlight passes through the atmosphere, the fine particles in air scatter the blue colour (shorter wavelengths) more strongly than red.

Reason: The red light has a wavelength about 1.8 times greater than blue light.

6. Assertion: During sunset, the sun's disc appears red.

Reason: Light from the Sun near the horizon passes through a shorter distance in the earth's atmosphere before reaching our eyes.

7. Assertion: The twinkling of stars is not seen from the moon.

Reason: The starlight, on entering the moon's atmosphere, undergoes refraction strongly.

8. Assertion: All the seven colours of the spectrum, when passed through a second prism, white light emerges from the other side of the second prism.

Reason: All the seven colours of light when combined give white light.

9. Assertion: The stars twinkle, while the planets do

not. Reason: The stars are much bigger in size than the

planets.

10. Assertion : A white light on passing through prism splits into its component colours as such that the red light emerges nearest to the base of the prism.

Reason : Wavelength of red light is more than other component colours and hence, red light deviates least.

CASE STUDY

One of nature's most splendid masterpieces is the rainbow. A rainbow is an excellent demonstration of the dispersion of light and one more piece of evidence that visible light is composed of a spectrum of wavelengths, each associated with a distinct color. To view a rainbow, sun must be at your back as you look at an approximately 40 degree angle above the ground into a region of the atmosphere with suspended droplets of water or even a light mist. Each individual droplet of water acts as a tiny prism that both disperses the light and reflects it back to your eye.



i) Formation of rainbow involves some natural phenomena which are in the correct order respectively is

a) refraction, dispersion, internal reflection and refraction
b) refraction, dispersion, internal reflection

c) reflection, refraction, dispersion and refraction

d) dispersion, reflection, refraction and internal reflection

ii) During the formation of a rainbow the position of observer and sun is

a) Observer behind sun b) sun behind the observer

b) Observer facing sun d) at any position

iii) During the formation of rainbow, dispersion of sunlight is done by

a) tiny air molecules b) dust particles of atmosphere

c) tiny droplets of rain water suspended in air d) air and water

iv) The dispersion of light into its components by prism is due to

- a) each component get deviated by the same angle by refraction
- b) each component gets deviated by a different angle by refraction
- c) reflection of each component light by different angle
- d) reflection of each component light by same angle

ANSWERS

1.MCQ

1.c.2.d.3.c 4.b 5. b6.a 7.c 8.d 9.d 10.a 11.a 12.d

2.ASSERION REASON TYPE

1.B 2. A 3.A 4.C5.A 6.C 7.C 8.A 9.C 10.D

3.CASE STUDY

- i)a ii) b iii)c iv) b

ELECTRICITY

Electric Current: Electric current is expressed by the rate of flow of electric charges. Electric current is carried by moving electrons through a conductor. By convention, direction of electric current is in the opposite direction of flow of electrons.

If a net electric charge (Q) flows through a cross-section of a conductor in time t, then,

$$\text{Electric current (I)} = \frac{\text{Net charge (Q)}}{\text{Time (t)}} \text{ or, } \boxed{I = \frac{Q}{t}}$$

Where I is electric current, Q is a net charge and t is a time in second.

SI unit of Electric Charge-coulomb (C). One coulomb is nearly equal to charge of 6×10^{18} electrons.

S.I. unit of electric current is ampere (A). $1 \text{ A} = 1 \text{ C}/1 \text{ s}$,

When 1 coulomb of electric charge flows through a cross section for 1 second, the current is said to be 1 ampere.

Ammeter: An apparatus to measure electric current in a circuit.,

Electric Potential: The amount of electric potential energy at a point is called electric potential. **Potential Difference:** Electric potential difference is known as voltage, which is equal to the amount of work done to move a unit charge between two points against static electric field.

Therefore, Voltage = $\frac{\text{work done}}{\text{charge}}$

Voltage or electric potential difference is denoted by V' . Therefore,

$$V = W/Q$$

Where, $W = \text{Work done}$ and $Q = \text{Charge}$

S.I. unit of electric potential difference is volt and denoted by 'V'

When 1 joule of work is done to move a charge of 1 coulomb from one point to another in an electric circuit the potential difference is said to be 1 volt.

$$1\text{V} = 1\text{Joule}/1\text{Coulomb} = 1\text{J}/1\text{C}$$

Voltmeter: An apparatus to measure the potential difference or electric potential difference between two points in an electric circuit.

Electric Circuit: Electric circuit is a continuous and closed path of electric current.

Ohm's Law: Ohm's Law states that the potential difference between two points in a conductor is directly proportional to the electric current flowing through it at a constant temperature.

$$V \propto I$$

$$V = RI$$

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

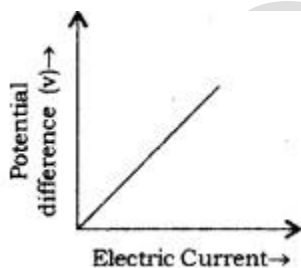
Where, R is constant for the given conductor at a given temperature and is called resistance. **Resistance:** Resistance is the property of conductor which resists the flow of electric current through it.

S.I. unit of resistance is ohm. Ohm is denoted by Greek letter Ω .

1 Ohm: 1 ohm of resistance is equal to the flow 1A of current through a conductor between two points having a potential difference equal to 1V.

$$1\Omega = \frac{1V}{1A}$$

The graph of V (potential difference) versus I (electric current) is always a straight line.



Factors on Which Resistance of a Conductor Depends:

(i) **Nature of Material:** Some materials allow current to pass and are called good conductors. Materials which do not allow flow of electrons through them are called bad conductors or insulators.

(ii) **Length of Conductor:** Resistance (R) is directly proportional to the length of the conductor. This means, resistance increases with increase in length of the conductor.

or, $R \propto l$... (i)

(iii) **Area of Cross Section:** Resistance R is inversely proportional to the area of cross section (A) of the

conductor.or,

$$R \propto \frac{l}{A} \dots (ii)$$

From equations(i)and(ii)

$$R \propto \frac{l}{A}$$

$$R = \rho$$

Where, ρ (rho) is the proportionality constant. It is called the electrical resistivity of the material of

conductor.

$$\text{or } \rho = \frac{RA}{l}$$

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.

The S.I. unit of Resistivity: (ρ) =

$$\frac{\Omega \times m^2}{m} = \Omega m \text{ Thus, S.I. unit of}$$

resistivity (ρ) is Ωm .

Resistivity depends on the nature of the material and temperature.

Materials having a resistivity in the range of $10^{-8} \Omega m$ to $10^{-6} \Omega m$ are considered as very good conductors.

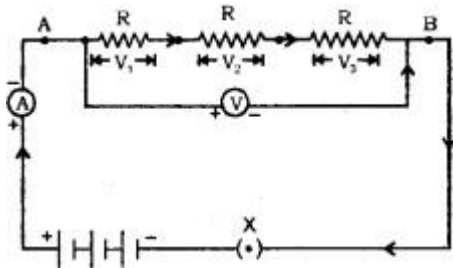
Insulators have a resistivity in the order of $10^{-12} \Omega m$ to $10^8 \Omega m$.

Variable Resistance: The component of an electric circuit which is used to regulate the current, without changing the voltage from the source, is called variable resistance.

Rheostat: This is a device which is used in a circuit to provide variable resistance.

Combination of resistors

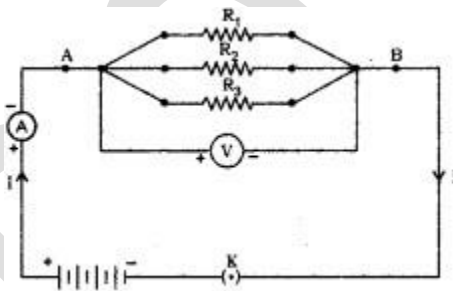
1. **Resistors in Series:** When resistors are joined from end to end, it is called in series. In this case, the total resistance of the system is equal to the sum of the resistance of all the resistors in the system.



$$R_s = R_1 + R_2 + R_3$$

When the resistors are connected in series, the current flowing through each resistor is the same and is equal to the total current.

Resistors in Parallel: When resistors are joined in parallel, the reciprocal of the total resistance of the system is equal to the sum of reciprocal of the resistance of resistors.



$$1/R_p = 1/R_1 + 1/R_2 + 1/R_3$$

Heating Effect of Electric Current: The heating of resistor because of dissipation of electrical energy is commonly known as Heating Effect of Electric Current.

Heating effect is used in many appliances, such as electric iron, electric heater, electric geyser, etc.

Joule's Law Of Heating: It states that heat produced in a resistor is directly proportional to the square of current given to the resistor, directly proportional to the resistance for a given current and directly proportional to the time for which the current is flowing through the resistor.

$$H = I^2Rt$$

Electric Power

The rate of doing work or rate of consumption of electrical energy is called Electric Power. If W is work done in time t, then

$$P = W/t.$$

S.I unit is Watt (W).

One watt of power is consumed when 1 A of current flows at a potential difference of 1V.

$$P = VI \text{ or } P = I^2R \text{ or } P = V^2/R$$

The commercial unit of electrical energy is a kilowatt-hour

(kWh) or unit. $1\text{kWh} = 3.6 \times 10^6 \text{ J}$

One kilowatt-hour is defined as the amount of energy consumed when 1kW of power is used for 1 hour.

Multiple choice Questions

1. The resistivity does not change if
 - a) The material is changed

- b) The temperature is changed
 - c) The shape of the resistor is changed
 - d) Both material and temperature are changed
2. Two resistors of resistances $2\ \Omega$ and $4\ \Omega$ when connected to a battery will have
- a) Same current flowing through them when connected in parallel
 - b) Same current flowing through them when connected in series
 - c) Same potential difference across them when connected in series
 - d) None of these
3. In an electric circuit three incandescent bulbs of rating 40W, 60W and 100W respectively are connected in parallel to an electric source. Which of the following is likely to happen regarding their brightness
- a) Brightness of all the bulbs will be the same
 - b) Brightness of bulb A will be the maximum
 - c) Brightness of bulb B will be more than that of A
 - d) Brightness of bulb C will be less than that of B
4. A cylindrical conductor of length l and uniform area of cross section A has resistance R . Another conductor of length $2l$ and resistance R of the same material has area of cross section
- a) $A/2$
 - b) $3A/2$
 - c) $2A$
 - d) $3A$
5. The resistance of an electric iron drawing a current of 4A when connected to a 220V mains would be
- a) $1000\ \Omega$
 - b) $55\ \Omega$
 - c) $44\ \Omega$
 - d) $64\ \Omega$
6. Ohm's law states the relationship between
- a) Electric current and heat produced in it
 - b) Electric power and work done
 - c) Electric current and potential difference
 - d) Electric current and electric charge
7. The unit of resistivity is
- a) Ohm

- b) Ohm metre²
 - c) Ohm metre
 - d) Ohm per metre
8. An electric kettle consumes 1kW of electric power when operated at 220V. The rating of fuse wire that must be used would be
- a) 1A
 - b) 2A
 - c) 4A
 - d) 5A
9. Unit of electric power may also be expressed as
- a) Volt ampere
 - b) Kilowatt hour
 - c) Watt second
 - d) Joule second
10. If 25 joule of work is done in moving a charge of 5C across two points A and B the potential difference between these points would be
- a) V
 - b) 125V
 - c) 5V
 - d) 625V

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

Assertion and reasoning questions

The following questions consists of two statements –Assertion(A)and Reason (R). Answer these questions selecting the appropriate option given below.

- a) Both A and R are true and R is the correct explanation for A
- b) Both A and R are true and R is not the correct explanation for A
- c) A is true but R is false
- d) A is false but R is true.

1. Assertion (A): Longer wires have greater resistance and the smaller wires have lesser resistance.

Reason(R): Resistance is inversely proportional to the length of the wire.

2. Assertion (A): Alloys are commonly used in electrical

heating devices. Reason(R): Alloys do not oxidize at high temperatures.

3. Assertion (A): If a graph is plotted between potential difference and current the graph is a straight line passing through the origin.

Reason(R): current is directly proportional to the potential difference.

4. Assertion (A): A cell converts chemical energy into electrical energy.

Reason(R): A cell maintains a potential difference across its terminals due to chemical reactions.

5. Assertion (A): When resistances are connected between the same two points they are said to be in series.

Reason(R): When resistors are connected in series the current through each resistor is the same.

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

Answer in a word or sentence (1 mark)

1. What is the resistance of an ideal voltmeter? Ans. Infinite

2. Mention the conditions under which current can flow in a conductor?

Ans. a) Circuit is closed b) There is a potential difference along the conductor.

3. When do we say that potential difference between two points in a circuit is 1 volt?

Ans. When 1 joule of work is done to move a charge of 1 coulomb from one point to the other.

4. What is the amount of charge when a current of 4A flows in a circuit

for 10 minutes? Ans. $Q = I \times t = 4 \times 10 \times 60 = 2400C$

5. How will be the resistance of a conductor change if its

area is doubled? Ans. Resistance will become half as R is inversely proportional to area.

Short Answer Questions (3 marks)

1. Two wires of equal length, one of copper and the other of manganin (an alloy) have the same thickness. Which one can be used for i) electrical transmission ii) electrical heating devices? Why?

Ans) i) Copper wire can be used for electrical transmission lines because copper has very low resistivity and hence it is a very good conductor of electricity.

ii) Manganin can be used for electrical heating devices because it has very high resistivity and hence produces a lot of heat when current passes through it,

2. In an electrical circuit two resistors of $2\ \Omega$ and $4\ \Omega$ respectively are connected in series to a $6\ \text{V}$ battery. What will be the heat dissipated by the $4\ \Omega$ resistor in $5\ \text{s}$?

Ans) $I = V / R = 6 / (2+4)$
 $= 1\ \text{A}$
 $H = I^2 R t = 1 \times 4 \times 5 = 20\ \text{J}$

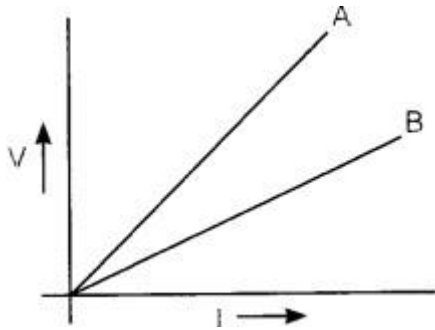
3. In a household circuit an electric iron of $100\ \text{W}$ is used for 10 hours and an electric oven of $1000\ \text{W}$ is used for 2 hours every day. Calculate the cost of using them for 30 days if the cost of one unit of electrical energy is Rs 5.

Ans) electrical energy consumed by the electric iron = $100 / 1000 \times 10 = 1\ \text{kWh}$.
electrical energy consumed by the electric oven = $1000 / 1000 \times 2 = 2\ \text{kWh}$.

Total energy consumed in 1 day = $1+2 = 3\ \text{kWh}$.

Cost of electrical energy consumed 30 days = $3 \times 30 \times 5 = \text{Rs } 450$

4. V-I graph for two wires A and B are shown in the figure. If both wires are of same length and same thickness, which of the two is made of a material of high resistivity? Give justification for your answer.



Answer. Greater than slope of V-I graph, greater will be the resistance of given metallic

wire. In the given graph, wire A has greater slope than B. Hence, wire A has greater resistance. For the wires of same length and same thickness, resistance depends on the nature of material of the wire

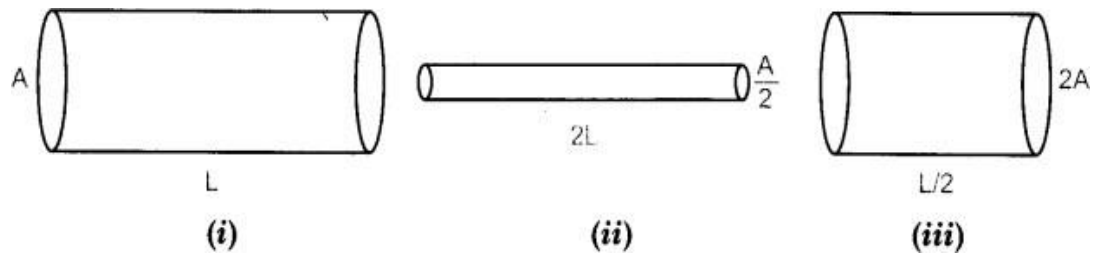
$$R_1 = \rho_1 \frac{l}{A} \quad \text{and} \quad R_2 = \rho_2 \frac{l}{A}$$

$$\Rightarrow \frac{R_1}{R_2} = \frac{\rho_1}{\rho_2} \quad \text{or} \quad R \propto \rho$$

Hence, wire 'A' is made of a material of high resistivity.

i.e.

5. The figure below shows three cylindrical copper conductors along with their face areas and lengths. Discuss in which geometrical shape the resistance will be highest.



Answer.

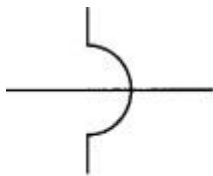
For geometrical shape shown in

Figure (i) $R_1 = \rho \frac{L}{A}$

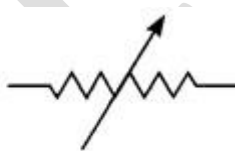
Figure (ii) $R_2 = \rho \frac{2L}{A/2} = 4 \left(\rho \frac{L}{A} \right) = 4R_1$

Figure (iii) $R_3 = \rho \frac{L/2}{2A} = \frac{1}{4} \left(\rho \frac{L}{A} \right) = \frac{R_1}{4}$

6. (a) What do the following circuit symbols represent?



(i)



(ii)

(b) The potential difference between the terminals of an electric heater is 60 V when it draws a current of 4 A from the source. Find the resistance of heater when in use.

Answer.

(a) (i) Wires crossing without touching each other.

(ii) Rheostat/Variable resistor

(b) Given: $V = 60 \text{ V}$, $I = 4 \text{ A}$,

$R = ?$ From Ohm's law, $V =$

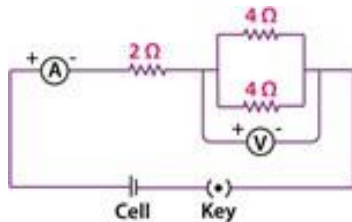
IR

$$60 = 4 \times R = 15 \Omega$$

Long Answer Type Questions (5 Mark)

1. Draw a circuit diagram of an electric circuit containing a cell, a key, an ammeter, a resistor of $2\ \Omega$ in series with a combination of two resistors ($4\ \Omega$ each) in parallel and a voltmeter across the parallel combination. Will the potential difference across the $2\ \Omega$ resistor be the same as that across the parallel combination of $4\ \Omega$ resistors? Give reason.

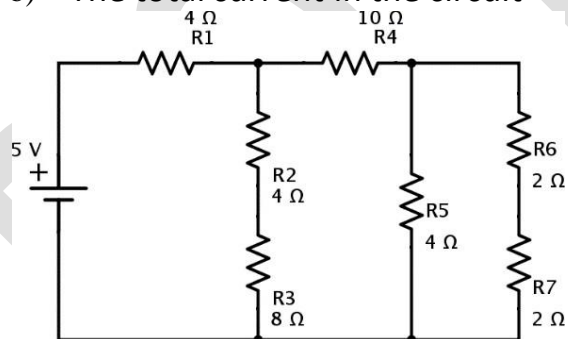
Ans) Circuit diagram



Effective resistance of the two $4\ \Omega$ resistors in parallel = $2\ \Omega$. Since now they are in series same current will flow through both and hence potential difference will be the same across both.

2. i) In the following circuit calculate:

- The resultant resistance in the circuit
- The total current in the circuit



Ans) a) resultant resistance = $R_6 + R_7 = 2\ \Omega +$

$$2\ \Omega = 4\ \Omega \quad 1 / R_5 + 1 / 4 = 2\ \Omega$$

$$R_4 + 2\ \Omega = 12\ \Omega$$

$$R_2 + R_3 = 4\ \Omega + 8\ \Omega =$$

$$12\ \Omega \quad 1 / 12 + 1 / 12 =$$

$$6\ \Omega$$

$$R_1 + 6\ \Omega = R = 10\ \Omega$$

b) $I = V / R = 5 / 10 = 0.5A$

ii) Why should we connect different devices in parallel in our domestic circuit? Ans) 1) Each appliance gets the same voltage as the supply power line.

2) Overall resistance of the circuit is less.

3) Even if one appliance stops working others are not affected.

3. (a) Write two points of difference between electric energy and electric power. Out of 60 W and 40 W lamps, which one has higher electrical resistance when in use.

(c) What is the commercial unit of electric energy? Convert it into joules.

Answer. (a) Difference between electric energy and electric power:

Electrical energy	Electric power
<p>(i) The work done or energy supplied by the source in maintaining the flow of electric current is called electrical energy. It appears in the form of heat given by</p> $H = VIt = \frac{V^2 t}{R} = I^2 RT$	<p>(i) The time rate at which electric energy is consumed or dissipated by an electrical device is called electric power and is given by</p> $P = VI = \frac{V^2}{R} = I^2 R$
<p>(ii) It is equal to the product of power and time</p> $E = P \times t$	<p>(ii) It is equal to the rate of doing work by an energy source.</p> $P = \frac{W}{t}$
<p>(iii) Its SI unit is joule (J) 1 J = 1 W × 1s</p>	<p>(iii) Its SI unit is watt (W) 1 W = 1 J s⁻¹</p>

(b) For the same applied voltage, $P \propto \frac{1}{R}$

i.e. lesser the power of electrical device, higher is its electrical resistance. Hence 40W lamp has higher resistance.

(c) Kilowatt hour – Commercial unit of electrical energy

1 kWh = 1000 Wh = 1000 J/S × 3600 sec = 3600000 J = 3.6 × 10⁶J

4. a) A given length of a wire is doubled on itself and this process is repeated

once again. By what factor does the resistance of the wire change? **Answer.** Am. Length becomes one-fourth of the original length and area of cross-section becomes four times that of original.

$$\text{i.e.} \quad l_2 = \frac{1}{4}l_1 \text{ and } A_2 = 4A_1$$

$$\therefore \quad \frac{R_2}{R_1} = \frac{l_2}{l_1} \times \frac{A_1}{A_2} = \frac{1}{4} \times \frac{1}{4} = \frac{1}{16}$$

$$\Rightarrow \quad R_2 = \frac{1}{16}R_1$$

So, new resistance is (1/16)th of original resistance.

Find the current drawn from the battery by the network of four resistors Shown in the

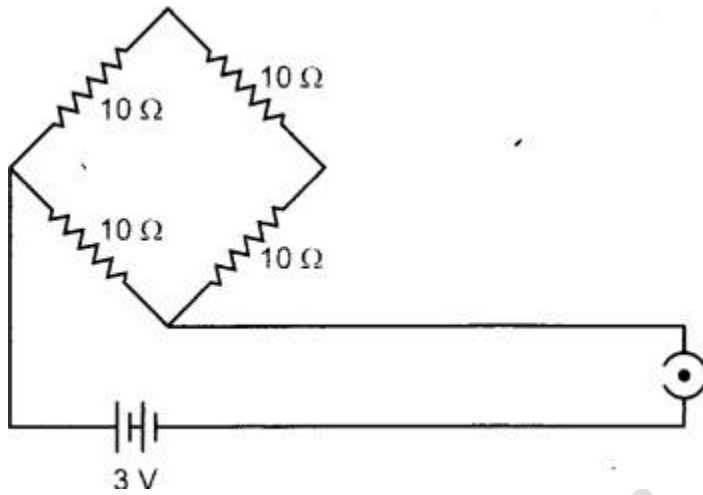


figure.

Answer.

Equivalent resistance the given network is

$$\begin{aligned} \frac{1}{R} &= \frac{1}{R_4} + \frac{1}{R_1 + R_2 + R_3} \\ &= \frac{1}{10} + \frac{1}{10 + 10 + 10} = \frac{1}{10} + \frac{1}{30} = \frac{3+1}{30} = \frac{4}{30} \end{aligned}$$

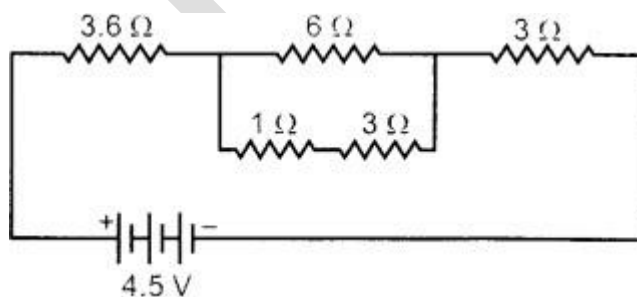
$$\therefore R = \frac{30}{4} = 7.5 \Omega$$

Current drawn from the battery

$$I = \frac{V}{R} = \frac{3}{7.5} = \frac{30}{75} = \frac{2}{5}$$

$$\Rightarrow I = 0.4 \text{ A}$$

5 a) Find the current flowing through the following electric circuit.



Answer.

Series combination of $1\ \Omega$ and $3\ \Omega$ resistance is in parallel combination with $6\ \Omega$. Their equivalent resistance is

$$\frac{1}{R_p} = \frac{1}{6} + \frac{1}{3+1} = \frac{1}{6} + \frac{1}{4} = \frac{2+3}{12}$$

$$\therefore R_p = \frac{12}{5} = 2.4\ \Omega$$

Now, $3.6\ \Omega$, $2.4\ \Omega$ and $3\ \Omega$ are in series, their equivalent resistance be

$$\begin{aligned} R_s &= R_1 + R_2 + R_3 \\ &= 3.6 + 2.4 + 3 = 9\ \Omega \end{aligned}$$

Hence, the current flowing through the circuit is

$$I = \frac{V}{R} = \frac{4.5}{9} = \frac{45}{90} = \frac{1}{2} = 0.5\ \text{A.}$$

b) A $9\ \Omega$ resistance is cut into three equal parts and connected in parallel. Find the equivalent resistance of the combination.

Answer.

Resistance of each part = $\frac{R}{3} = \frac{9}{3} = 3\ \Omega$

$$\therefore R_1 = R_2 = R_3 = 3\ \Omega$$

In parallel combination,

$$\begin{aligned} \frac{1}{R_p} &= \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} \\ &= \frac{1}{3} + \frac{1}{3} + \frac{1}{3} = \frac{3}{3} = 1 \end{aligned}$$

$$\therefore R_p = 1\ \Omega$$

Creative and Critical thinking

LEVITATING TRAINS: CURRENT SCENARIO

Levitating Train or Maglev is a system of train transportation that uses two sets of magnets, one set to repel and push the train up off the track, and another set to move the elevated train ahead, taking advantage of the lack

of friction. Maglev transport systems are now operational in just three countries (Japan, South Korea and China)

The Six Operational Maglev Lines in 2018

1. Daejeon Expo Maglev, South-Korea – Since 1993

The urban train runs today on a short track between the Expo Park and the National Science Museum.

2. Shanghai Maglev, China - Since 2004

Also known as the [Transrapid](#), has a top speed of 430 km/h (270 mph). The line is the fastest and currently the first and only, commercially successful, operational high-speed maglev train.

3. Linimo Maglev, Japan – Since 2005

Japan's first commercial maglev line. 100 km/h (62 mph) the Linimo has historical importance: it was the world's first unmanned commercial urban maglev.

4. Incheon Airport Maglev, South-Korea – Since 2016

The Incheon Airport Maglev is an unmanned commercial maglev train at 110 km/h (68mph) operating speed.

5. Changsha Maglev Express, China – Since 2016

It is the first Chinese developed and built maglev train with 100 km/h (62 mph) operating speed.

Beijing S1 Metro Line China – Since 2017

It's the newest and China's third commercial maglev train in operation at 110 km/h (68 mph) speeds.

Answer the following questions:

1. Name three countries where Maglev system is operational

2. The high speed of levitating train is due to

a) Less friction b) High friction c) No friction

3. The fastest commercially used levitating train is _____

4. Why are levitating trains called as Maglev trains?

5. How are Maglev trains different from conventional trains?

6. Are levitating trains more environmentally friendly? Suggest any two reasons to support your answer.

Answers:

1. China, Japan and South Korea.
2. c) No friction.
3. Shanghai Maglev train.
4. They use magnetic levitation by using two sets of magnets, one to repel and lift the train off the track and other to push it forward.
5. Conventional trains use electric current or diesel as the source of energy while levitating trains use electricity to produce magnetic levitation. The former has wheels while the latter do not have wheels and use 30% less energy.
6. Yes. Levitating trains have no carbon emissions and no noise pollution, less maintenance as less wear and tear.

MAGNETIC EFFECTS OF ELECTRIC CURRENT

KEY CONCEPTS & GIST OF THE LESSON

Magnet:

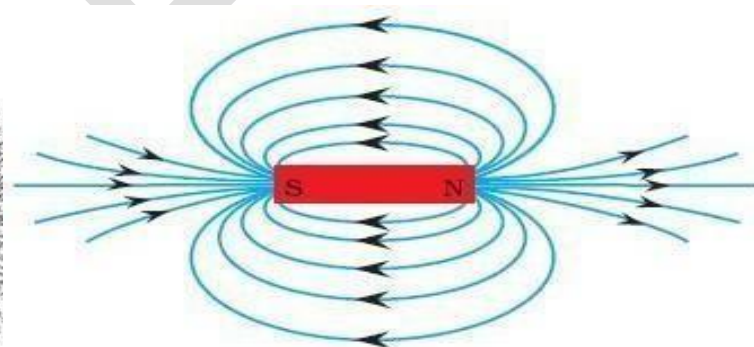
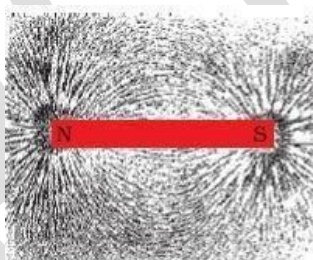
- (i) Is an object that attracts objects made of iron, cobalt & nickel.
- (ii) Have two poles, north and south.
- (iii) Comes to rest in the North-South direction, when suspended freely.

Magnets are used:

- (i) In radio & stereo speakers,
- (ii) In refrigerator doors,
- (iii) On audio & video cassettes players,
- (iv) On hard discs & floppies of computers &
- (v) In children's toys and magnetic compass.

Magnetic field: The region or space around a magnet where a magnetic force is experienced is called a magnetic field. The strength of magnetic force is also called the magnetic field. It is a quantity that has both direction & magnitude. Its unit is Tesla(T). Direction is from north pole to south pole.

Magnetic field lines: Magnetic field is represented by field lines. They are lines drawn in a Magnetic field along which a North magnetic pole moves. Magnetic field lines are called Magnetic lines of force.

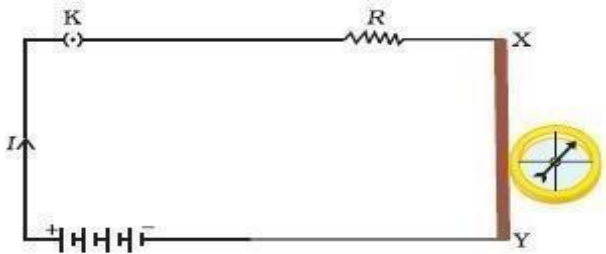


Properties of Magnetic field lines:

1. Magnetic field lines emerge from north pole and merge at the south pole. Inside the magnet, the direction of field lines is from its south pole to its north pole. Thus the magnetic field lines are closed curves.
2. The relative strength of the magnetic field is shown by the degree of closeness of the field lines. The field is stronger, that is, the force acting on the pole of another magnet placed is greater

where the field lines are crowded .

3. No two field-lines are found to cross each other. If they did, it would mean that at the point of intersection, the compass needle would point towards two different directions, which is not possible.

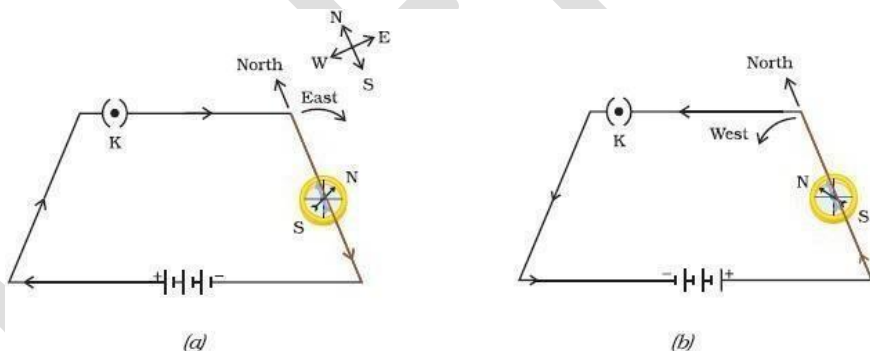


MAGNETIC EFFECTS OF CURRENT

Hans Christian Oersted, accidentally discovered that a compass needle got deflected when a current carrying metallic wire is placed nearby.

SNOW RULE : When current is flowing from south to north the magnetic needle gets deflected towards west .

When current is flowing from north to south the magnetic needle gets deflected towards east. (as in figure below)



MAGNETIC FIELD DUE TO A STRAIGHT CURRENT-CARRYING CONDUCTOR

The magnetic field lines due to a straight current carrying conductor are concentric circles whose centers lie on the wire

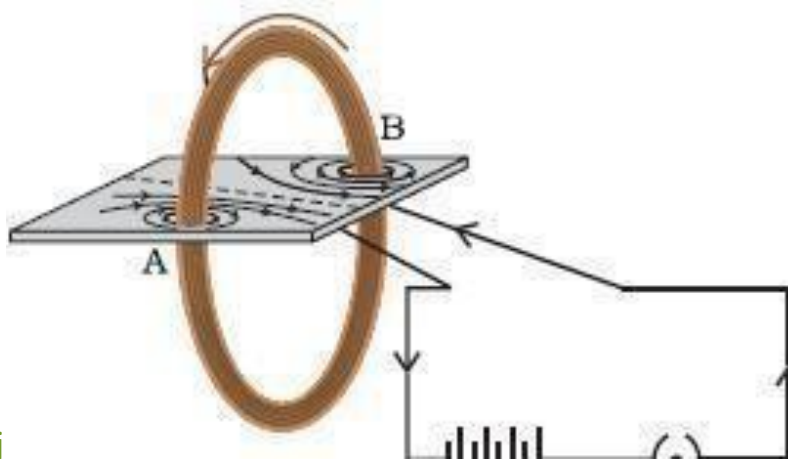
Factors on which the magnitude of magnetic field due to straight current carrying conductor depends

The magnitude of magnetic field produced is

a) **Directly proportional to the current passing in the wire.** If the magnitude of the magnetic field produced at a given point

increases as the current through the wire increases.

b) **Inversely proportional to the distance of that point from the wire.** The magnetic field produced by a given current in the conductor decreases as the distance from it increases. From Fig. It can be noticed that the concentric circles representing the magnetic field around a current-carrying straight wire become larger and larger as we move away from it.



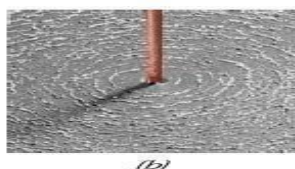
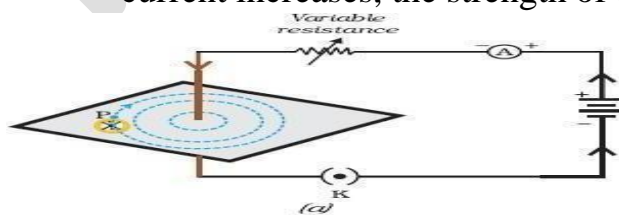
Ri

If a current carrying straight conductor is held in your right hand such that the thumb points towards the direction of current, then the wrapped fingers show the direction of magnetic field lines.

Magnetic field lines due to a current through a circular loop .

The strength of the magnetic field at the center of the loop (coil) depends on:

- (i) **The radius of the coil-** The strength of the magnetic field is inversely proportional to the radius of the coil. If the radius increases, the magnetic strength at the center decreases.
- (ii) **The number of turns in the coil:** As the number of turns in the coil increases, the magnetic strength at the center increases, because the current in each circular turn is having the same direction, thus the field due to each turn adds up.
- (iii) **The strength of the current flowing in the coil:** as the strength of the current increases, the strength of the magnetic fields also increases.



Solenoid:

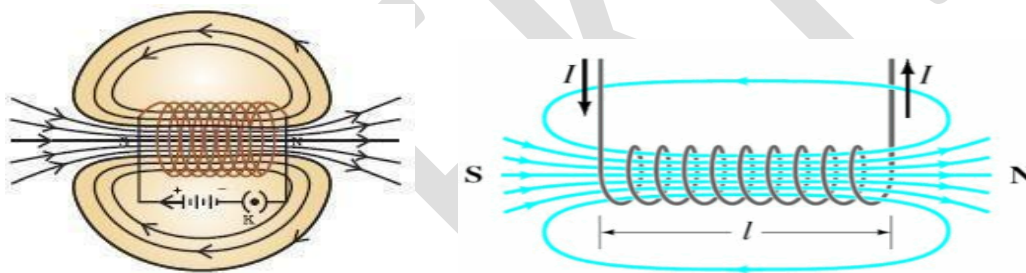
A coil of many circular turns of insulated copper wire wrapped closely in the shape of a cylinder is called a solenoid.

In fact, one end of the solenoid behaves as a magnetic north pole, while the other behaves as the south pole.

The field lines inside the solenoid are in the form of parallel straight lines. This indicates that the magnetic field is the same at all points inside the solenoid. That is, the field is uniform inside the solenoid.

The strength of the magnetic field inside a solenoid depends on

1. The number of turns in the solenoid : Larger the number of turns in the solenoid greater the magnetism
2. The strength of current in the solenoid: Larger the magnitude of current passing through the solenoid greater the strength of magnetic field.
3. The nature of core material used in making solenoid: The use of soft iron core inside the solenoid produces stronger magnetic field.



Electromagnet:

A device consisting of a coil of insulated wire wrapped around an iron core that becomes magnetized when an electric current flows through the wire.

Permanent (Bar) Magnet	Electromagnet
They are permanently magnetized.	These are temporarily magnetized.
These are usually made of hard materials.	They are usually made of soft materials.
The strength of the magnetic field line is constant i.e. it cannot be varied.	The strength of the magnetic field lines can be varied according to our need.

The poles of a Permanent magnet cannot be changed.	The poles of an electromagnet can be altered.
Example of a permanent magnet is a Bar Magnet	Example of a temporary magnet is solenoid wound across a nail and connected to a battery.

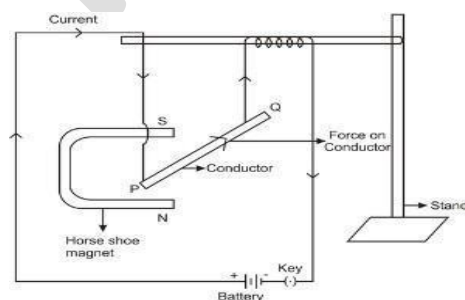
Uses of electromagnets :In magnetic locks, relays, magnetic levitation, electric bells, loudspeakers etc.

Factors affecting strength of electromagnet:

1. The number of turns in the coil: As the number of turns increases strength of electromagnet increases.
2. The current flowing in the coil : Strength of electromagnet increases when current increases.
3. The length of air gap between the poles. If we reduce the length of air gap then strength of electromagnet increases.

FORCE ON A CURRENT-CARRYING CONDUCTOR IN A MAGNETIC FIELD

- A current carrying conductor placed in a magnetic field experiences a force.
- If the direction of the field and that of current are mutually perpendicular to each other, then the force acting on the conductor will be perpendicular to both and that can be determined using the Fleming's left-hand rule.
- When current establishes in the conductor, it gets displaced which verifies the existence of a force on



the conductor.

Aim:

To show that a current carrying wire experiences a force when placed in a magnetic field.

- **Experimental Setup:**
 - 1. A conductor PQ is suspended horizontally from a stand.
 - 2. A horse shoe magnet is placed in such a way that rod lies between two poles of a magnet.
 - 3. Conductor is connected with the battery and the key.
- **Observations:**
 - 1. On closing the key, the conductor gets displaced towards right.
 - 2. On reversing the direction of current, the conductor gets displaced towards left.
 - 3. On changing the polarity of horse shoe magnet, the direction of force acting on the current carrying conductor gets reversed.
 - 4. When current carrying conductor is placed perpendicular to the direction of magnetic field, the maximum displacement occurs indicating the maximum force on the conductor.
 - 5. On placing the conductor parallel to the direction of magnetic field no displacement is noticed.
- **Conclusion:**
 - The displacement of the conductor shows that it experiences some force when it carries some current and is placed in a magnetic field.

Cause of Force on the current carrying conductor

Force on the current carrying conductor is due to the interaction between magnetic field due to current and external magnetic field.

Its magnitude increase when

1. Strength of current increases
2. External magnetic field strength increases.
3. Length of conductor increases

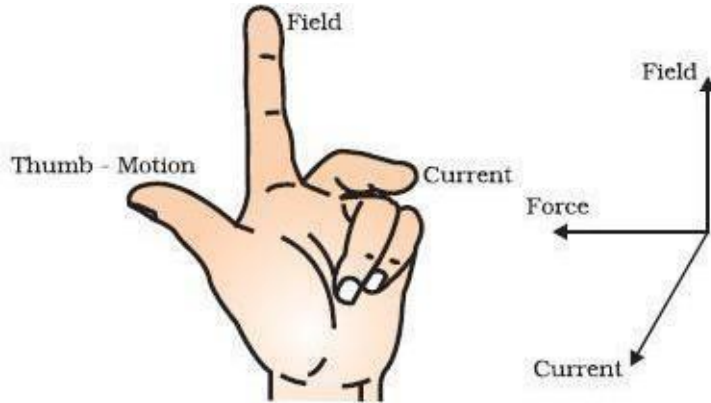
Maximum and minimum force

Force is maximum when the conductor is perpendicular to the magnetic field and minimum (zero) when conductor is parallel to the magnetic field.

The direction of force is given by **Fleming's left hand rule**

Fleming's Left hand rule:

Stretch the thumb, forefinger and middle finger of left hand such that they are mutually perpendicular. Forefinger points in the direction of magnetic field and middle finger in the direction of current, then the thumb gives the direction of force acting on the conductor. □



Devices that use current-carrying conductors and magnetic fields include electric motor, electric generator, loudspeakers, microphones and measuring instruments

Alternating current (AC) and Direct current (DC)

Alternating current (A.C.) : An electric current whose magnitude changes with time and direction reverses periodically is called alternating current or A current, which changes direction after equal intervals of time, is called an alternating current (abbreviated as AC).

Direct current (D.C.) : An electric current whose magnitude is either constant or variable but the direction of flow in a conductor remains the same is called direct current or a current which does not change its direction with time

Difference between AC and DC

The difference between the direct and alternating currents is that the direct current always flows in one direction, whereas the alternating current reverses its direction periodically. Most power stations constructed these days produce AC. An important advantage of AC over DC is that electric power can be transmitted over long distances without much loss of energy

<u>Basis of Comparison</u>	<u>AC</u>	<u>DC</u>
----------------------------	-----------	-----------

Definition	In AC, the direction of the current keeps reversing periodically.	The direction of the current remains the same in DC.
Frequency	50 or 60 Hz	Zero
Polarity	AC has a polarity (+, -)	It does not have polarity
The direction of flowing electrons	The direction of flow of electrons in AC is bidirectional	In DC, the flowing electrons are unidirectional
Attained from	Alternators or AC generators	DC Generators, battery, solar cell and more.
Purpose	Used in factories, industries, households	Used in electroplating, electrolysis, electronic equipment, and more

Frequency- In India, the AC changes direction after every 1/100 second, that is, the frequency of AC is 50 Hz.

Domestic electric circuit

*In our homes, we receive supply of electric power through a main supply (also called mains), either supported through overhead electric poles or by underground cables.

*One of the wires in this supply, usually with red insulation cover, is called **live wire** (or positive).

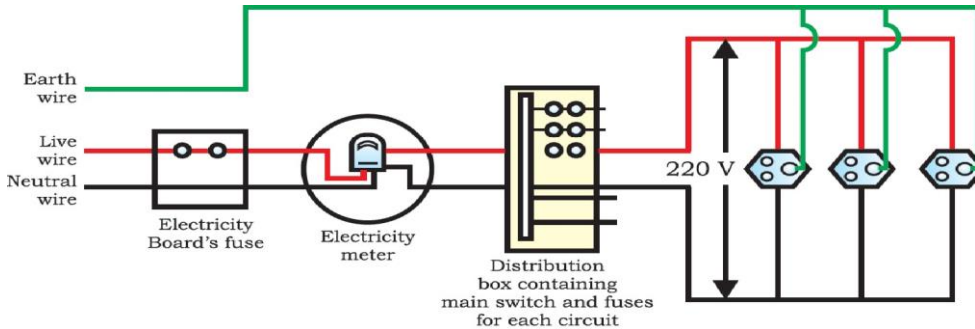
*Another wire, with black insulation, is called **neutral wire** (or negative).

*In our country, the potential difference between the two is 220 V.

*At the meter-board in the house, these wires pass into an electricity meter through a main fuse. Through the main switch they are connected to the line wires in the house. These wires supply electricity to separate circuits within the house. Often, two separate circuits are used, one of 15 A current rating for appliances with higher power ratings such as geysers, air coolers, etc. The other circuit is of 5 A current rating for bulbs, fans, etc.

***The earth wire**, which has insulation of green colour, is usually connected to a metal plate deep in the earth near the house. This is used as a safety measure, especially for those appliances that

have a metallic body, for example, electric press, toaster, table fan, refrigerator, etc. The metallic body is connected to the earth wire, which provides a low-resistance conducting path for the current. Thus, it ensures that any leakage of current to the metallic body of the appliance keeps its potential to that of the earth, and the user may not get a severe electric shock.



Electric fuse -A fuse in a circuit prevents damage to the appliances and the circuit due to overloading. The use of an electric fuse prevents the electric circuit and the appliance from a possible damage by stopping the flow of unduly high electric current. The Joule heating that takes place in the fuse melts it to break the electric circuit.

Over loading -Overloading can occur when the live wire and the neutral wire come into direct contact. (This occurs when the insulation of wires is damaged or there is a fault in the appliance.) In such a situation, the current in the circuit abruptly increases. This is called short-circuiting. Overloading can also occur due to an accidental hike in the supply voltage. Sometimes overloading is caused by connecting too many appliances to a single socket.

Same poles repel and opposite poles attract each other in a magnet.

Magnetic Field
Compass needle align itself in the direction of magnetic field.

North Pole of a compass needle points in the direction of magnetic field.
Magnetic field is a quantity that has both magnitude and direction.

Magnetic Field Lines

- Magnetic field lines outside the magnet emerge from north pole and merge at south pole.
- Inside the magnet, field lines are from south pole to north pole
- Magnetic field lines are closed curves.
- Magnetic field is stronger where the field lines are crowded.
- No two field lines are found to cross (intersect) each other.

Magnetic Field due to a Current through a Straight Conductor

- Magnetic field lines around a straight current carrying conductor forms concentric circles centered on the wire.
- As current increases deflection of compass needle increases.
- As compass needle is moved away from the wire, deflection in compass needle decreases.
- As current is reversed in direction, compass needle deflects in opposite direction.

Magnetic Field due to a Current through a Circular Loop

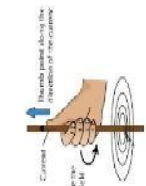
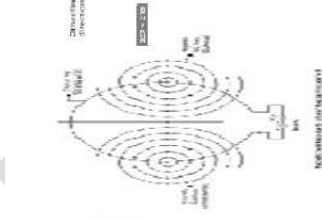
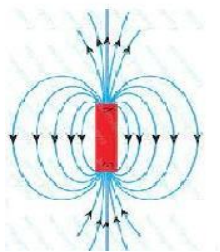
If there is circular coil having n turns, the field produced is n times as large as that produced by a single turn.

Magnetic Field due to a Current in Solenoid

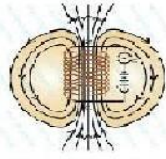
A coil of many circular turns of insulated copper wire wrapped closely in the shape of a cylinder is called a solenoid.

Magnetic field of a solenoid is similar to that of the bar magnet.

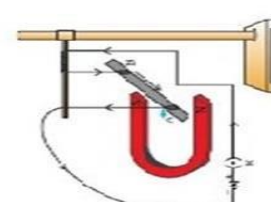
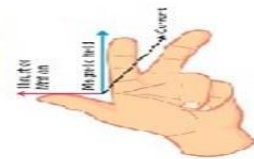
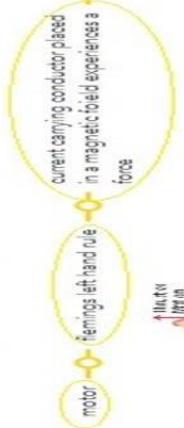
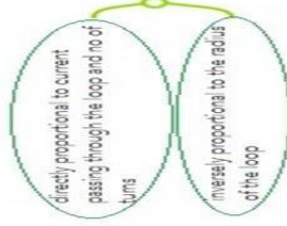
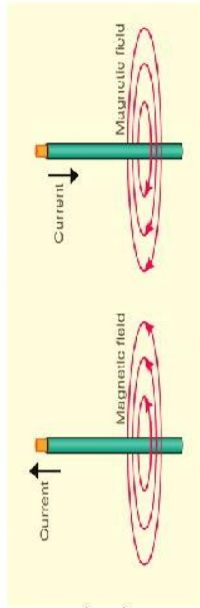
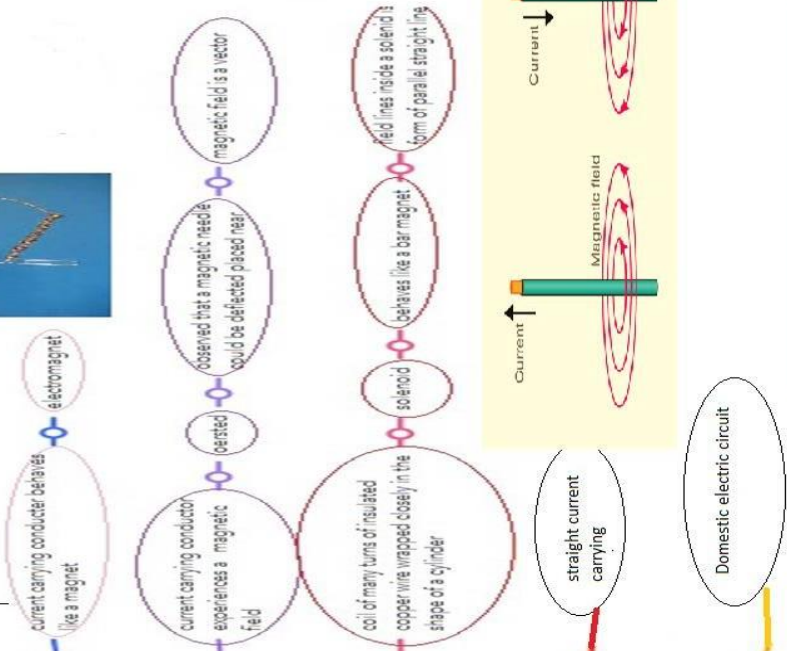
The field lines inside the solenoid are in the form of parallel straight lines. The field is uniform inside the solenoid.



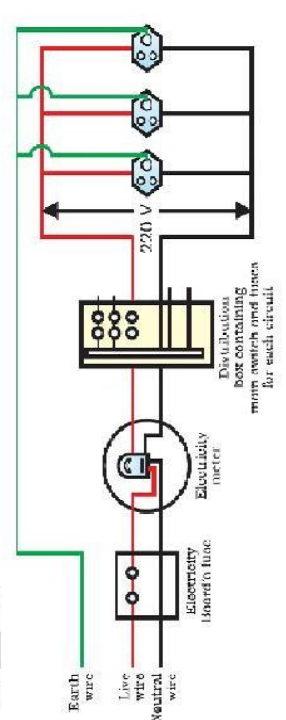
Magnetic Field in a Solenoid



magnetic effects of electric current



Domestic electric circuit



MCQ

1. Choose the incorrect statement from the following regarding magnetic lines of field

(A) The direction of magnetic field at a point is taken to be the direction in which the north pole of a magnetic compass needle points.

(B) Magnetic field lines are closed curves.

(C) If magnetic field lines are parallel and equidistant, they represent zero field strength.

(D) Relative strength of magnetic field is shown by the degree of closeness of the field lines.

2. Which of the following correctly describes the magnetic field near along straight current carrying wire?

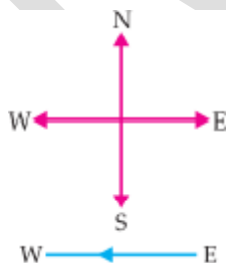
(A) The field consists of straight lines perpendicular to the wire.

(B) The field consists of straight lines parallel to the wire.

(C) The field consists of radial lines originating from the wire.

(D) The field consists of concentric circles centered on the wire.

3. A constant current flowing in a horizontal wire in the plane of the paper from East to West is shown in Figure. The direction of magnetic field at a point will be from North to



South :

(A) Directly above the wire.

(B) Directly below the wire.

(C) At a point located in the plane of the paper, on the northside of the wire.

(D) At a point located in the plane of the paper, on the southside of the wire.

4. For a current in a long straight solenoid N- and S-poles are created at the two ends. Among the following statements, the incorrect statement is :

(A) The field lines inside the solenoid are in the form of straight lines which indicates that the magnetic field is the same at all points inside the solenoid.

(B) The strong magnetic field produced inside the solenoid can be used to magnetize a piece of magnetic material like soft iron, when placed inside the coil.

(C) The pattern of the magnetic field associated with the solenoid is different from the pattern of the magnetic field around a bar magnet.

(D) The N and S-poles exchange position when the direction of current through the solenoid is reversed.

5. The strength of magnetic field inside a long current carrying straight solenoid is :

(E) More at the ends than at the centre

(F) Minimum in the middle

(G) Same at all points

(H) Found to increase from one end to the other

6. Which of the following properties of a proton can change while it moves freely in a magnetic field? (There may be more than one correct answer.)

(I) Mass

(J) Speed

(K) Velocity

(L) Momentum

7. A positively-charged particle (alpha – particle) projected towards west is deflected towards north by a magnetic field. The direction of magnetic field is

- (M) Towards south.
- (N) Towards east.
- (O) Downward.
- (P) Upward.

8.A rectangular coil of copper wires is rotated in a magnetic field.

The direction of the induced current changes once in each:

- (Q) Two revolutions.
- (R) One revolution.
- (S) Half revolution
- (T) One-fourth revolution.

9.What is SI unit of magnetic field

strength: (A)Pascal (B) Nm^2 (C) Tesla

(D) Nounit

10.What does the crowding of iron filings at the end of the magnet indicate?

- (U) Magnetic field is strongest near the poles of the magnet.
- (V) Magnetic field is weakest near the poles of the magnet.
- (W) There is no significant magnetic field at the poles of the magnet.
- (X) The significance of polarity.

11.What should be the core of an electromagnet?

- (A) Soft iron
- (b) Hard iron
- (C) Rusted iron
- (D) None of above

12.No force acts on a current carrying conductor when it is placed-

- (A) Perpendicular to the magnetic field
- (B) Parallel to the magnetic field
- (C) Far away from the magnetic field
- (D) Inside a magnetic field

13.A plotting compass is placed near the south pole of a bar magnet.The pointer of plotting compass will:

- (A) point away from the south pole
- (B) point parallel to the south pole
- (C) point towards the south pole
- (D) point at right angles to the south pole

14. Two magnetic field lines:

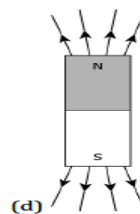
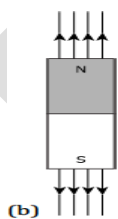
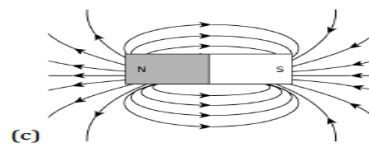
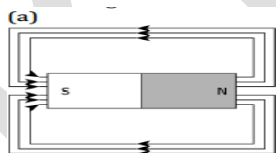
- a) Intersect at neutral point
- b) Never intersect each other
- c) Intersect near north-pole or south pole
- d) Intersect at the midpoint of the magnet

16. A student learns that magnetic field strength around

a bar magnet is different at every point. Which

diagram shows the correct magnetic field lines

around a bar magnet?



ASSERTION – REASON TYPE QUESTIONS

Each of these questions contain two statements, Assertion (A) and Reason (R). Each of these questions also has four alternative choices, only one of which is the correct answer. You have to select one of the codes (a), (b), (c) and (d) given below.

Assertion is correct, reason is correct; reason is a correct explanation for assertion.

(A) Assertion is correct, reason is correct; reason is not a correct explanation for assertion

(B) Assertion is correct, reason is incorrect (D) Assertion is incorrect, reason is correct.

1. **Assertion:** The magnetic field intensity at the centre of a circular coil carrying current changes, if the current through the coil is doubled.
Reason: The magnetic field intensity is dependent on current in the conductor.

2. **Assertion:** Deflection in the compass needle placed at a given point near a current carrying copper wire increases on increasing the current through the copper wire.
Reason: Copper is a good conductor of electricity

3. **Assertion:** A current carrying conductor experience a force in the magnetic field
Reason: The force acting on a current carrying conductor in a magnetic field is due to interaction between magnetic fields produced by the conductor and external magnetic field.

4. **Assertion:** In Fleming's left hand rule, the direction of magnetic field, magnetic force and current are mutually perpendicular.

Reason: Fleming's left hand rule is applied to measure the induced current.

5. **Assertion:** Magnetic Field due to a current carrying coil at its centre becomes double if current in the coil is doubled.

Reason: Magnetic Field due to a current carrying coil at its centre is directly proportional to the current.

MCQ & ASSERTION REASON ANSWERS

1. Ans. Option (C) is correct. Explanation: Magnetic field lines appear parallel when they are far from the magnet. But this does not mean that field strength is zero. No field line would be present where field

strength becomes zero.

2. Ans. Option (D) is correct. Explanation: On applying right-hand thumb rule, we find the direction of magnetic field. The field is in the form of concentric circles centered on the wire carrying current.

3. Ans. Option (B) is correct.

Explanation: Line WE shows a straight conductor through which current is moving from E to W. When seen from east, the magnetic field lines appear in clockwise direction, i.e., S to N above the wire and N to S below the wire. This is in accordance with the right hand thumb rule.

4. Ans. Option (C) is correct

Explanation: A solenoid behaves like a bar magnet. Hence, the pattern of the magnetic field associated with the solenoid is same as the pattern of the magnetic field around a bar magnet.

5. Ans. Option (C) is correct.

Explanation: Magnetic field lines are straight and parallel inside the solenoid. This indicates a same magnetic field. Hence, inside the solenoid, the magnetic field is same throughout.

6. Ans. Option (C) and (D) is correct.

Explanation: When a proton enters a magnetic field, it starts moving on a circular path. Because of its movement along a circular path it attains angular momentum. We know that momentum is a product of mass and velocity. Therefore velocity and mass of a proton change when it enters a magnetic field.

7. Ans. Option (D) is correct.

Explanation: In accordance with Fleming's Left-Hand Rule, the direction of magnetic field is vertically upward.

8. Ans. Option (C) is correct.

Explanation: When a rectangular coil of copper wire is rotated in a magnetic field, the direction of the induced current changes once in each half revolution.

9. Ans. Option (C) is correct.

Explanation: Tesla is the SI unit of magnetic field.

10. Ans. Option (A) is correct. Explanation: Crowding of iron filings at the ends of the magnet

indicates that the magnetic field is strongest near the poles of the magnet.

11. Ans. Option (a) is correct.

12. Ans. Option (b) is correct.

13. Correct Answer: Option (c)

14. C

Correct

Answer

is:

Option

(b)15

Correct

Answer

is:

Option

(c)

Option

(c)

ASSERTION REASON ANSWERS

1. A. The magnetic field at the center of the circular coil is directly proportional to the current flowing through it

2. B, Magnitude of magnetic field produced at a given point increases as the current through the wire increases at a given point

C

3. Ans : A

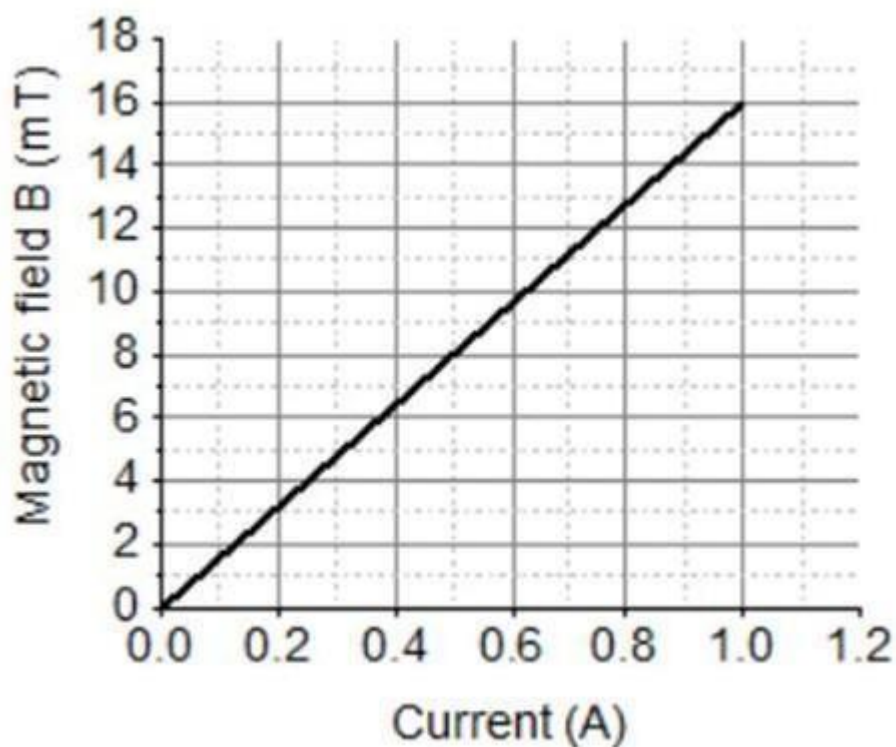
4. Ans : C

5. Ans : A

CASE BASED QUESTIONS

Question1.

A solenoid is a long helical coil of wire through which a current is run in order to create a magnetic field. The magnetic field of the solenoid is the superposition of the fields due to the current through each coil. It is nearly uniform inside the solenoid and close to zero outside and is similar to the field of a bar magnet having a north pole at one end and a south pole at the other depending upon the direction of current flow. The magnetic field produced in the solenoid is dependent on a few factors such as, the current in the coil, number of turns per unit length etc. The following graph is obtained by a researcher while doing an experiment to see the variation of the magnetic field with respect to the current in the solenoid. The unit of magnetic field as given in the graph attached is in milli-Tesla (mT) and the current is given in Ampere.



- (i) What type of energy conversion is observed in a linear solenoid?
- Mechanical to Magnetic
 - Electrical to Magnetic

- c. Electrical to Mechanical
- d. Magnetic to

Mechanical

Ans: b

(ii) What will happen if a soft iron bar is placed inside the solenoid?

- a. The bar will be electrocuted resulting in short-circuit.
- b. The bar will be magnetised as long as there is current in the circuit.
- c. The bar will be magnetised permanently.
- d. The bar will not be affected by any means.

Ans: b

iii) The magnetic field lines produced inside the solenoid are similar to that of ...

- a. a bar magnet
- b. a straight current carrying conductor
- c. a circular current carrying loop
- d. electromagnet of any shape

Ans: a

iv) After analysing the graph a student writes the following statements.

- I. The magnetic field produced by the solenoid is inversely proportional to the current.
- II. The magnetic field produced by the solenoid is directly proportional to the current.
- III. The magnetic field produced by the solenoid is directly proportional to square of the current.

IV. The magnetic field produced by the solenoid is independent of the current.

Choose from the following which of the following would be the correct statement(s).

- a. Only IV
- b. I and III and IV
- c. I and II

v) From the graph deduce which of the following statements is correct.

- a. For a current of 0.8A the magnetic field is 13 mT
- b. For larger currents, the magnetic field increases non-linearly.
- c. For a current of 0.8A the magnetic field is 1.3 mT
- d. There is not enough information to find the magnetic field corresponding to 0.8A current.

Ans: a

Question 2

A coil of many circular turns of insulated copper wire wound on a cylindrical insulating body (i.e. cardboard etc.) such that its length is greater than its diameter is called solenoid. When current is flowing through the solenoid, the magnetic field is present inside the solenoid. These current carrying solenoids are used in electronic circuit and to form an electromagnet. By inserting the magnetic field sensor between the coils of a solenoid, one can measure the magnetic field inside the solenoid and determine the relationship between the (i) magnetic field and current, and (ii) magnetic field and number of turns per metre in a solenoid. On performing the experiment with the help of suitable apparatus, the following observations were noted.

Sr. No.	Current in solenoid (A)	Magnetic Field ($\times 10^{-4}$ T)
1	0.5	2.51
2	1.0	3.14
3	1.5	3.77
4	2.0	4.39

Sr. No.	Length of solenoid (m)	No. of turns per metre (m^{-1})	Magnetic Field ($\times 10^{-4}$ T)
1	0.5	200	2.51
2	1.0	250	3.14
3	1.5	300	3.77
4	2.0	350	4.39

(a) From the table, what relationship would you observe between the (i) magnetic field and current, and (ii) magnetic field and number of turns per metre of a solenoid?

Ans. (i) The magnetic field depends directly on the current passing through it.
(ii) The magnetic field depends directly on the number of turns per metre of a solenoid.

(b) Why is the magnetic field inside the solenoid is uniform?

Ans. A solenoid is a long coil of wire wrapped in many turns. Each loop in the solenoid carries the same amount of current in the same direction when connected to the battery. The field produced due to each turn just adds up along the axis of a solenoid due to same direction and are in the form of parallel straight lines. This indicates that the magnetic field is uniform inside the solenoid.

(c) How can magnetic field strength of a solenoid be increased?

Ans. The Magnetic field of a solenoid increases when we insert an iron core because iron itself magnetised due to strong uniform magnetic field produced by current carrying solenoid. This help in increasing the magnetic property of solenoid.

(d) For same current flowing through a solenoid and a straight conductor, the magnetic field produced by a solenoid is much stronger than the magnetic field produced by a straight current carrying conductor. State one reason to justify this statement.

Ans. Each segment of current produces a magnetic field like that of a long straight wire, and the total field due to all loops of a solenoid is the vector sum of the fields due to each loop. Therefore, the magnetic field produced by a solenoid is much stronger than the magnetic field produced by a straight current carrying conductor.

Question 3

The region around a magnet where magnetism acts is represented by the magnetic field. The force of magnetism is due to moving charge or some magnetic material. Like stationary charges produce an electric field proportional to the magnitude of charge, moving charges produce magnetic fields proportional to the current. In other words, a current carrying conductor produces a magnetic field around it. The sub-atomic particles in the conductor like the electrons moving in atomic orbitals are responsible for the production of magnetic field. The magnetic fieldlines around a straight conductor (straight wire) carrying current are concentric circle whose centres lie on the wire.

1) The magnetic field associated with a current carrying straight conductor is in anti-clockwise direction. If the conductor was held horizontally along east west direction, what is the direction of current through it?

Ans. Direction of current will be from east to west

2) Name and state the rule applied to determine the direction of magnetic field in a straight current carrying conductor.

Ans. Right hand thumb rule. Imagine that you are holding a straight current carrying conductor in your right hand so that your thumb points in the direction of current, the direction of fingers encircling the wire will give the direction of magnetic field

3) Ramus performs an experiment to study the magnetic effect

of current around a current carrying straight conductor with the help of a magnetic compass. He reports that

- a) The degree of deflection of magnetic compass increases when the compass is moved away from the conductor.
- b) The degree of deflection of the magnetic compass increases when the current through the conductor is increased.

Which of the above observations of the student appears to be wrong and why?

Ans. Observation a is wrong because as the distance from the conductor increases the strength of the magnetic field will decrease

- 4) What type of field is produced by stationary and moving charges respectively?

Ans. stationary charges produce an electric field proportional to the magnitude of charge, moving charges produce magnetic fields proportional to the current.

DESCRIPTIVE TYPE QUESTIONS

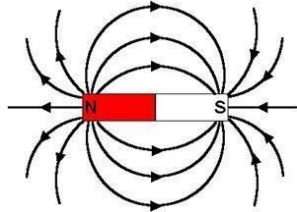
1. What do you understand by magnetic effect of current?

Ans: When electric current flows through a conductor it produces a magnetic field around it and behaves like a magnet. This is called the magnetic effect of electric current.

2. Why does a compass needle get deflected when brought near a bar magnet ?

Ans: The magnetic field of the magnet exerts force on both the poles of the compass needle. The forces experienced by the two poles are equal and opposite. These two forces form a couple which deflects the compass needle.

3. Draw magnetic field lines around a bar magnet. List the properties of magnetic lines of force.



Properties of magnetic lines of force:

- Outside the magnet, the direction of field lines is from north pole to south pole,
- Inside the magnet, the direction of field lines is from south pole to north pole.
- The magnetic field lines are closed curves.
- The magnetic field is stronger, where the field lines are crowded.
- No two field-lines intersect each other.

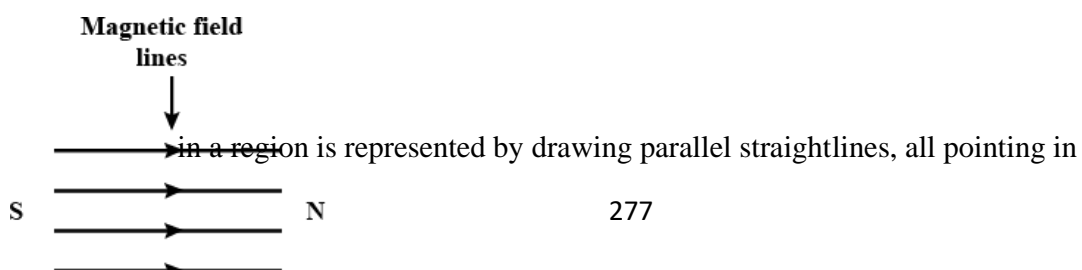
4. Why don't two magnetic lines of force intersect each other ?

Ans: The resultant force on a north pole of the compass needle at any point can be only in one direction. But if the two magnetic field lines intersect one another, then the resultant force on the north pole placed at the point of intersection will be along two directions, which is not possible.

5. The magnetic field in a given region is uniform.

Draw a diagram to represent it.

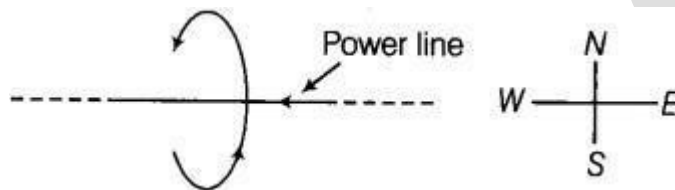
Ans: A uniform magnetic field



the same direction. For example, the uniform magnetic field which exists inside a current-carrying solenoid can be represented by parallel straight lines pointing from its S-pole to N-pole

6. A current through a horizontal power line flows in an east to west direction. What is the direction of the magnetic field at a point directly below it and at a point directly above it?

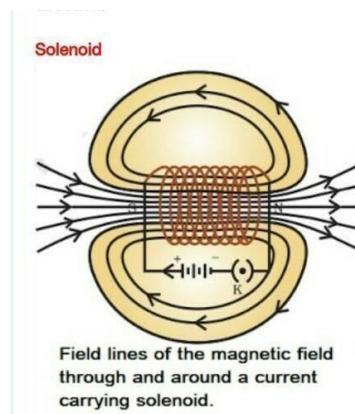
Ans: The current is in the east-west direction. Applying the right-hand thumb rule,



we get that the magnetic field (at any point below or above the wire) turns clockwise in a plane perpendicular to the wire, when viewed from the east end, and anti-clockwise, when viewed from the west end.

7. What is a Solenoid? Draw magnetic field lines for a current carrying solenoid.

Ans: A coil of many circular turns of insulated copper wire wrapped closely in the shape of a cylinder is called a solenoid. The magnetic field lines around a current-carrying solenoid are similar to a bar magnet. One end of the solenoid acts as North Pole, while the other behaves as the South Pole. The field lines inside the solenoid are parallel straight lines, that is, the field is uniform inside the solenoid.

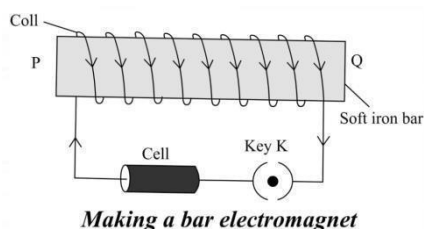


8. What is an electromagnet? What are the factors that decide the strength of the electromagnet?

Ans: The strong magnetic field produced inside a solenoid can be used to magnetize a piece of magnetic material, like soft iron, when placed inside the coil. The magnet so formed is called an electromagnet. The strength of the

electromagnet depends on:

- i) Amount of current flowing through it
- ii) No of turns in the coil (solenoid)
- iii) Nature of the core.



9.State Fleming's left hand rule.

Ans: Fleming's left hand rule : Stretch the first finger, the middle finger and the thumb of your left hand mutually perpendicular to each other in such a way that the first finger represents the direction of the magnetic field, the middle finger represents the direction of the current in the conductor, then the thumb will represent the direction of Force (motion of the conductor).

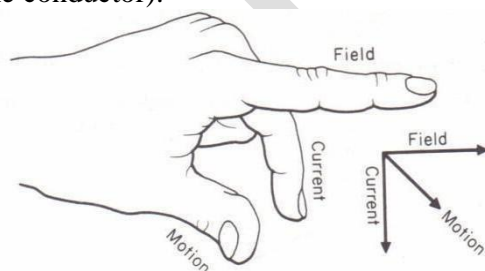


Fig. 38.3. Fleming's left-hand rule (motor rule)

rotates, it cuts the magnetic field lines due to which a current is produced in the coil.

10.Name some sources of direct current.

Ans: Some of the sources of direct current are dry cells, button cells, lead accumulators.

11.Which sources produce alternating current?

Ans: Alternating current is produced by AC generators of nuclear power plants, thermal power plants, hydroelectric power stations, etc.

12.Name two safety measures commonly used in electric circuits and appliances.

Ans:(i) Earthing and (ii) Electric fuse.

13 An electric oven of 2 kW power rating is operated in a domestic electric circuit (220 V) that has a current rating of 5 A. What result do you expect? Explain.

Ans: The electric oven draws a current given by

$$I = P/V$$
$$= 2000/220$$
$$= 9.09 \text{ A}$$

The electric oven draws much more current than the current rating of 5 A. That is the circuit is overloaded. Due to excessive current, the fuse wire will blow and the circuit will break.

14 When is the force experienced by a current-carrying conductor placed in a magnetic field largest?

Ans: When the conductor carries current in a direction perpendicular to the direction of the magnetic field, the force experienced by the conductor is largest.

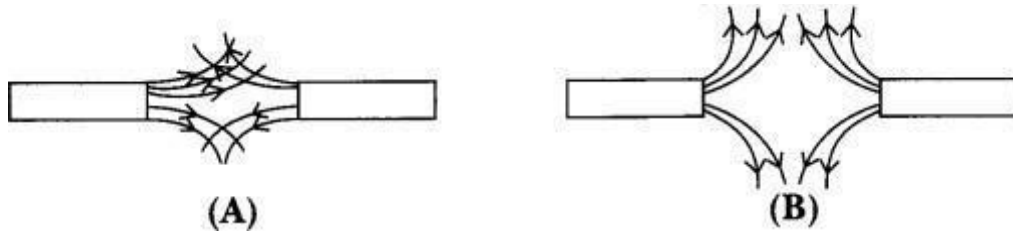
15. Imagine that you are sitting in a chamber with your back to one wall. An electron beam, moving horizontally from the back wall towards the front wall, is deflected by a strong magnetic field to your right side. What is the direction of the magnetic field?

Ans: Here the electron beam is moving from our back wall to the front wall, so the direction of current will be in the opposite direction, from front wall towards the back wall or towards us. The direction of deflection (or force) is towards our right side. Now, we know two things: direction of current is from front towards us and direction of force is towards our right side.

Let us now hold the forefinger, middle finger and thumb of our left hand at right angles to one another. We now adjust the hand in such a way that our center finger points towards us (in the direction of current) and our thumb points towards the right side (in the direction of force). Now, if we look at our forefinger, it will be pointing vertically downwards. Since the direction of the forefinger gives the direction of the magnetic field,

therefore, the magnetic field is in the vertically downward direction.

16. Magnetic field lines of two magnets are shown in fig. A and fig. B.



Select the figure that represents the correct pattern of field lines. Give reasons for your answer. Also name the poles of the magnets facing each other.

Ans. Figure B represents the correct pattern of field lines.

In figure A, field lines cross each other which is not possible because if they cross each other, at the point of intersection, there would be two directions of field lines.

In figure B, field lines are emerging in nature, so poles of magnet facing each other are north poles while opposite faces will have south polarity.

17. Write the frequency of alternating current (AC) in India. How many times per second it changes its direction?

Ans: The frequency of A.C. in India is 50 Hz and it changes direction twice in each cycle. Therefore, it changes direction $2 \times 50 = 100$ times in one second.

18. How is the type of current that we receive in domestic circuit different from the one that runs a clock?

Ans: The current that we receive from domestic circuit is alternating current (A.C.) and the current that is used to run clock is direct current (D.C.). Direct current always flows in one direction whereas the alternating current reverses its direction periodically.

19. Define alternating current and direct current.

Explain why alternating current is preferred over direct current for transmission over long distances.

Ans: Alternating current (A.C.) : An electric current whose magnitude changes with time and direction reverses periodically is called alternating current.

Direct current (D.C.) : An electric current whose magnitude is either constant or variable but the direction of flow in a conductor remains the same is called direct current.

A.C. can be transmitted to distant places without much loss of electric power than D.C. That is why A.C. is preferred over D.C. for transmission of current.

over a long distances.

20. Mention and explain the function of an earth wire.

Why it is necessary to earth metallic appliances?

Ans: Many electric appliances of daily use like electric press, heater, toaster, refrigerator, table fan etc. have a metallic body. If the insulation of any of these appliances melts and makes contact with the metallic casing, the person touching it is likely to receive a severe electric shock. This is due to the reason that the metallic casing will be at the same potential as the applied one. Obviously, the electric current will flow through the body of the person who touches the appliance. To avoid such serious accidents, the metal casing of the electric appliance is earthed. Since the earth does not offer any resistance, the current flows to the earth through the earth wire instead of flowing through the body of the person.

21. Give reason for the following :

a. The burnt out fuse should be replaced by another fuse of identical rating. Ans: A burnt out fuse should be replaced with another fuse of identical rating because it helps in protecting the circuit from overloading and short circuiting. If a fuse of higher rating is used then it may not melt and cut off the supply during overloading. Similarly a fuse of lower rating may melt frequently even for a normal flow of current.

This results in decreasing the efficiency of the circuit.

b. It is dangerous to touch the live wire of the main supply rather than neutral wire.

Ans: Live wire is at 220V and neutral wire is at zero volt since the electric current flows from higher potential to lower potential, we can get an electric shock by touching live wire but that is not the case with neutral wire.

c. Using fuse in a household electric circuit is important.

Ans: Fuse is an important safety device. It is used in series with any electrical appliance and protects it from short-circuiting and overloading.

22. (a) Fuse acts like a watchman in an electric circuit. Justify this statement.

(b) Mention the usual current rating of the fuse wire in the line to (i) lights and fans (ii) appliance of 2 kW or more power.

Answer:

(a) When an unduly high electric current flows through the circuit, the fuse wire melts due to joule heating effect and breaks the circuit. Hence, it keeps an eye on the amount of current flowing and also stops the current if it exceeds the

maximum value. So, fuse acts like a watchman in an electric circuit.

- (b) (i) A fuse of rating 5A is usually used for lights and fans.
(ii) A fuse of rating 15 A is usually used for appliance of 2 kW or more power.

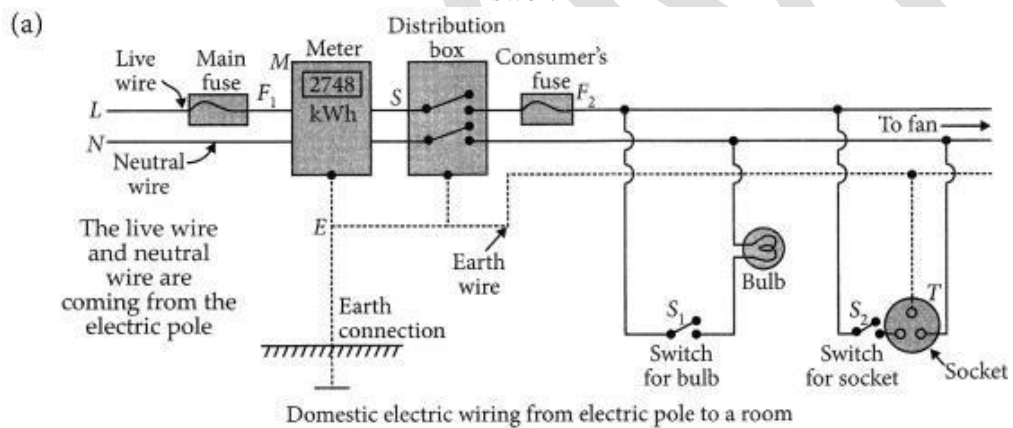
23. (a) Draw a schematic diagram of a common domestic circuit showing provision of

(i) Earth wire, (ii) Main fuse

(iii) Electricity meter and
(iv) Distribution box.

(b) Distinguish between short circuiting and overloading.

Answer:



(b) Overloading : The condition in which a high current flows through the circuit and at the same time too many appliances are switched on then the total current drawn through the circuit may exceed its rated value.

Short circuiting: The condition when the live wire comes in direct contact with the neutral wire, due to which a high current flows in the circuit.

KENDRIYA VIDYALAYA SANGATHAN ERNAKULAM REGION

Science (086)

Class X Sample Question Paper 1-2022-23

Max. Marks: 80

Time Allowed: 3 hours

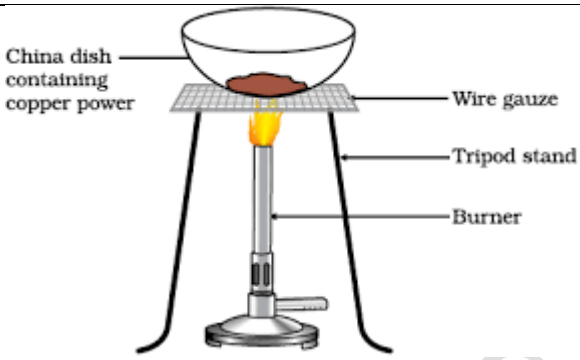
General Instructions:

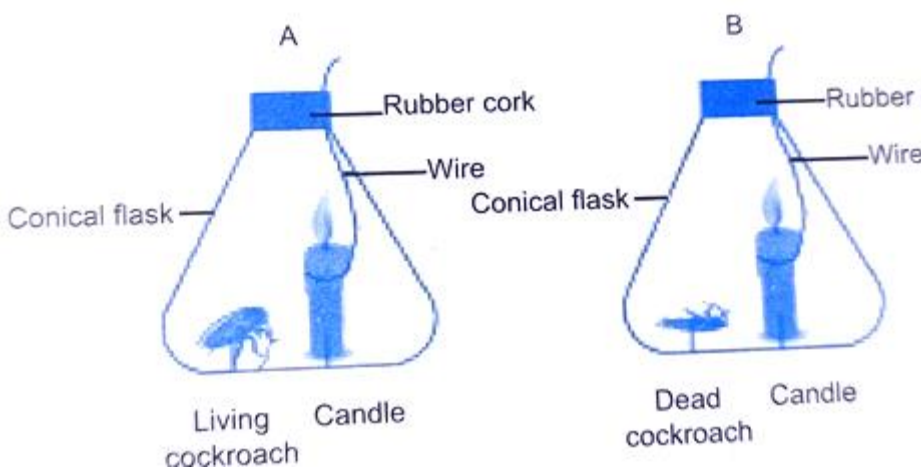
- i. This question paper consists of 39 questions in 5 sections.
- ii. All questions are compulsory. However, an internal choice is provided in some questions. A student is expected to attempt only one of these questions.
- iii. Section A consists of 20 objective type questions carrying 1 mark each.
- iv. Section B consists of 6 Very Short questions carrying 02 marks each. Answers to these questions should be in the range of 30 to 50 words.
- v. Section C consists of 7 Short Answer type questions carrying 03 marks each. Answers to these questions should be in the range of 50 to 80 words
- vi. Section D consists of 3 Long Answer type questions carrying 05 marks each. Answers to these questions should be in the range of 80 to 120 words.
- vii. Section E consists of 3 source-based/case-based units of assessment of 04 marks each with sub-parts.

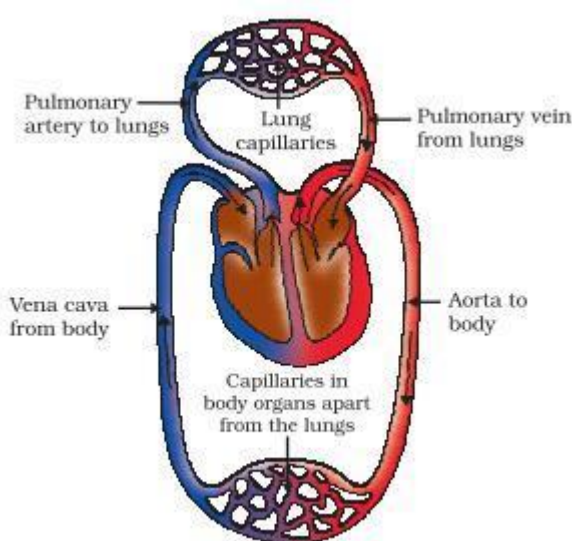
SECTION A

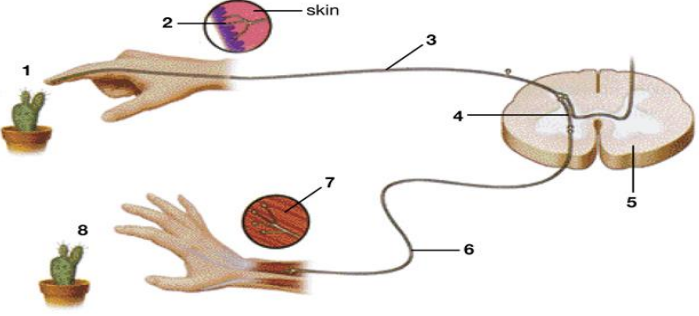
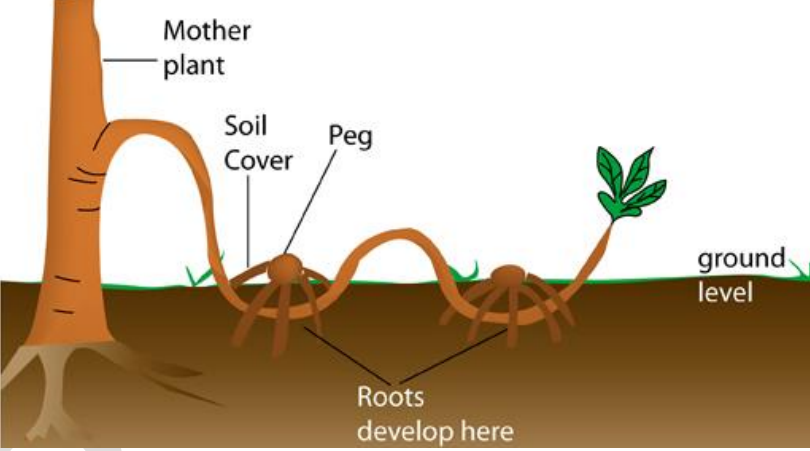
Select and write one most appropriate option out of the four options given for each of the questions 1 – 20

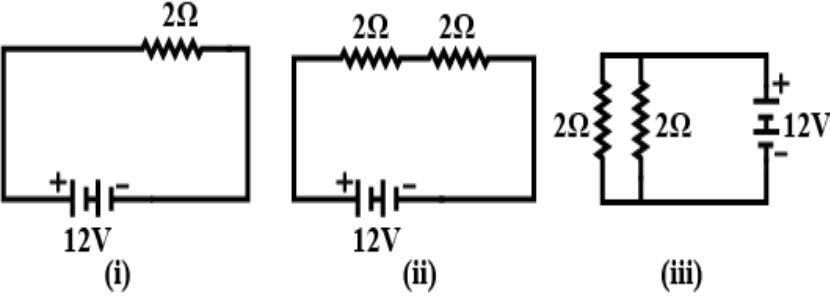
Q. No	Questions	Marks
1.	A solution of an acid with pH 5.1 is given. Which of the following can be done to increase its pH? i. add distilled water to it ii. add a solution of a different acid with pH 5.8 iii. add few drops of a base with an unknown pH a. only i b. only iii c. only i and ii d. any of i, ii and iii	1
2.	Identify 'x', 'y' and 'z' in the following reaction:	1

	$\text{CaCO}_3 (x) \rightarrow \text{CaO}(y) + \text{CO}_2 (z)$ <p>a. x = gas; y = reaction condition, z = gas b. x = solid ; y = liquid; z = gas c. x = number of moles of CaCO_3 ; y = reaction condition; z = no. of molecules of Carbon dioxide. d. x = physical state of CaCO_3 , and CaO; y = reaction condition; z = physical state of CO_2.</p>	
3.	 <p>China dish containing copper powder Wire gauze Tripod stand Burner</p> <p>Which of the following is the correct observation of the reaction shown in the above set up?</p> <p>a. Colourless gas which burns with a pop sound is evolved. b. Copper powder turns black in colour. c. Reddish brown gas with a smell of burning Sulphur has evolved. d. Copper powder turns green in colour.</p>	1
4.	<p>The acid having a highest H^+ ions concentration is one with</p> <p>a. pH =1.8 b. pH=8.0 c. pH=8.1 d. pH=10.0</p>	1
5.	<p>Acid that does not give hydrogen gas on reacting with metals (Mn &Mg).</p> <p>a. H_2SO_4 b. HNO_3 c. HCl d. All of these</p>	1
6.	<p>Sodium hydrogen carbonate when added to acetic acid evolves a gas. Which of the following statements are true about the gas evolved?</p>	1

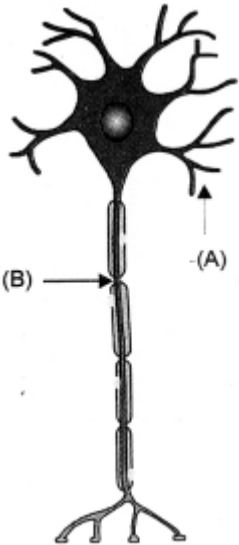
	<p>(i) It turns lime water milky.</p> <p>(ii) It extinguishes a burning splinter.</p> <p>(iii) It dissolves in a solution of sodium hydroxide.</p> <p>(iv) It has a pungent odour.</p> <p>a. (i) & (ii)</p> <p>b. (i) & (iv)</p> <p>c. (i), (ii) & (iii)</p> <p>d. All of these.</p>	
7.	<p>Identify unsaturated compounds from the following:</p> <p>i. Propane</p> <p>ii. Propene</p> <p>iii. Propyne</p> <p>iv. Chloropropane</p> <p>a. i & ii</p> <p>b. ii & iii</p> <p>c. iii & iv</p> <p>d. i & iv</p>	1
8.	<p>A student setup an experiment to study the human respiratory system. In the experiment, the student places a lighted candle and a living cockroach in flask A, while a lighted candle and a dead cockroach in flask B. The burning of candle needs oxygen.</p>  <p>After 10 minutes, the student observes that the candle in flask A extinguishes faster while candle in flask B keeps burning for a longer time. What can be evaluated from this experiment?</p> <p>(a) candle produces high amount of carbon dioxide</p>	1

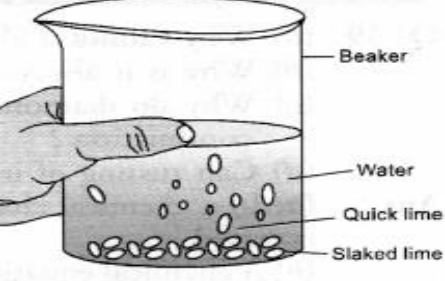
	<p>(b) living beings consumes oxygen during respiration</p> <p>(c) burning of candle decreases the lifespan of cockroach</p> <p>(d) water vapours produced by living beings prevents burning of candle</p>	
9.	<p>Choose the correct route of oxygenated blood in the body starting from its oxygenation:</p>  <p>(a) Lungs -- pulmonary vein -- left atrium --left ventricle— aorta-- body cells</p> <p>(b) Lungs -- pulmonary vein --right atrium -- right ventricle – aorta-- body cells</p> <p>(c) Lungs-- pulmonary artery – left atrium --left ventricle – vena cava - body cells</p> <p>(d) Lungs-- pulmonary artery--right atrium -- right ventricle-- vena cava - body cells</p>	1
10.	<p>In peas, a pure tall plant (TT) is crossed with a pure short plant (tt). The ratio of pure tall plants to pure short plants in F₂ generation will be:</p> <p>(a) 1:3 (b) 3:1 (c) 1:1 (d) 2:1</p>	1

<p>11.</p>	 <p>In the given figure, identify “3” and its function.</p> <ol style="list-style-type: none"> It is a sensory neuron that carries the message from the receptor to the CNS It is a motor neuron that carries the message from the receptor to the CNS It is a sensory neuron that carries the message from the CNS to the effector It is a motor neuron that carries the message from the CNS to the effector 	<p>1</p>
<p>12.</p>	 <p>The advantage of this process is:</p> <ol style="list-style-type: none"> This results in plant of different flowers This helps to grow plants without adding extra manure. This eliminates the need of growing plants using seeds. This allows growth of plants with new genetic composition. 	<p>1</p>
<p>13.</p>	<p>In the following circuits, power produced in the resistor or combination of resistors connected to a 12 V battery will be:</p>	<p>1</p>

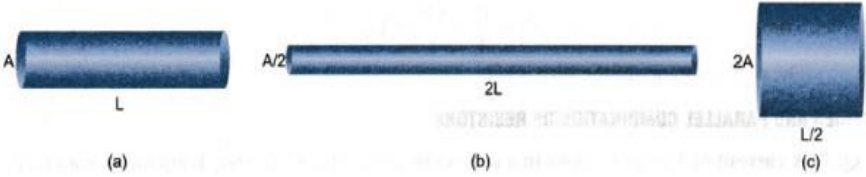
	 <p>(i) (ii) (iii)</p> <p>a. Same in all the three cases b. Minimum in case (i) c. Maximum in case (ii) d. Maximum in case (iii)</p>	
14.	<p>A current through a horizontal power line flows in an east to west direction. What is the direction of the magnetic field at a point directly below it and at a point directly above it?</p> <p>a. North to South b. South to North c. West to East d. North to West</p>	1
15.	<p>At the time of short circuit, the current in the circuit</p> <p>a. Reduces substantially b. Does not change c. Increases heavily d. Vary continuously</p>	1
16.	<p>A metallic wire of resistance 12Ω is bent to form a square. The resistance between two diagonal points would be</p> <p>a. 12Ω b. 24Ω c. 6Ω d. 3Ω</p>	1
	<p>Q. no 17 to 20 are Assertion - Reasoning based questions.</p> <p>These consist of two statements – Assertion (A) and Reason (R). Answer these questions selecting the appropriate option given below:</p> <p>(a) Both A and R are true and R is the correct explanation of A (b) Both A and R are true and R is not the correct explanation of A (c) A is true but R is false</p>	


	(d) A is False but R is true	
17	Assertion (A) : When HCl is added to zinc granules, a chemical reaction occurs. Reason (R) : Evolution of a gas and change in colour indicate that the chemical reaction is taking place.	1
18	Assertion(A) : Variations are seen in offspring produced by sexual reproduction. Reason (R) : DNA molecule generated by replication is not exactly identical to original DNA.	1
19	Assertion (A) : Human heart is four-chambered. Reason (R) : Vena cava is the only artery that supplies deoxygenated blood to the heart.	1
20	Assertion(A) : Strength of an electromagnet can be increased by increasing the number of turns per unit length in solenoid coil. Reason (R) : Strength of an electromagnet can be increased by increasing the current flowing through the solenoid.	1
	SECTION – B Q. no. 21 to 26 are very short answer questions	
21	What is observed when a solution of potassium iodide solution is added to a solution of lead nitrate? Name the type of reaction. Write a balanced chemical equation to represent the above chemical reaction. OR Which types of reactions are represented by the following equations? (a) $\text{CaO} + \text{CO}_2 \longrightarrow \text{CaCO}_3$ (b) $\text{Mg} + \text{CuSO}_4 \longrightarrow \text{MgSO}_4 + \text{Cu}$ (c) $\text{CH}_4 + 2\text{O}_2 \longrightarrow \text{CO}_2 + 2\text{H}_2\text{O}$ (d) $\text{NH}_4\text{NO}_2 \longrightarrow \text{N}_2 + 2\text{H}_2\text{O}$.	2

22	 <p>1. Name the parts labelled A and B in the neuron drawn above.</p> <p>2. Which part acquires the information in the neuron?</p> <p>3. Through which part does the information travel?</p> <p>4. In what form does this information travel?</p>	2
23	Even when we are not doing any apparent activity, we need energy. Justify giving reason.	2
24	<p>Draw a neat diagram to show the refraction of a light ray through a glass prism, and label on it the angle of incidence and angle of deviation.</p> <p>OR</p> <p>Why do we observe the seven colours when white light passes through a glass prism? Which component of white light deviates the least?</p>	2
25	Recycling is considered as a welcome practice to deal with the environmental problems. Justify the statement with two arguments?	2
26	What is ozone? How does it protect the organisms on the earth?	2
<p>SECTION - C</p> <p>Q.no. 27 to 33 are short answer question</p>		

27	<p>A person wanted her house to be white washed. She bought 15 kg of quick lime from the market and dissolved it in 40 litres of water.</p>  <p>He noticed that the water was very hot even though it was not being heated. Give reason for the observation. Write the corresponding equation and name the product formed.</p>	3
28	<p>What happens when an aqueous solution of sodium sulphate reacts with an aqueous solution of barium chloride ? State the physical conditions of reactants in which the reaction between them will not take place. Write the balanced chemical equation for the reaction and name the type of reaction.</p>	3
29	<p>What do you mean by double circulation of blood ? Why is it necessary ?</p> <p>OR</p> <p>What are stomata ? Draw a labelled diagram of stomata. Write any two functions of stomata.</p>	3
30	<p>A ray of light is incident obliquely on a glass slab. Draw a ray diagram showing the path of the light ray. Clearly, mark angle of incidence, angle of refraction, angle of emergence and lateral displacement of the ray. Give a formula to find the refractive index of glass slab in terms of angle of incidence and angle of refraction.</p>	3
31	<p>(a) A person is suffering from both myopia and hypermetropia.</p> <p>(i) What kind of lenses can correct this defect?</p> <p>(ii) How are these lenses prepared?</p> <p>(b) A person needs a lens of power +3 D for correcting his near vision and -3 D for correcting his distant vision. Calculate the focal lengths of the lenses required to correct these defects</p>	3
32	<p>(a) State three factors on which the strength of magnetic field produced by a current carrying solenoid depends.</p> <p>(b) Draw circuit diagram of a solenoid to prepare an electromagnet.</p>	3




	<p>OR</p> <p>A current carrying conductor is placed in a magnetic field. Now answer the following.</p> <p>(i) List the factors on which the magnitude of force experienced by the conductor depends.</p> <p>(ii) When is the magnitude of this force maximum?</p>	
33	<p>State in brief two ways in which nonbiodegradable substances would affect the environment. List two methods of safe disposal of the nonbiodegradable waste.</p>	3
	<p>SECTION - D</p> <p>Q.no. 34 to 36 are long answer questions.</p>	
34.	<p>1. Look at the figure and answer the following questions. (1+2+1+1)</p> <div style="text-align: center;"> <p>The diagram shows a test tube A held by a clamp on a stand. Inside test tube A, there is a mixture of ethanoic acid and NaHCO₃. A delivery tube is inserted into the mouth of test tube A and extends to the mouth of another test tube B. Test tube B contains lime water. The setup is designed to show the reaction between ethanoic acid and sodium bicarbonate, which produces carbon dioxide gas. This gas then passes through the delivery tube into test tube B, where it reacts with lime water.</p> </div> <p>a. What change would you observe in the calcium hydroxide solution taken in tube B?</p> <p>b. Write the reaction involved in A and B respectively.</p> <p>c. If ethanol is given instead of ethanoic acid would you expect the same change?</p> <p>d. How can a solution of lime water be prepared in the laboratory?</p>	5
	<p>OR</p> <p>An organic compound A on heating with concentrated H₂SO₄ forms a compound B which on addition of one mole of hydrogen in presence of Ni forms a compound C. One mole of compound C on combustion forms two moles of CO₂ and 3 moles of H₂O. Identify the compounds A, B and C and write the chemical equations of the reactions involved.</p>	

35.	<p>i. In the tobacco plant, the male gametes have twenty-four chromosomes. What is the number of chromosomes in the female gamete? What is the number of chromosomes in the zygote?</p> <p>ii. Is the chromosome number of the zygote, embryonal cells and adult of a particular organism always constant? How is the constancy maintained in these three stages?</p> <p>iii. Offspring formed as a result of sexual reproduction exhibit more variation. Justify.</p> <p style="text-align: center;">OR</p> <p>i. Two very small organisms X and Y both reproduce by the method of budding. Organism X is industrially very important because it is used in making alcohol from sugar. It is also used in making bread. Organism Y is a tiny animal having tentacles which lives in water.</p> <p>(a) What is organism X?</p> <p>(b) Name the process in which X converts sugar into alcohol.</p> <p>(c) To which class of organisms does X belong?</p> <p>(d) what is organism Y?</p> <p>(e) Out of X and Y, which organism is multicellular and which one is unicellular?</p>	5 (2+2+1)
36.	<p>a. The figure below shows three cylindrical copper conductors along with their face areas and lengths. Which of the conductors will have the highest resistance and why?</p> <div style="text-align: center;">  </div> <p>b. There are two resistors R1 and R2 having resistance equal to 20Ω and 30Ω respectively are connected in parallel in an electric circuit. If the potential</p>	5 (2.5+2.5)

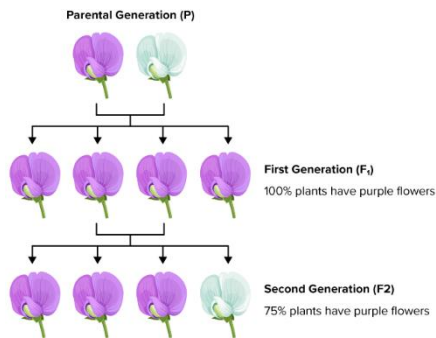
	<p>difference across the electric circuit is 5 V, find the electric current flowing through the circuit and the total resistance of the resistors.</p>	
	<p style="text-align: center;">SECTION - E</p> <p>Q.no. 37 to 39 are case - based/data -based questions with 2 to 3 short sub - parts. Internal choice is provided in one of these sub-parts.</p>	
37.	<p>All metals do not react with oxygen with the same speed. Different metals show different reactivity towards oxygen. For example, potassium and sodium react so vigorously that they catch fire even if kept in the open air .They are therefore kept under kerosene or paraffin oil. Metal oxides are solids. They are basic in nature. Metal oxide being basic, turns red litmus to blue. The metal oxides such as Aluminium oxide, Zinc oxide etc show both acidic as well as basic behaviour.</p>  <p>i. Name two metals that react violently with cold water.</p> <p>ii. An element X forms an oxide X_2O_3 which is basic in nature. What type of element is X?</p> <p>iii. What happens to the red litmus when it is treated with the solution of ash obtained after burning magnesium ribbon in air?</p> <p>iv. Name the gas evolved during the reaction in question no.1.</p>	4
38.	<p>Mendel worked out the main rules of inheritance. Inheritance is the transmission of genetically controlled traits from one generation to the next generation. Mendel choose pea plants to study Inheritance of characters of traits. Mendel first crossed pure bred tall pea plants with purebred dwarf plants. Only tall pea plants were produced in the first generation. No dwarf pea plants were found in the F1 generation. Mendel then crossed the tall pea plants of F1 generation. He found that tall and dwarf, both plants were</p>	4 (1+2+1)

obtained in the F₂ generation in the ratio 3:1. Dwarf plants which had disappeared in the F₁ generation reappeared in the F₂ generation.

- i. Why all of the F₁ Generation have tall phenotypes?
- ii. The given table represents the alleles for flower colour in pea plants.

		
BB X	Bb Y	Bb Z

Flower Y has the same colour as that of flower X. Why?



iii. Give reason for the appearance of new combinations of characters in the F₂ progeny.

OR

iii. In humans the gene for black hair colour is B and gene for brown hair colour is b. What will be the hair colour of a person having the genetic constitution Bb? Give a reason.

39. We know that the characteristics of an image formed by a concave mirror depend upon the position of the object with respect to the mirror.
- When an object is placed between F and infinity the image formed is real and inverted. But when the object is placed between F and mirror it cannot be

4
(1+1+2)

obtained on the screen. The image formed in this case is virtual erect and magnified. Such an image may be seen by looking in the mirror directly.



i. An object is placed 10cm in front of a concave mirror of focal length 20cm. What will be the nature and size of the image formed?

ii. The minimum distance between the object and its real image for concave mirror is

- . Zero b. F c. 2F d. 4F

iii. A candle flame 3 cm is placed at a distance of 3 m from a wall. How far from the wall must a concave mirror be placed in order that it may form an image of flame 9 cm high on the wall?

KENDRIYA VIDYALAYA SANGATHAN ERNAKULAM REGION

SCIENCE (086)

CLASS: X

SAMPLE PAPER- 2 (2022-23)

MAX. MARKS: 80

TIME ALLOWED- 3 HOURS

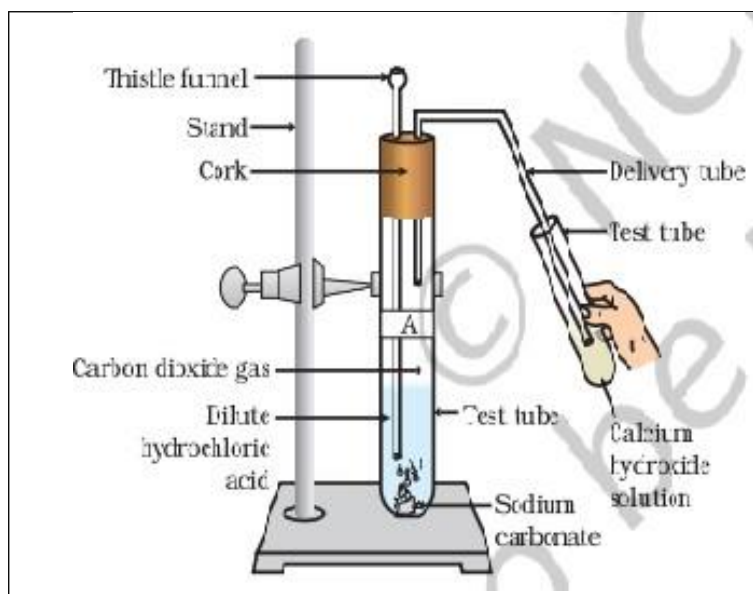
General Instructions:

- i.* This question paper consists of 39 questions in 5 sections.
- ii.* All questions are compulsory. However, an internal choice is provided in some questions. A student is expected to attempt only one of these questions.
- iii.* Section A consists of 20 objective type questions carrying 1 mark each.
- iv.* Section B consists of 6 Very Short questions carrying 02 marks each. Answers to these questions should be in the range of 30 to 50 words.
- v.* Section C consists of 7 Short Answer type questions carrying 03 marks each. Answers to these questions should be in the range of 50 to 80 words.
- vi.* Section D consists of 3 Long Answer type questions carrying 05 marks each. Answer to these questions should be in the range of 80 to 120 words.
- vii.* Section E consists of 3 source-based/case-based units of assessment of 04 marks each with sub-parts.

SECTION - A

Select and write one most appropriate option out of the four options given for each of the questions 1 – 20.

1. The change in colour of Calcium hydroxide solution in the given set up is due to



- (a). Presence of sodium carbonate
 (b). Presence of hydrochloric acid
 (c). Presence of carbon dioxide
 (d). None of the above
2. An aqueous solution turns red litmus solution blue. Excess addition of which of the following solution would reverse the change?
- (a) Baking powder
 (b) Lime
 (c) Ammonium hydroxide solution
 (d) Hydrochloric acid
3. Which of the following statements about the given reaction are correct?
- $$3\text{Fe} (s) + 4\text{H}_2\text{O} (g) \rightarrow \text{Fe}_3\text{O}_4 (s) + 4\text{H}_2 (g)$$
- (i) Iron metal is getting oxidised
 (ii) Water is getting reduced
 (iii) Water is acting as reducing agent
 (iv) Water is acting as oxidising agent

(a) (i), (zi) and (iii)

(b) in) and (iv)

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

(d) (ii) and (iv)

4. Generally metals react with acids to give salt and hydrogen gas. Which of the following acids does not give hydrogen gas on reacting with metals (except Mn and Mg)?

(a) H₂SO₄

(b) HCl

(c) HNO₃

(d) All of these

5. An alloy reacted with dilute hydrochloric acid to produce a gas which 'pops' a lighted splint. The residue reacted with dilute nitric acid to form a blue solution. Which one of the following pairs of metals is present in the alloy?

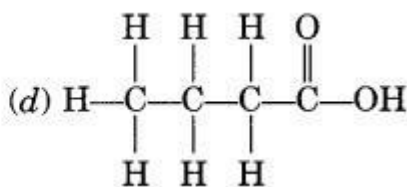
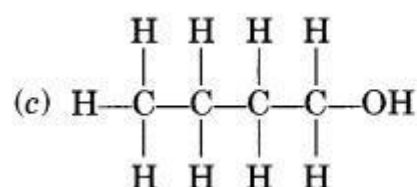
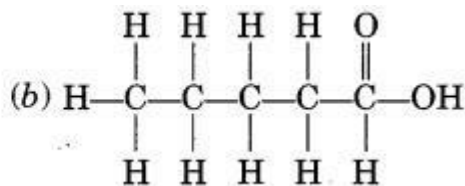
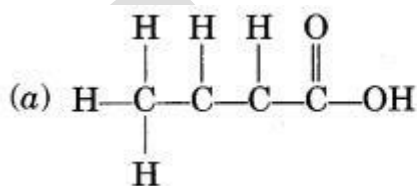
(a) Copper and lead

(b) Lead and magnesium

(c) Copper and magnesium

(d) Lead and zinc

6. The correct structural formula of butanoic acid is



7. The image shows the bread moulds on bread. How these fungi obtain nutrition?

(a) By using nutrients from the bread to prepare their own food.

(b) By allowing other organisms to grow on the bread and then consuming them.

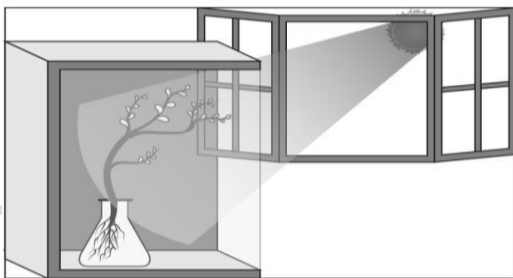
(c) By breaking down the nutrients of bread and then absorbing them.

(d) Sodium > Magnesium > Zinc > Iron

10. Two pea plants one with round green seeds (RRyy) and another with wrinkled yellow (rrYY) seeds produce F1 progeny that have round, yellow (RrYy) seeds. When F1 plants are selfed, the F2 progeny will have new combination of characters. Choose the new combination from the following:

- (i) Round, yellow
 - (ii) Round, green
 - (iii) Wrinkled, yellow
 - (iv) Wrinkled, green
- (a) (i) and (ii)
 - (b) (i) and (iv)
 - (c) (ii) and (iii)
 - (d) (i) and (iii)

11. Akshay potted some germinated seeds in a pot. He put the pot in a cardboard box that was open from one side. He keeps the box in a way that the open side of box faces sunlight near his window. After 2-3 days he observes the shoot bends towards light as shown in image.

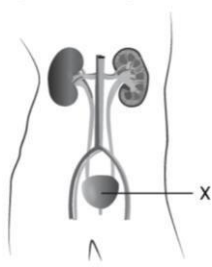


Which type of tropism he observes?

- (a) Geotropism
- (b) Phototropism
- (c) chemotropism
- (d) hydrotropism

12. What is the maximum resistance that can be made using five resistors each of $1/5\Omega$? a) $1/5\Omega$ b) 10Ω c) 5Ω d) 1Ω

13. The image shows the excretory system in humans.



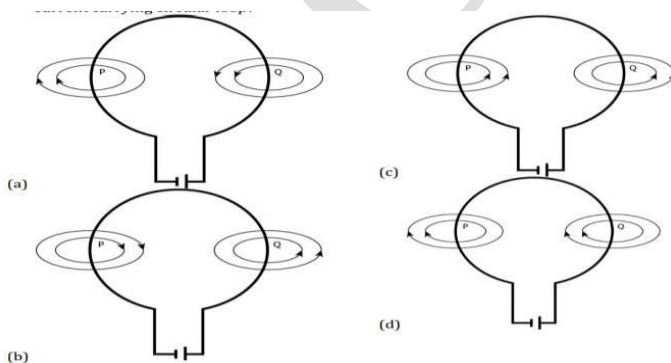
What is the importance of the labelled part in excretory system?

- (a) It produces urine.
- (b) It filters waste from the blood.
- (c) It stores the urine till urination.
- (d) It carries urine from kidney to outside.

14. Magnetic lines of force inside current carrying solenoid are

- (a) perpendicular to axis.
- (b) along the axis and are parallel to each other.
- (c) parallel inside the solenoid and circular at the ends.
- (d) circular.

15. Which diagram shows the correct direction of the magnetic field lines at point P and Q in current carrying circular loop?



16. A student inserts a bar magnet in the coil. The student observes deflection in the galvanometer connected to the coil. What will happen if the magnet is continuously getting in and out of the coil?

- (a) the current induced in the coil will increase
- (b) the current will change its direction continuously
- (c) the magnetic field will create a motion in the coil
- (d) the magnetic field of the bar magnet would keep decreasing

Q. no 17 to 20 are Assertion - Reasoning based questions. These consist of two statements – Assertion (A) and Reason (R). Answer these questions selecting the appropriate option given below:

- (a) Both A and R are true and R is the correct explanation of A
- (b) Both A and R are true and R is not the correct explanation of A
- (c) A is true but R is false
- (d) A is False but R is true

17. **Assertion:** Respiration is an endothermic reaction

Reason: Energy is released during respiration

18. **Assertion:** A geneticist crossed pea plant having violet flower with a pea plant having whiteflowers, he got all violet flowers in first generation.

Reason: White colour gene is not passed on to next generation.

19. **Assertion:** Aerobic respiration requires less energy as compared to anaerobic respiration.

Reason: Mitochondria is the powerhouse of the cell.

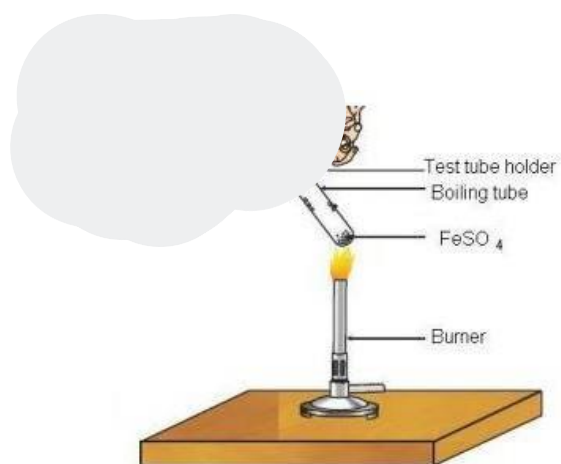
20. **Assertion:** A compass needle is placed near a current carrying wire. The deflection of the compass needle decreases when the compass needle is displaced away from the wire.

Reason: Strength of a magnetic field decreases as one moves away from a current carrying conductor.

SECTION – B

Q. no. 21 to 26 are very short answer questions

21. 2 g of ferrous sulphate crystals are heated in a dry boiling tube



- (a) List any two observations.
(b) Write balanced chemical equation for the reaction and name the products formed.

OR

In the electrolysis of water:

- a) name the gas collected at the anode and cathode
b) why is the volume of gas collected at one electrode double than the other?

22. Give reasons for the following :

- (a) Why is diffusion not sufficient to meet oxygen requirement of all the cells in multicellular organisms ?
(b) How desert plants perform photosynthesis if their stomata remain closed during the day

23. Trace a sequence of events which occur when a bright light is focused on your eyes.

24. During respiration of an organism 'A' one molecule of glucose produces two ATP molecules whereas in the respiration of another organism 'B' one molecule of glucose produces 38 ATP molecules.

- a. Which type of organism A or B can convert glucose into alcohol?
- b. Name one organism which behaves like 'B'.

25. Stars seem higher than they actually are explain why?

OR

With the help of suitable diagram, explain the phenomenon of early sunrise and delayed sunset.

26. We often see domestic waste decomposing in the bye lanes of our residential colony besides many empty plastic bottles, wrappers etc lying here and there. Suggest any two arguments to make the residents realise that the improper disposal of waste may be harmful to their own as well as community health.

SECTION - C

Q.no. 27 to 33 are short answer questions.

27. (i) Why is respiration considered as an exothermic reaction?

(ii) Write chemical name and the formula of the brown gas produced during thermal decomposition of lead nitrate.

(iii) Why do chips manufactures flush bags of chips with gas such as nitrogen?

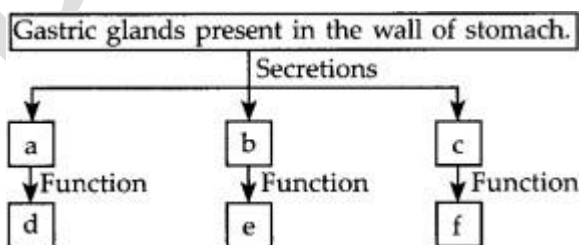
28. Write one point of difference between each of the following:

(i) A hydrated salt and an anhydrous salt.

(ii) Washing soda and soda ash.

(iii) Baking soda and baking powder.

29. Complete the following flow chart as per the given instructions.



OR

Leaves of a healthy potted plant were coated with vaseline. Will this plant remain healthy for long ? Give reasons for your answer.

30. A concave mirror is used for image formation for different positions of an object. What

inferences can be drawn about the following when an object is placed at a distance of 10 cm from the pole of a concave mirror of focal length 15 cm?

- (a) Position of the image
- (b) Size of the image
- (c) Nature of the image

Draw a labelled ray diagram to justify your inferences.

31. A compass needle is placed near a current carrying straight conductor. State your observation for the following cases and give reasons for the same in each case.

- (a) Magnitude of electric current is increased.
- (b) The compass needle is displaced away from the conductor

OR

We know a current carrying conductor placed in a magnetic field experiences a force due to which the conductor moves. How do we think the rod displaces if-

- (a) current in rod is increased
- (b) a stronger horse shoe is inserted
- (c) length of the rod is increased.

32. A convex lens forms a real and inverted image of a needle at a distance of 50 cm from it. Where is the needle placed in front of the convex lens if the image is equal to the size of the object? Also, find the power of the lens.

33. In a certain study conducted on the occurrence of DDT along food chains in an ecosystem, the concentration of DDT in grass was found to be 0-5 ppm. In sheep, it was 2 ppm and in man it was 10 ppm. Why was the concentration of DDT maximum in case of man?

SECTION – D

Q.no. 34 to 36 are Long answer questions

34. 34.

- i. Elements forming ionic compounds attain noble gas electronic configuration by either gaining or losing electrons from their valence shells. Explain giving reason why carbon cannot attain such a configuration in this manner to form its compounds.

- ii. Name the type of bonds formed in ionic compounds and in the compounds formed by carbon.
- iii. Explain with reason why carbon compounds are generally poor conductors of electricity.

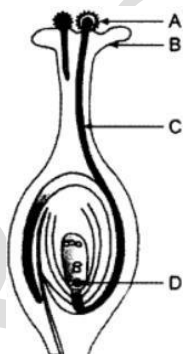
OR

An element X combines with Y to form a colourless odourless gas, Z which turns lime water milky is the major constituent of all organic molecules. Five X atoms combine with hydrogens to form a cyclic saturated hydrocarbon J and aliphatic unsaturated hydrocarbon Q. Q is used in gas welding.

- a) Identify compound Z and draw its electron dot structure.
- b) Write the chemical formula and IUPAC name of compound Q
- c) What is the common name of Q
- d) How many single covalent bonds are present in compound J?
- e) Draw the structure of J and write its chemical formula.

35. (a) List two reasons for the appearance of variations among the progeny formed by sexual reproduction.

(b)



- (i) Name the part marked 'A' in the diagram.
- (ii) How does 'A' reach part 'B'?
- (iii) State the importance of part 'C'.
- (iv) What happens to the part marked 'D' after fertilisation is over?

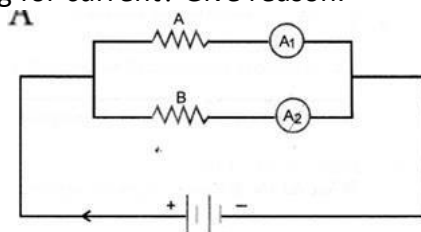
OR

- (a) In the human body what is the role of seminal vesicles and prostate gland? List two functions performed by testes in human beings.
- (b) Specify the events which occur in reproductive system of human female:

- (i) If egg is fertilised. (ii) If egg is not fertilised.

36. 36.

- a) In the circuit diagram shown, the two resistance wires A and B are of the same length and same material, but A is thicker than B. Which ammeter A1 or A2 will indicate higher reading for current? Give reason.



- b) Draw a schematic diagram of a circuit consisting of a battery of 12V, three resistors of 5Ω, 10Ω and 20Ω connected in parallel, an ammeter to measure the total current through the circuit, voltmeter to measure the potential difference across the combination of resistors.
- c) Why is series arrangement not found satisfactory for domestic lights

SECTION - E

Q.no. 37 to 39 are case - based/data -based questions with 2 to 3 short sub - parts. Internal choice is provided in one of these sub-parts.

37. The arrangement of metals in a vertical column in the decreasing order of their reactivities is called the reactivity series or activity series of metals. The most reactive metal is at the top position of the reactivity series. The least reactive metal is at the bottom of the reactivity series.

Hydrogen, though non-metal, has been included in the activity series of metals only for comparison. Apart from it, the hydrogen atom also has a tendency to lose its valence electron and form a cation that behaves like a metal.



(i) Which metal can be displaced by copper from its salt solution? Support your answer with valid reason.

- (a) Zinc (b) Silver (c) Iron (d) Lead

(ii) An element 'X' after reacting with acids liberates hydrogen gas and can displace lead and tin from their salt solutions. The metal 'X' is what?

OR

(ii) A metal 'X' acquires a green colour coating on its surface on exposure to air. Name and write chemical formula of the green coating formed on the metal.

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

List your observations regarding :

- (i) Colour of stem in their F1 progeny
- (ii) Percentage of brown stemmed plants in F2 progeny if plants are self pollinated.
- (iii) Ratio of GG and Gg in the F2 progeny.
- (a) Based on the findings of this cross, what conclusion can be drawn?

39. Sudha finds out that the sharp image of the window pane of her science laboratory is formed at a distance of 15 cm from the lens. She now tries to focus the building visible to her outside the window

instead of the window pane without disturbing the lens.

- (i) In which direction will she move the screen to obtain a sharp image of the building?
- (ii) What is the approximate focal length of this lens?
- (iii) A real image $\frac{2}{3}$ rd of the size of an object is formed by a convex lens when the object is at a distance of 12 cm from it. Find the focal length of the lens.

OR

- (iv) A student wants to project the image of a candle flame on the walls of school laboratory by using a mirror.
 - (a) Which type of mirror should he use and why?
 - (b) At what distance in terms of focal length 'f' of the mirror should he place the candle flame so as to get the magnified image on the wall?
 - (c) Draw a ray diagram to show the formation of image in this case.
 - (d) Can he use this mirror to project a diminished image of the candle flame on the same wall? State 'how' if your answer is 'yes' and 'why not' if your answer is 'no'.

KENDRIYA VIDYALAYA SANGATHAN ERNAKULAM REGION

SCIENCE (086)

CLASS: X

SAMPLE PAPER- 3 (2022-23)

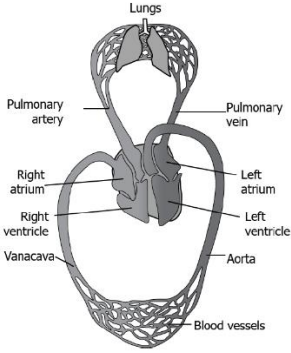
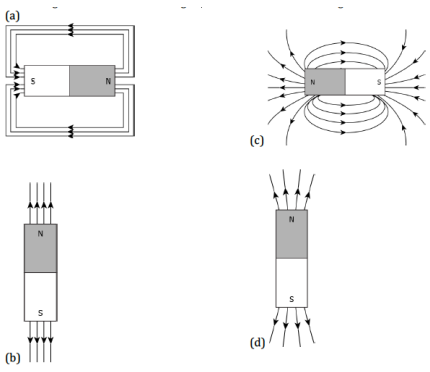
MAX. MARKS: 80

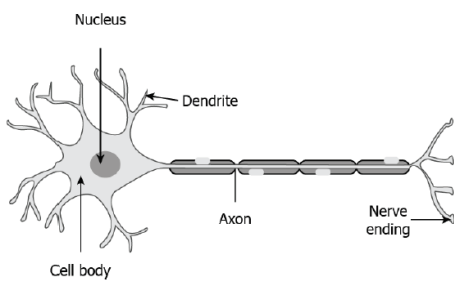
TIME ALLOWED- 3 HOURS

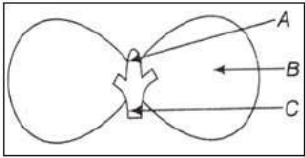
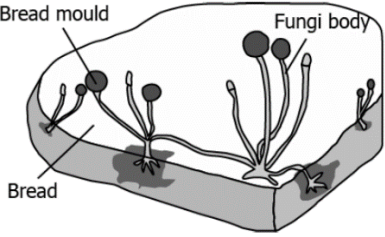
General Instructions:

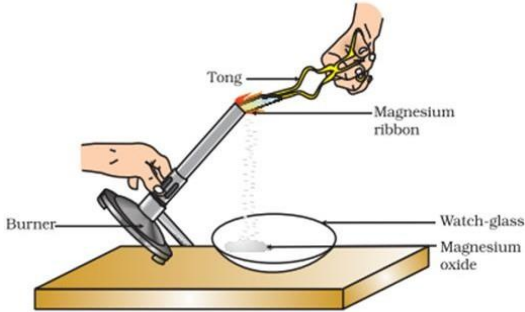
- viii. This question paper consists of 39 questions in 5 sections.
- ix. All questions are compulsory. However, an internal choice is provided in some questions. A student is expected to attempt only one of these questions.
- x. Section A consists of 20 objective type questions carrying 1 mark each.
- xi. Section B consists of 6 Very Short questions carrying 02 marks each. Answers to these questions should be in the range of 30 to 50 words.
- xii. Section C consists of 7 Short Answer type questions carrying 03 marks each. Answers to these questions should be in the range of 50 to 80 words.
- xiii. Section D consists of 3 Long Answer type questions carrying 05 marks each. Answer to these questions should be in the range of 80 to 120 words.
- xiv. Section E consists of 3 source-based/case-based units of assessment of 04 marks each with sub-parts.

SECTION -		
A		
Select and write one most appropriate option out of the four options given for each of the questions 1 – 20		
1.	The least resistance obtained by using 2 Ω , 4 Ω , 1 Ω and 100 Ω is (a) < 100 Ω (b) < 4 Ω (c) < 1 Ω (d) > 2 Ω	1
2.	The image shows the transport of gases in the body through the heart and lungs.	1

	 <p>Which option correctly shows the transport of oxygen to the cell?</p> <p>(a) Lungs → pulmonary vein → left atrium → left ventricle → aorta → body cells</p> <p>(b) Lungs → pulmonary vein → right atrium → right ventricle → aorta → body cells</p> <p>(c) Lungs → pulmonary artery → left atrium → left ventricle → vena cava → body cells</p> <p>(d) Lungs → pulmonary artery → right atrium → right ventricle → vena cava → body cells</p>	
3.	<p>A student learns that magnetic field strength around a bar magnet is different at every point. Which diagram shows the correct magnetic field lines around a bar magnet?</p>  <p>(a) Option a</p> <p>(b) Option b</p> <p>(c) Option c</p> <p>(d) Option d</p>	1
4.	<p>Which of the following statements about the given reaction are correct?</p> $3\text{Fe} (s) + 4\text{H}_2\text{O} (g) \rightarrow \text{Fe}_3\text{O}_4 (s) + 4 \text{H}_2 (g)$ <p>(i) Iron metal is getting oxidised</p> <p>(ii) Water is getting reduced</p> <p>(iii) Water is acting as reducing agent</p>	1

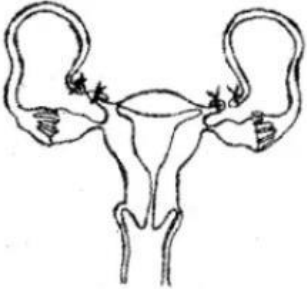
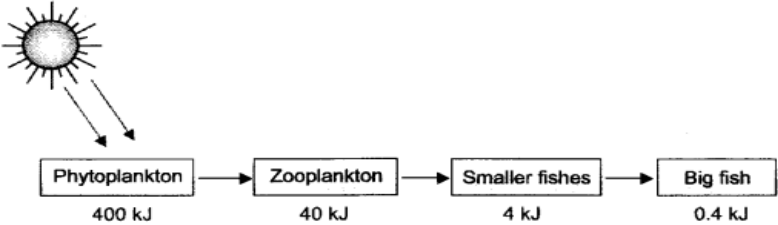
	<p>(iv) Water is acting as oxidising agent</p> <p>(a) (i), (ii) and (iii)</p> <p>(b) (in) and (iv)</p> <p>(c) (i), (ii) and (iv)</p> <p>(d) (ii) and (iv)</p>	
5.	<p>An electric bulb is connected to a 220V generator. The current is 0.50 A.</p> <p>What is the power of the bulb?</p> <p>(a) 440 W</p> <p>(b) 110 W</p> <p>(c) 55 W</p> <p>(d) 0.0023 W</p>	1
6.	<p>The image shows the structure of a neuron.</p> <div style="text-align: center;">  <p>The diagram illustrates a multipolar neuron. It features a central cell body (soma) containing a dark, circular nucleus. Several branching structures called dendrites extend from the cell body. A long, thin axon extends from the cell body, covered by a myelin sheath, and terminates in a branched structure labeled as nerve ending.</p> </div> <p>After our nose senses a smell, which option shows the mechanism of the travelling of sense in our body?</p> <p>(a) olfactory receptors → dendritic tip of a nerve cell → axon → nerve ending → release of signal dendritic tip of other nerve cell</p> <p>(b) olfactory receptors → dendritic tip of a nerve cell → axon → cell body → release of signal → dendritic tip of other nerve cell</p> <p>(c) gustatory receptors → dendritic tip of a nerve cell → cell body → axon → release of signal dendritic tip of other nerve cell</p> <p>(d) gustatory receptors → dendritic tip of a nerve cell → axon → cell body → release of signal dendritic tip of other nerve cell</p>	1
7.	<p>Which of the following is the correct arrangement of the given metals in descending order of their reactivity?</p> <p>Zinc, Iron, Magnesium, Sodium</p> <p>(a) Zinc > Iron > Magnesium > Sodium</p> <p>(b) Sodium > Magnesium > Iron > Zinc</p> <p>(c) Sodium > Zinc > Magnesium > Iron</p> <p>(d) Sodium > Magnesium > Zinc > Iron</p>	1
8.	<p>Name the functional group present in CH_3COCH_3.</p> <p>(a) Alcohol</p> <p>(b) Carboxylic acid</p> <p>(c) Ketone</p> <p>(d) Aldehyde</p>	1

9.	<p>In the below figure the parts A, B and C are sequentially</p>  <p>a) Cotyledon, plumule and radicle b) Plumule, radicle and cotyledon c) Plumule, cotyledon and radicle d) Radicle, cotyledon and plumule</p>	1
10.	<p>A person gets out in the sunlight from a dark room. How does his pupil regulate and control the light entering in the eye?</p> <p>(a) the size of pupil will decrease, and less light will enter the eye (b) the size of pupil will decrease, and more light will enter the eye (c) the size of pupil will remain the same, but more light will enter the eye (d) the size of pupil will remain the same, but less light will enter the eye</p>	1
11.	<p>The image shows the bread moulds on a bread</p>  <p>How do these fungi obtain nutrition?</p> <p>(a) by eating the bread on which it is growing (b) by using nutrients from the bread to prepare their own food (c) by breaking down the nutrients of bread and then absorbing them (d) by allowing other organisms to grow on the bread and then consuming them</p>	1
12.	<p>What happens when a solution of an acid is mixed with a solution of a base in a test tube?</p> <p>(i) The temperature of the solution increases (ii) The temperature of the solution decreases (iii) The temperature of the solution remains the same</p>	

	(iv) Salt formation takes place (a) (i) only (b) (i) and (iii) (c) (ii) and (iii) (d) (i) and (iv)	1
13.	 <p>Which of the following is the correct observation of the reaction shown in the above set up?</p> <p>(a) Brown powder of Magnesium oxide is formed. (b) Colourless gas which turns lime water milky is evolved. (c) Magnesium ribbon burns with brilliant white light. (d) Reddish brown gas with a smell of burning Sulphur has evolved</p>	1
14.	Name the substances whose build up in the muscles during vigorous physical exercise may cause cramps? (a) Ethanol + Carbon dioxide + Energy (b) Lactic acid + Energy (c) Carbon dioxide + Water + Energy (d) Pyruvate	1
15.	If the object is placed at infinity in case of concave mirror then image formed at the focus F will be _____ (a) Real, inverted, diminished (b) Real, inverted, diminished with point size (c) Real, inverted, magnified (d) Virtual, inverted, magnified	1
16.	Humans have two different sex chromosomes, X and Y. Based on Mendel's laws; a male offspring will inherit which combination of chromosomes? (a) both the X chromosomes from one of its parents	1

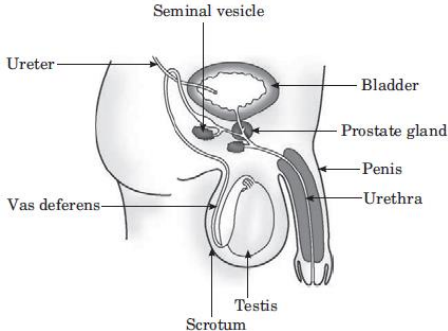
	(b) both the Y chromosomes from one of its parents (c) combination of X chromosomes from either of its parents (d) combination of X and Y chromosome from either of its parents	
<p>Q. no 17 to 20 are Assertion - Reasoning based questions. These consist of two statements – Assertion (A) and Reason (R). Answer these questions selecting the appropriate option given below:</p> <p>(a) Both A and R are true and R is the correct explanation of A (b) Both A and R are true and R is not the correct explanation of A (c) A is true but R is false (d) A is False but R is true</p>		
17.	Assertion (A): Light does not travel in the same direction in all the media. Reason (R): The speed of light does not change as it enters from one transparent medium to another.	1
18.	Assertion (A): The effect of auxin hormone on the growth of root is exactly opposite to that on a stem. Reason (R): Auxin hormone increases the rate of growth in root and decreases the rate of growth in stem.	1
19.	Assertion (A): Zinc carbonate is heated strongly in presence of air to form zinc oxide and carbon dioxide. Reason (R): Calcination is the process in which a carbonate ore is heated strongly in the absence of air to convert into metal oxide.	1
20.	Assertion: When pea plants (pure line) having round yellow seeds are crossed with pure line plants having wrinkled green seeds, then all pea plants obtained in F ₁ generation bear wrinkled green seeds. Reason: Round and yellow seeds are dominant to wrinkled and green seeds.	1
SECTION – B Q. no. 21 to 26 are very short answer questions.		
21.	<p>a) Why are covalent compounds generally poor conductors of electricity?</p> <p>b) Name the following compound</p> $ \begin{array}{c} \text{H} & & \text{H} \\ & & \\ \text{H}-\text{C}- & \text{C} & -\text{C}-\text{H} \\ & & \\ \text{H} & \text{O} & \text{H} \end{array} $	2
22.	<p>a) What happens when nitric acid is added to the egg shells?</p> <p>b) Write the balanced chemical equation.</p> <p style="text-align: center;">OR</p> <p>a) How would you distinguish between baking powder and washing soda by heating?</p>	2

	Explain with balanced chemical equation?	
23.	How is the mode of action in beating of the heart different from reflex actions? Give any four differences.	2
24.	In the following food chain, 100 J of energy is available to the lion. How much energy was available to the producers? Plants → Deer → Lion	2
25.	A ray of light is incident on a convex mirror as shown. Redraw the diagram and complete the path of this ray after reflection from the mirror. Mark angle of incidence and angle of reflection on it.	2
26.	A compass needle is placed near a current carrying straight conductor. State your observation for the following cases and give reasons for the same in each case. (a) Magnitude of electric current is increased. (b) The compass needle is displaced away from the conductor. OR Two circular coils P and Q are kept close to each other, of which coil P carries a current. What will you observe in the galvanometer connected across the coil Q (a) if current in the coil P is changed? (b) if both the coils are moved in the same direction with the same speed? Give reason to justify your answer in each.	2
SECTION - C Q.no. 27 to 33 are short answer questions.		
27.	What happens when a piece of (a) Zinc metal is added to copper sulphate solution? (b) Aluminium metal is added to dilute hydrochloric acid? (c) Silver metal is added to copper sulphate solution? Also, write the balanced chemical equation if the reaction occurs	3
28.	(a) What does the diagram depict?	

	 <p>(b) Name and define this surgical method. (c) Why is this surgical method adopted?</p>	3
29.	<p>In the following food chain, 5 J of energy is available to man. How much energy was available at the producer level?</p> <p>Plants → Sheep → Man</p> <p>OR</p> <p>What is depicted in the scheme? Name any two non biodegradable wastes.</p> 	3
30.	<p>a) How is copper extracted from its sulphide ore? b) Explain the various steps supported by chemical equations?</p>	3
31.	<p>Draw a flow chart to show the breakdown of glucose by various pathways</p>	3
32.	<p>What eye defect is myopia? Describe with a neat diagram how this defect of vision can be corrected by using a suitable lens</p> <p>OR</p> <p>(a) List two causes of hypermetropia. (b) Draw ray diagrams showing (i) a hypermetropic eye and (ii) its correction using suitable optical device.</p>	3
33.	<p>Draw the pattern of magnetic field lines around a current carrying straight conductor. How does the strength of the magnetic field produced change:</p>	3

	(i) with the distance from the conductor? (ii) with an increase in current in a conductor?	
SECTION - D Q.no. 34 to 36 are Long answer questions.		
34.	(a) On diluting an acid, it is advised to add acid to water and not water to acid. Explain why it is so advised? (b) Draw a labelled diagram to show the preparation of hydrogen chloride gas in laboratory. (i) Test the gas evolved first with dry and then with wet litmus paper. In which of the two cases, does the litmus paper show change in colour? (ii) State the reason of exhibiting acidic character by dry HCl gas/HCl solution. OR (a) Illustrate an activity to investigate whether all compounds containing hydrogen are acidic. (b) What happens when dilute hydrochloric acid is added to sodium carbonate? Write a balanced chemical equation of the reaction involved.	5
35.	(a) A green stemmed rose plant denoted by GG and a brown stemmed rose plant denoted by gg is allowed to undergo a cross with each other. (a) List your observations regarding : (i) Colour of stem in their F_1 progeny (ii) Percentage of brown stemmed plants in F_2 progeny if plants are self pollinated. (iii) Ratio of GG and Gg in the F_2 progeny. (b) "It is a matter of chance whether a couple will have a male or a female child." Justify this statement by drawing a flow chart.	5
36.	(i) Draw ray diagrams to represent the nature, position and relative size of the image formed by a convex lens for the object placed: (a) At $2F_1$ (b) Between F_1 and the optical center O of lens. (ii) A concave mirror of focal length 15 cm forms an image of an object kept at a distance of 10 cm from the mirror. Find the position, nature and size of the image formed by it. OR A convex lens has a focal length of 10 cm. At what distance from the lens should the object be placed so that it gives a real and inverted image 20 cm away from the lens? What would be the size of the image formed if the object is 2 cm high? With the help of a ray diagram show the formation of the image by the lens in this case.	5
SECTION - E		

Q.no. 37 to 39 are case - based/data -based questions with 2 to 3 short sub - parts. Internal choice is provided in one of these sub-parts

<p>37.</p>	<p>The compounds which have the same molecular formula but differ from each other in physical or chemical properties are called isomers and the phenomenon is called isomerism. When the isomerism is due to difference in the arrangement of atoms within the molecule, without any reference to space, the phenomenon is called structural isomerism. In other words, structural isomers are compounds that have the same molecular formula but different structural formulas, i.e., they are different in the order in which different atoms are linked. In these compounds, carbon atoms can be linked together in the form of straight chains, branched chains or <u>even</u> rings.</p> <ol style="list-style-type: none"> 1) Among CH_4, C_2H_6 and C_4H_{10} which is expected to show isomerism? 2) Why doesn't ethane have any structural isomers? 3) Draw the structure of an unsaturated cyclic compound having six carbon atoms. Also draw its electron dot structure. <p style="text-align: center;">OR</p> <p>Draw the possible structural isomers of pentane.</p>	<p>4</p>
<p>38.</p>	<p>The male reproductive system consists of portions that produce the germ cells and other portions that deliver the germ cells to the site of fertilization. Testes are located outside the abdominal cavity in the scrotum because sperm formation requires a lower temperature than normal body temperature. It also has a role of secretion of male sex hormone which brings changes in appearance seen in boys at the time of puberty. Vas deferens unites with a tube coming from the urinary bladder. The urethra is a common passage for sperms and urine. The prostate gland and seminal vesicles add their secretions so that sperms are now in a fluid.</p> <div style="text-align: center;">  <p style="text-align: center;">Human-male reproductive system</p> </div> <ol style="list-style-type: none"> i) Explain why scrotum remains outside the body of human males? ii) List two functions performed by the testis in human beings. iii) Name the organs producing sperms and ova respectively in humans. <p style="text-align: center;">OR</p>	<p>4</p>

	<p>What are secondary sexual characteristics? Name any two such characteristics in males.</p>									
39.	<p>The heating effect of current is obtained by the transformation of electrical energy into heat energy. Just as mechanical energy used to overcome friction is covered into heat, in the same way, electrical energy is converted into heat energy when an electric current flows through a resistance wire. The heat produced in a conductor, when a current flows through it is found to depend directly on (a) strength of current (b) resistance of the conductor (c) time for which the current flows.</p> <p>The mathematical expression is given by $H = I^2Rt$.</p> <p>The electrical fuse, electrical heater, electric iron, electric geyser, etc. all are based on the heating effect of current.</p> <p>(i) Name any two properties of heating elements?</p> <p>(ii) A heater of resistance 300Ω is connected to the main supply for 30 mins. If 10 A current flows through the filament of the heater then what is the heat produced in the heater?</p> <p>(iii) When the current is doubled in a heating device and time is halved, the heat energy produced is</p> <table border="1"> <tr> <td>(a) doubled</td> <td>(b) halved</td> </tr> <tr> <td>(c) four times</td> <td>(d) one fourth times</td> </tr> </table> <p style="text-align: center;">OR</p> <p>When a current of 0.5 A passes through a conductor for 5 min and the resistance of conductor is 10 ohm, the amount of heat produced is</p> <table border="1"> <tr> <td>(a) 250 J</td> <td>(b) 5000J</td> </tr> <tr> <td>(c) 750J</td> <td>(d) 1000J</td> </tr> </table>	(a) doubled	(b) halved	(c) four times	(d) one fourth times	(a) 250 J	(b) 5000J	(c) 750J	(d) 1000J	4
(a) doubled	(b) halved									
(c) four times	(d) one fourth times									
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(c) 750J	(d) 1000J									

KENDRIYA VIDYALAYA SANGATHAN ERNAKULAM REGION

SAMPLE PAPER 4 SCIENCE (086) 2022 - 23

Max: Marks -80

Time Allowed : 3hours

General Instructions.

I. This question paper consists of 39 questions in 5 sections.

ii. All questions are compulsory. However, an internal choice is provided in some questions. Student is expected to attempt only one of these questions.

iii. Section A consist of 20 objective type questions carrying 1 mark each.

iv. Section B consist of Very Short questions carrying 2 mark each. Answer to these questions should be in the range of 30 to 50 words.

v. Section C consist of 7 Short Answer type questions carrying 3 mark each. Answer to these questions should be in the range of 50 to 80 words.

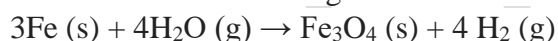
vi. Section D consist of 3 Long Answer type questions carrying 5 mark each. Answer to these questions should be in the range of 80 to 120 words.

vi. Section E consist of 3 Source based or case -based units of assessment of 04 marks each with sub – parts.

SECTION A

Select and write one most appropriate option out of the four options given for each of the questions 1 – 20.

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



- (i) Iron metal is getting oxidised
 - (ii) Water is getting reduced
 - (iii) Water is acting as reducing agent
 - (iv) Water is acting as oxidising agent
- (a) (i), (ii) and (iii)
(b) (in) and (iv)
(c) (i), (ii) and (iv)
(d) (ii) and (iv)

2. Three beakers labelled as A, B and C each containing 25 ml of water were taken. A small amount of NaOH, anhydrous CuSO₄ and NaCl were added to the beakers A, B and C respectively. It was observed that there was an increase in the temperature of the solution contained in beakers A and B, whereas in case of beaker C, the temperature of the solution falls. Which one of the following statements(s) is (are) correct?

- (i) In beakers A and B, exothermic process has occurred.
- (ii) In beakers A and B, endothermic process has occurred.
- (iii) In beaker C exothermic process has occurred.
- (iv) In beaker C endothermic process has occurred.

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

3. Which of the following phenomena occurs when acid is mixed with water

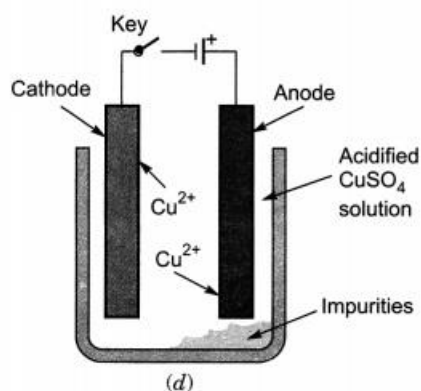
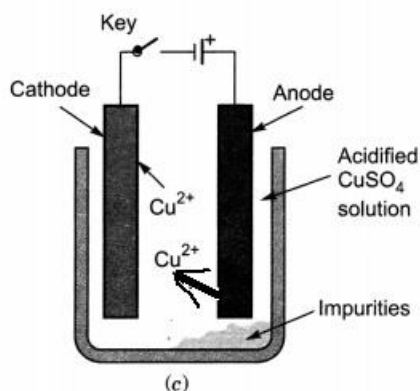
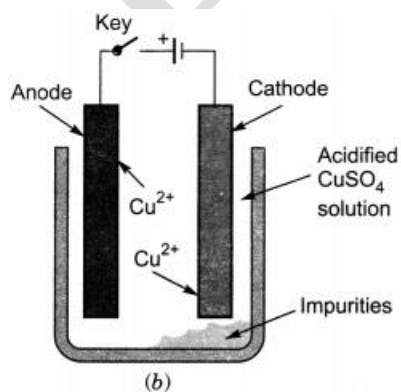
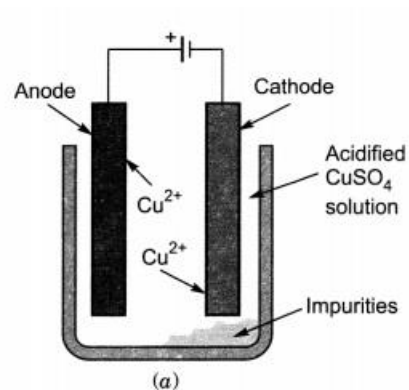
- (a) Neutralization
- (b) Dilution
- (c) Ionization

- A. Only (B) is correct
- B. (A) & (B) are correct
- C. (B) & (C) are correct
- D. Only (C) is correct

4. During the preparation of HCl gas on a humid day, the gas is usually passed through the guard tube containing CaCl_2 . The purpose of using CaCl_2 is

- A. To add moisture to the gas (HCl)
- B. To absorb HCl gas
- C. To absorb moisture from the HCl gas
- D. To prevent the mixing of HCl gas with air

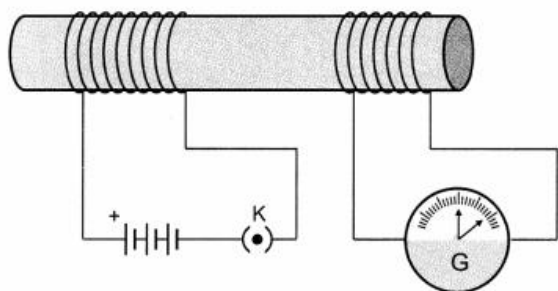
5. Which one of the following figures correctly describes the process of electrolytic refining?



6. Which part of nephron allows the selective reabsorption of useful substances like glucose, amino acids, salts and water into the blood capillaries?

- (a) Tubule
- (b) Glomerulus
- (c) Bowman's capsule
- (d) Ureter

7. In the arrangement shown in the figure there are two coils wound on a non-conducting cylindrical rod. Initially the key is not inserted. Then the key is inserted and later removed. Then

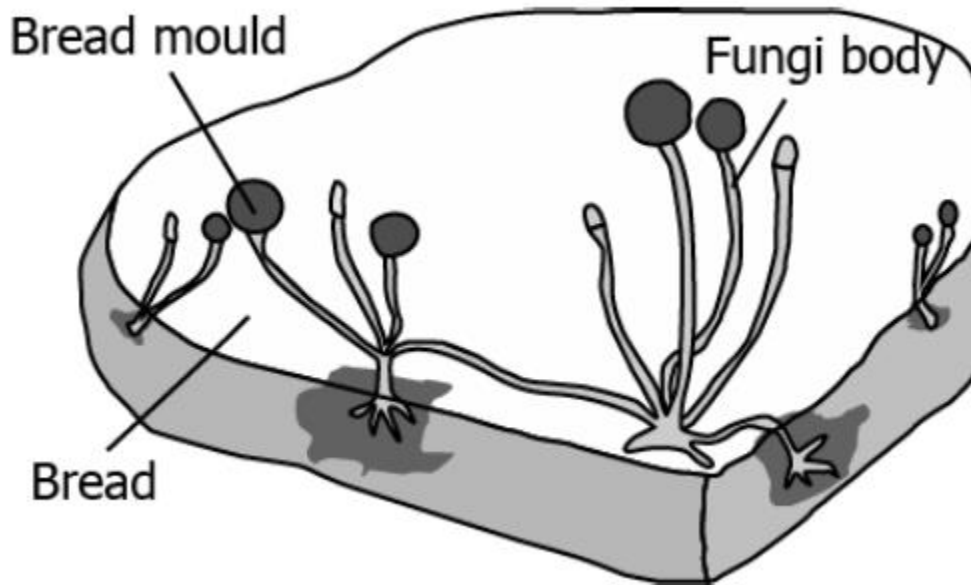


- (a) the deflection in the galvanometer remains zero throughout.
- (b) there is a momentary deflection in the galvanometer but it dies out shortly and there is no effect when the key is removed.
- (c) there are momentary galvanometer deflections that die out shortly; the deflections are in the same direction.
- (d) there are momentary galvanometer deflections that die out shortly; the deflection are in opposite directions.

8. Which of the following equations is the summary of photosynthesis?

- (a) $6\text{CO}_2 + 12\text{H}_2\text{O} \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2 + 6\text{H}_2\text{O}$
- (b) $6\text{CO}_2 + \text{H}_2\text{O} + \text{Sunlight} \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + \text{O}_2 + 6\text{H}_2\text{O}$
- (c) $6\text{CO}_2 + 12\text{H}_2\text{O} + \text{Chlorophyll} + \text{Sunlight} \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2 + 6\text{H}_2\text{O}$
- (d) $6\text{CO}_2 + 12\text{H}_2\text{O} + \text{Chlorophyll} + \text{Sunlight} \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{CO}_2 + 6\text{H}_2\text{O}$

9. The image shows the bread moulds on a bread



How do these fungi obtain nutrition?

- (a) by eating the bread on which it is growing
- (b) by using nutrients from the bread to prepare their own food
- (c) by breaking down the nutrients of bread and then absorbing them
- (d) by allowing other organisms to grow on the bread and then consuming them

10. A plant gets rid of excess water through transpiration. Which is a method used by plants to get rid of solid waste products?

- (a) shortening of stem
- (b) dropping down of fruits
- (c) shedding of yellow leaves
- (d) expansion of roots into the soil

11. Which of the following statements are true about the brain?

- (i) The main thinking part of the brain is hind brain.
 - (ii) Centres of hearing, smell, memory, sight, etc. are located in fore brain.
 - (iii) Involuntary actions like salivation, vomiting, blood pressure are controlled by the medulla in the hind brain.
 - (iv) Cerebellum does not control posture and balance of the body.
- (a) (i) and (ii)
 - (b) (i), (ii) and (iii)

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

12. Alloys are homogeneous mixtures of a metal with a metal or non-metal. Which among the following alloys contain non-metal as one of its constituents?

- (a) Brass
- (b) Bronze
- (c) Amalgam
- (d) Steel

13. The highly reactive metals like Sodium, Potassium, Magnesium, etc. are extracted by the

- (a) electrolysis of their molten chloride
- (b) electrolysis of their molten oxides
- (c) reduction by aluminium
- (d) reduction by carbon

14. If a round, green seeded pea-plant (RRyy) is crossed with a wrinkled yellow seeded pea-plant (rrYY), the seeds produced in F₁ generation are

- (a) round and green
- (b) round and yellow
- (c) wrinkled and green
- (d) wrinkled and yellow

15. A zygote which has an X-chromosome inherited from the father will develop into a

- (a) girl
- (b) boy
- (c) either boy or girl
- (d) X-chromosome does not influence the sex of a child.

16. Three resistors of 1 Ω , 2 Ω , and 3 Ω are connected in parallel. The combined resistance of the three resistors should be

- (a) greater than 3 Ω
- (b) less than 1 Ω
- (c) equal to 2 Ω
- (d) between 1 Ω and 3 Ω

Question no 17 to 20 are assertion – Reasoning based questions.

These consist of two statements-Assertion (A) and Reason (R). Answer these questions selecting the appropriate options given below'

- (a) Both A and R are true and R is the correct explanation of A
- (b) Both A and R are true and R is not the correct explanation of A
- (c) A is true but R is false.
- (d) A is false but R is true.

17. **Assertion (A)** :Calcium carbonate when heated gives calcium oxide and water.

Reason (R) : On heating calcium carbonate, decomposition reaction takes place.

18. **Assertion (A)** : Longer wires have greater resistance and the smaller wires have lesser resistance.

Reason (R) : Resistance is inversely proportional to the length of the wire.

19. Assertion (A): Pancreatic juice digests starch, proteins and fats

Reason (A): Pancreatic juice contains digestive enzymes like pancreatic amylase, pepsin and lipase.

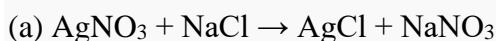
20. Assertion(A): A compass needle is placed near a current carrying wire. The deflection of the compass needle decreases when the magnitude of an electric current in the wire is increased.

Reason (R) : Strength of a magnetic field at a point near the conductor increases on increasing the current.

SECTION B

Q.no21 to 26 are very short answer questions

21. (i) Classify the following reaction into different type:



(ii) Which of the above reaction are precipitation reaction? Why is a reaction called precipitation reaction?

22. (a) What is peristaltic movement?

(b) 'Stomata remain closed in desert plants during daytime'. How do they do photosynthesis?

23. Write down any two differences between the transport of materials in xylem and phloem?

24. (a) State one example of chemotropism.

(b) Draw a schematic diagram showing chemotropism

25. (a) What is a solenoid?

(b) Draw the pattern of magnetic field lines produced by a solenoid through which a steady current flow.

26. What is Ozone? How it is formed in the upper layer of the earth's atmosphere? How does ozone affect our ecosystem?

SECTION C

Q.no. 27 to 33 are short answer questions

27. (i) Draw a labelled diagram to show the preparation of hydrogen chloride gas in laboratory.

(ii) Test the gas evolved first with dry and then with wet litmus paper. In which of the two cases, does the litmus paper show change in colour?

(iii) State the reason of exhibiting acidic character by dry HCl gas/HCl solution.

28. State the type of chemical reactions, represented by the following equations : (Board Term I, 2014)

- (a) $A + BC \rightarrow AC + B$
- (b) $A + B \rightarrow C$
- (c) $PQ + RS \rightarrow PS + RQ$
- (d) $A_2O_3 + 2B \rightarrow B_2O_3 + 2A$

29. Name the glands present in the wall of the stomach and name the secretion produced by this gland that help in the digestion of food. Write the three components of secretion that are released by these glands.

OR

What are the different ways in which glucose is oxidised to provide energy in various organisms?

30. The linear magnification produced by a spherical mirror is +3. Analyse this value and state the (i) type of mirror and (ii) position of the object with respect to the pole of the mirror. Draw a ray diagram to show the formation of image in this case.

31. How does a solenoid behave like a magnet? Can you determine the north and south poles of a current-carrying solenoid with the help of a bar magnet? Explain.

32. Define the term refraction. State the laws of refraction with the help of labelled diagram.

33. Why is damage to the ozone layer a cause for concern? What steps are being taken to limit this damage?

SECTION D

Q.no. 34 to 36 are long answer questions

34.(a) Draw three different possible structures of a saturated hydrocarbon having five carbon atoms in its molecule.

(b) What are these three structures of a hydrocarbon having same molecular formula called?

(c) Write the molecular formula and the common name of this compound.

(d) Write the molecular formula and the common name of its alkyne.

35. (a) How do Leishmania and Plasmodium reproduce?

(b) State one difference in their mode of reproduction.

(c) Define the term vegetative propagation

(d) List four advantages of vegetative propagation.

OR

List two sexually transmitted diseases in each of the following cases:

(i) Bacterial infections

(ii) Viral infections

(a) State the role of placenta in the development of embryo.

(b) What happens when the egg is not fertilized?

36.(a) Draw a schematic diagram of a circuit consisting of a battery of three cells of 2 V each, a 5Ω resistor, an 8Ω resistor, and a 12Ω resistor, and a plug key, all connected in series.

(b) Redraw the circuit of Questions 1, putting in an ammeter to measure the current through the resistors and a voltmeter to measure the potential difference across the 12Ω resistor. What would be the readings in the ammeter and the voltmeter?

(c) How can three resistors of resistances 2Ω , 3Ω , and 6Ω be connected to give a total resistance of (i) 4Ω , (ii) 1Ω ?

SECTION -E

Q.no. 37 to 39 are case - based/data -based questions with 2 to 3 short sub - parts. Internalchoice is provided in one of these sub-parts.

37. The absolute refractive index of a medium is simply called its refractive index. The refractive index of several media is given in Table given below. From the Table you can know that the refractive index of water, $n_w = 1.33$. This means that the ratio of the speed of light in air and the speed of light in water is equal to 1.33. Similarly, the refractive index of crown glass, $n_g = 1.52$.

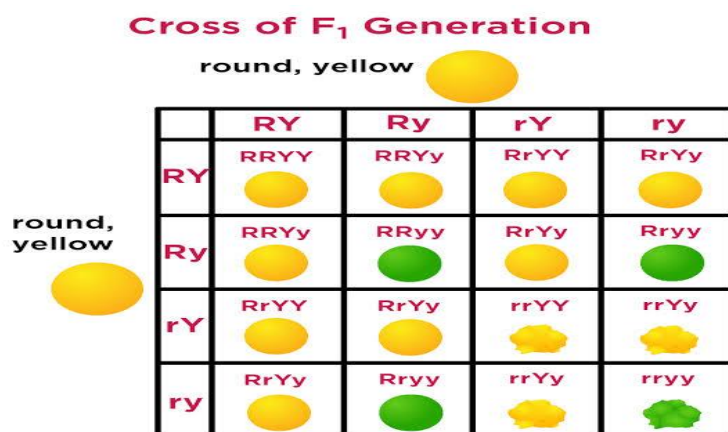
Material medium	Refractive index	Material medium	Refractive index
Air	1.0003	Canada Balsam	1.53
Ice	1.31	Rock salt	1.54
water	1.33	Carbon disulphide	1.63
alcohol	1.36	Dense flint glass	1.65
kerosene	1.44	ruby	1.71
Fused quartz	1.46	Sapphire	1.77
Turpentine oil	1.47	diamond	2.42
benzene	1.50		
Crown glass	1.52		

(i) Write down the formula used to find out the absolute refractive index of a medium. (1)

ii) Find out the speed of light in benzene. (speed of light in air $= 3 \times 10^8$ m/s) (1)

ii) Find out medium with lowest refractive and medium with highest refractive index by using the data given above. Also mention the refractive index of the corresponding media. (2)

38. Observe the picture and answer following questions



- (i) Identify the type of cross (0.5 marks)
- (ii) Find out and write the dihybrid phenotypic ratio. (0.5 marks)
- (iii) Identify and write homozygous genotypes from the cross (1 mark)
- (iv) Which law of heredity is applicable for Dihybrid cross and why? (2 mark)

39. Elements can be classified as metals or non-metals on the basis of their properties. The easiest way to start grouping substances is by comparing their physical properties. Metals, in their pure state, have a shining surface. This property is called metallic lustre. metals are generally hard. The hardness varies from metal to metal. some metals are used for making cooking vessels. Metals are present in our body and in all living organisms and help with various functions. Sodium and potassium are highly reactive and react vigorously with air and water. Certain metals are non-reactive like gold and they are found in free state in nature. Metals and nonmetals together form ionic bond by donating and accepting electrons

- (i) The metal that reacts with cold water is –(1 mark)
 - (a) mercury
 - (b) sodium
 - (c) zinc
 - (d) tungsten
- ii) Metal present in chloroplast is (1 mark)
 - (a) Iron
 - (b) Copper
 - (c) Magnesium
 - (d) Cobalt
- iii) What type of bonds metals are forming? (1 mark)
- iv). Gold is found in free state in nature why? (1 mark)

KENDRIYA VIDYALAYA ERNAKULAM REGION

Class X

Sample Question Paper 5- 2022-23

Max. Marks: 80

Time Allowed: 3 hours

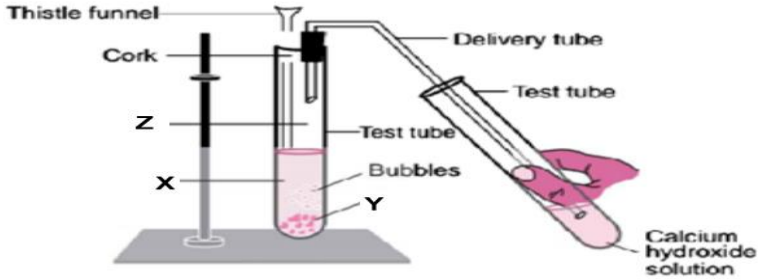
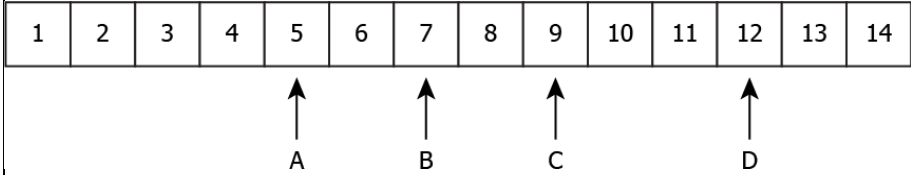
General Instructions:

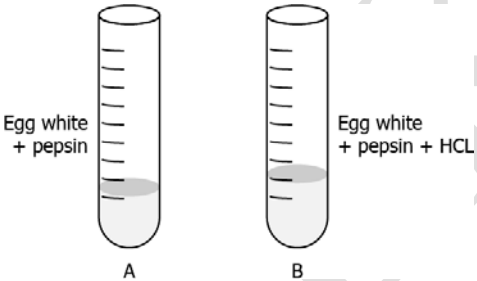
- a This question paper consists of 39 questions in 5 sections.
- b All questions are compulsory. However, an internal choice is provided in some questions. A student is expected to attempt only one of these questions.
- c **Section A** consists of 20 objective type questions carrying 1 mark each.
- d **Section B** consists of 6 Very Short questions carrying 02 marks each. Answers to these questions should be in the range of 30 to 50 words.
- e **Section C** consists of 7 Short Answer type questions carrying 03 marks each. Answers to these questions should be in the range of 50 to 80 words.
- f **Section D** consists of 3 Long Answer type questions carrying 05 marks each. Answer to these questions should be in the range of 80 to 120 words.
- g **Section E** consists of 3 source-based/case-based units of assessment of 04 marks each with sub-parts.

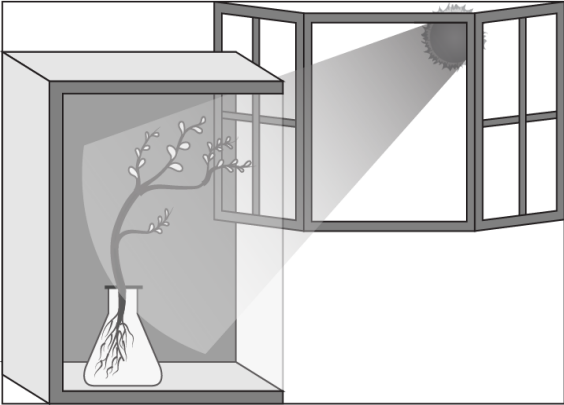
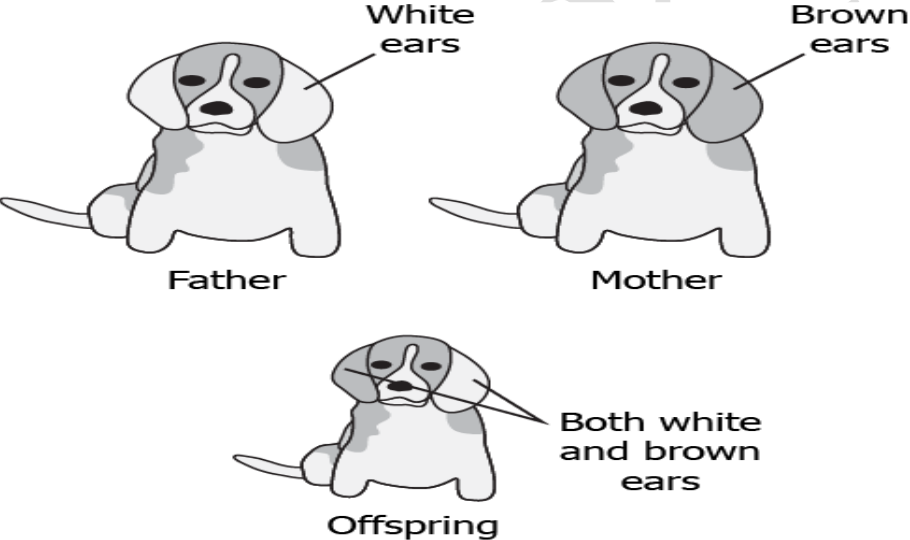
SECTION-A

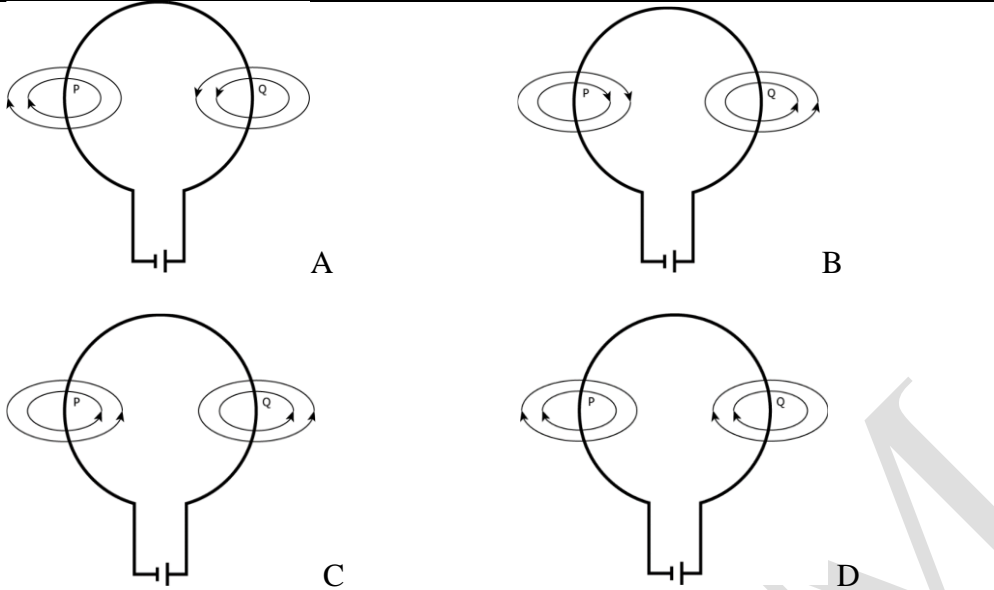
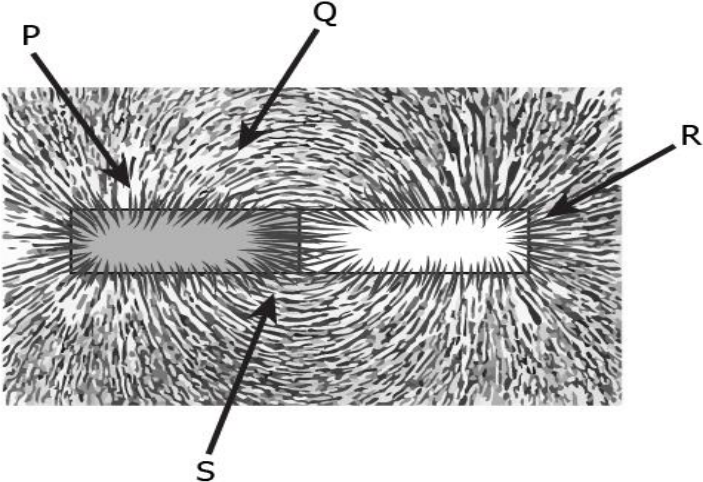
Select and write one most appropriate option out of the four options given for each of the questions 1 – 20

Q N O	QUESTION	MAR K
1.	<p>Raju had a silver coin which turned black. He kept the coin in a bowl lined with aluminum foil. Then he filled the bowl with water and boiled it. After some time he found that the coin has become new. Its blackness disappeared. The type of reaction involved here is:</p> <p>a) Double displacement reaction b) Single displacement reaction c) Combination reaction d) Oxidation reaction</p>	1

2.	<p>Given below is an experimental set up in which two chemicals X and Y react together and releases a gas Z.</p>  <p>Which option in the given table correctly represents the substances X, Y and Z</p> <table border="1"> <thead> <tr> <th>option</th> <th>X</th> <th>Y</th> <th>Z</th> </tr> </thead> <tbody> <tr> <td>a)</td> <td><u>HCl</u></td> <td>CaCl₂</td> <td>H₂</td> </tr> <tr> <td>b)</td> <td><u>HCl</u></td> <td>Na₂CO₃</td> <td>CO₂</td> </tr> <tr> <td>c)</td> <td><u>NaOH</u></td> <td>Na₂CO₃</td> <td>CO₂</td> </tr> <tr> <td>d)</td> <td>CaCl₂</td> <td><u>NaOH</u></td> <td>O₂</td> </tr> </tbody> </table>	option	X	Y	Z	a)	<u>HCl</u>	CaCl ₂	H ₂	b)	<u>HCl</u>	Na ₂ CO ₃	CO ₂	c)	<u>NaOH</u>	Na ₂ CO ₃	CO ₂	d)	CaCl ₂	<u>NaOH</u>	O ₂	1
option	X	Y	Z																			
a)	<u>HCl</u>	CaCl ₂	H ₂																			
b)	<u>HCl</u>	Na ₂ CO ₃	CO ₂																			
c)	<u>NaOH</u>	Na ₂ CO ₃	CO ₂																			
d)	CaCl ₂	<u>NaOH</u>	O ₂																			
3.	<p>Gold is used for making ornaments based on some of its properties. From the given properties which all properties might have used by a gold smith in doing so.</p> <p>a) Malleability b) Ductility c) Lustrous nature d) All the above</p>	1																				
4.	<p>A trait of an organism is influenced by</p> <p>(a) Paternal DNA only (b) Maternal DNA only (c) Both maternal and paternal DNA (d) None of these</p>	1																				
5.	<p>Which of the following molecular formula belongs to alkyne family?</p> <p>(a) C₃H₆ (b) C₃H₄ (c) C₄H₈ (d) C₃H₈</p>	1																				
6.	<p>The image shows the pH values of four solutions on a pH scale.</p> 	1																				

	<table border="1"> <tbody> <tr> <td>A</td> <td>Increase</td> <td>Increase</td> </tr> <tr> <td>B</td> <td>Decrease</td> <td>Increase</td> </tr> <tr> <td>C</td> <td>Increase</td> <td>Decrease</td> </tr> <tr> <td>D</td> <td>Decrease</td> <td>Decrease</td> </tr> </tbody> </table> <p>Which pH change is correct? A b) B c) C d) D</p>	A	Increase	Increase	B	Decrease	Increase	C	Increase	Decrease	D	Decrease	Decrease	
A	Increase	Increase												
B	Decrease	Increase												
C	Increase	Decrease												
D	Decrease	Decrease												
10	<p>A student sets up an experiment to study the role of enzymes in digestion of food.</p>  <p>In which test tube, the digestion of protein will occur?</p> <p>(a) Test tube A as pepsin will breakdown into simple molecules. (b) Test tube B as HCl will breakdown protein into simple molecules. (c) Test tubes A as pepsin will breakdown protein into simple molecules. (d) Test tube B as HCl will activate pepsin for breakdown of protein into simple molecules.</p>	1												
11	<p>Akash potted some germinated seeds in a pot. He put the pot in a cardboard box that was open from one side. He keeps the box in a way that the open side of box faces sunlight near his window. After 2-3 days he observes the shoot bends towards light as shown in image.</p>	1												

	<p>Which type of tropism he observes?</p>  <p>(a) Geotropism (b) Phototropism (c) chemotropism (d) hydrotropism</p>	
12	<p>The image shows the model of a family of dogs. It can be observed that the offspring is similar to the parent but not identical. What is the likely reason for this?</p>  <p>(a) variation in the genetic material (b) fast multiplication of body cells (c) asexual mode of reproduction (d) effect of environment on the offspring</p>	1
13	<p>Which combination of a $2\ \Omega$ resistor and $4\ \Omega$ resistor offers the least resistance to current in the circuit?</p> <p>(a) Series combination, which results in a net resistance of $2\ \Omega$. (b) Parallel combination, which results in a net resistance of $2\ \Omega$. (c) Series combination, which results in a net resistance of $1.5\ \Omega$. (d) Parallel combination, which results in a net resistance of $0.5\ \Omega$.</p>	1
14	<p>Which diagram shows the correct direction of the magnetic field lines at point P and Q in current carrying circular loop?</p>	1

		
15	<p>What is the relationship between resistance and current?</p> <p>(a) They are directly related to each other. (b) They are inversely related to each other. (c) The resistance has a greater magnitude than current. (d) The current has a greater magnitude than resistance.</p>	1
16	<p>A student places some iron filings around a magnet. The iron filings arrange themselves as</p>  <p>shown in image. The student labelled four different regions around the magnet. Where would be the magnetic be the strongest?</p> <p>(a) P (b) Q (c) R (d) S</p>	1
	<p>Q. no 17 to 20 are Assertion - Reasoning based questions. These consist of two statements – Assertion (A) and Reason (R). Answer these questions selecting the appropriate option given below:</p> <ul style="list-style-type: none"> • Both A and R are true and R is the correct explanation of A • Both A and R are true and R is not the correct explanation of A • A is true but R is false 	

	<ul style="list-style-type: none"> A is False but R is true 	
17	<p>Assertion: Calcium carbonate when heated gives calcium oxide and water.</p> <p>Reason :On heating calcium carbonate, decomposition reaction takes place.</p>	1
18	<p>Assertion: Mutation is the sudden change in the genetic material.</p> <p>Reason: Variation is useful for the survival of species over time.</p>	1
19	<p>Assertion: Human heart is four chambered.</p> <p>Reason: Vena cava is the only artery that supplies deoxygenated blood to the heart</p>	1
20	<p>Assertion: A current carrying wire deflects a magnetic needle placed near it.</p> <p>Reason : A magnetic field exists around a current carrying wire.</p>	1
SECTION-B QT NUMBER 21 TO 26 ARE VERY SHORT ANSWER QUESTIONS		
21	<p>Name the substance which upon treating with chlorine gas gives bleaching powder. Write the chemical equation for the reaction.</p>	2
22	<p>A squirrel is in a scary situation .State the immediate change that takes place in its body so that the squirrel is able to either fight or run.</p>	2
23	<p>In each of the following situations what happens to the rate of photosynthesis?</p> <p>a) Cloudy days</p> <p>b) Stomata gets blocked due to dust</p>	2
24	<p>a) What are the constituents of solder alloy? Which property of solder makes it suitable for welding electrical wires?</p> <p>OR</p> <p>During extraction of metals, electrolytic refining is used to obtain pure metals.</p> <p>(a) Which material will be used as anode and cathode for refining of silver metal by this process?</p> <p>b) Suggest a suitable electrolyte .</p>	2
25	<p>Name the correct substrate for the following enzymes.</p> <p>a) Trypsin</p> <p>b) Amylase</p> <p>c) Pepsin</p> <p>d) Lipase</p> <p>Explain the role of mouth in digestion of food?</p>	2
26	<p>List two changes in habit that people must adopt to dispose non-biodegradable waste ,for saving the environment.</p>	2
SECTION – C Qt 27 to 33 are short answer questions		
27	<p>(i) $X + Y \rightarrow XY$</p>	3

	<p>(ii) $X + YZ \rightarrow XZ + Y$</p> <p>Identify the types of reaction mentioned above in (i) and (ii). Give one example for each type in the form of a balanced chemical equation</p>	
28	Normally metals react with acids and produce hydrogen gas. But hydrogen gas is not evolved with nitric acid. Why?	3
29	Two green plants are kept separately in oxygen free containers. one in dark and the other in continuous light. Which one will live longer and why?	3
	<p style="text-align: center;">Or</p> <p>When a sportsman runs, he gets muscle cramps. Why ?</p>	
30	<p>A student wants to project the image of a candle flame on the walls of school laboratory by using a lens.</p> <p>(a) Which type of lens should he use and why?</p> <p>(b) At what distance in terms of focal length F of the lens should he place the candle flame, so as to get</p> <p>(i) A magnified image on the wall</p> <p>(ii) A diminished image on the wall</p> <p>(c) Draw a ray diagram to show the formation of image in any one case.</p>	3
31	<p>a) What is the far point and near point of the human eye with normal vision ?</p> <p>b) A student sitting at the back of the classroom cannot read clearly the letters written on the blackboard. What advice will a doctor give to her? C) Draw ray diagram for the correction of this defect.</p>	3
32	<p>a) What is meant by magnetic field?</p> <p>A compass needle is placed near a current carrying straight conductor. State your observation for the following cases and give reasons for the same in each case.</p> <p>(b) Magnitude of electric current is increased.</p> <p>(c) The compass needle is displaced away from the conductor.</p>	3
33	<p>A) Ozone forms by combination of free oxygen atoms and oxygen molecules. How do free oxygen atoms form at higher levels of atmosphere?</p> <p>B) The depletion of ozone layer is a cause of concern. Why?</p> <p>C) Why is excessive use of CFCs a cause of concern?</p>	3
	<p>SECTION – D</p> <p>QT NUMBER 34 TO 36 ARE LONG ANSWER QUESTIONS</p>	
34	<p>An ester has the molecular formula $C_4H_8O_2$. Write its structural formula.</p> <p>What happens when this ester is heated in presence of NaOH solution?</p> <p>Write the balanced chemical equation for the reaction and name the products.</p>	5

	<p>What is a saponification reaction?</p> <p style="text-align: center;">Or</p> <p>Ethanoic acid reacts with ethanol in the presence of Conc.H₂SO₄ to form a compound.</p> <p>(a) Write the smell and class of compound to which this compound belongs.</p> <p>(b) Write the chemical equation for the reaction and state the role of Conc. H₂SO₄ in the reaction.</p> <p>(c) Write one use of the product of this reaction.</p>	
35	<p>A) Name the causative agent of the disease “kala- azar” and its mode of asexual reproduction.</p> <p>B) Write two differences between binary fission and multiple fission in a tabular form.</p> <p>C) List TWO advantages of vegetative propagation.</p>	5
36	<p>A) State Ohm’s law</p> <p>B) List three factors on which the resistance of a conductor depends.</p> <p>C) Write the SI unit of resistivity.</p>	5
SECTION-E		
QT NUMBER 37 TO 39 ARE CASE BASED/DATA BASED QUESTIONS WITH SUBPARTS		
37	<p>An element is a pure substance made of same kind of atoms. Elements are classified into metals, nonmetals and metalloids. Metals are electropositive in nature and nonmetals are electro negative. A more reactive metal can displace a less reactive metal from its salt solution. Metals react with non-metals by losing or gaining electrons. They have a give- and-take relation between them. Ionic compounds are usually solid and hard in nature. They are generally soluble in water and insoluble in solvent like petrol, kerosene, etc. The melting and boiling points of electrovalent compounds are high. In order to change the physical state of the electrovalent compounds (from solid to liquid to gas), a high temperature is needed to overcome the attractive forces.</p> <p>(i) The atomic number of four elements A(6) , B(8), C(10) and D(12) .Which are the two elements which can react to form ionic compounds .</p> <p>(ii) Kiran saw that his mother is keeping the pickle in a metallic container. He told her that pickle should not be stored in metallic container. Why did he say so and how it is to be stored?</p> <p>(iii) (a)Zinc displaces iron from Ferrous sulphate. (b)Iron displaces Zinc from Zinc sulphate.</p>	<p>1</p> <p>1</p> <p>2</p>

	<p>Which of the above statement is correct and why ?</p> <p>Or</p> <p>What is meant by cation and anion? Give one example each for cation and anion.</p>	
38	<p>The branch of biology that deals with the study of heredity and variations is known as Genetics. Gregor Johann Mendel was the first person to carry out experiments regarding the heredity of certain characters from one generation to another in a scientific manner. He worked mainly on the garden pea plant. His observations regarding the occurrence of contrasting characters in various generations of garden pea led him to interpret that these are controlled by units which he called, factors. These factors are today known as genes. Mendel carried out crosses with two traits to see the interaction and basis of inheritance</p> <div> <p>The diagram illustrates a monohybrid cross of pea plants for the trait of flower color. In the Parent generation, a Red flower (genotype RR) is crossed with a White flower (genotype rr). The resulting F1 generation consists of Red flowers (genotype Rr). The diagram shows the parental plants at the top, with lines indicating the cross, leading to the F1 plant below.</p> </div> <p>between them.</p> <p>A) Define Genetics. OR What is the scientific name of the garden pea?</p> <p>B) What is the contribution of Mendel in the field of genetics?</p> <p>C) Why did Mendel carry out an experiment to study inheritance of two traits in garden pea?</p> <p>D) R and r denote two different genes for colour. Which law of Mendel can be explained using the image?</p> <p>(a) Only Law of segregation</p> <p>(b) Only Law of independent assortment</p> <p>(c) Law of segregation and Law of dominance</p> <p>(d) Law of segregation and Law of independent assortment</p> <p>OR</p> <p>D) How do Mendel's experiments show that traits may be dominant or recessive ?</p>	<p>1</p> <p>1</p> <p>1</p> <p>1</p>
39	<p>The lenses form different types of images when object placed at different locations. When a ray is incident parallel to the principal axis, then after refraction, it passes through the focus or appears to come from the focus.</p> <p>When a ray goes through the optical centre of the lens, it passes without any deviation. If the object is placed between focus and optical center of the convex lens, erect and magnified image is formed. As the object is</p>	

	<p>brought closer to the convex lens from infinity to focus, the image moves away from the convex lens from focus to infinity. Also the size of image goes on increasing and the image is always real and inverted. A concave lens always gives a virtual, erect and diminished image irrespective to the position of the object.</p> <p>A) The location of image formed by a convex lens when the object is placed at infinity is (a) at focus (b) at 2F (c) at optical center (d) between F and 2F</p> <p>B) When the object is placed at 2F in front of convex lens, the location of image is at</p> <p>C) Rahul conducts an experiment using an object of height 10 cm and a concave lens with focal length 20 cm. The object is placed at a distance of 25 cm from the lens. Can the image be formed on a screen? Why? OR</p> <p>C) An image of an object produced on a screen which is about 36 cm using a convex lens. The image produced is about 3 times the size of the object. What is the size of the object?</p>	<p>1</p> <p>1</p> <p>2</p>
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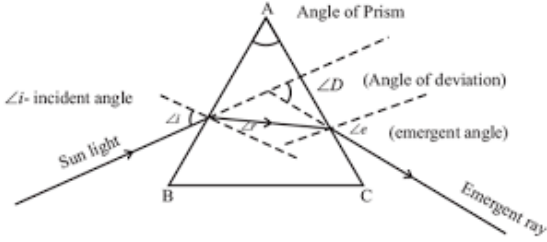
SCIENCE (086)
CLASS X SAMPLE PAPER 1
MARKING SCHEME

Q. No	Questions	Marks
SECTION – A		
1.	(d) any of i, ii and iii	1
2.	(d) x = physical state of CaCO_3 , and CaO ; y = reaction condition; z = physical state of CO_2 .	1
3.	(b) Copper powder turns black in colour.	1
4.	(a) pH =1.8	1
5.	(b) HNO_3	1
6.	(c) (i) , (ii) & (iii)	1
7.	(b) ii & iii	1
8.	(b) living beings consumes oxygen during respiration	1
9.	(a) Lungs -- pulmonary vein -- left atrium --left ventricle— aorta-- body cells	1
10.	(c) 1:1	1
11.	(a) It is a sensory neuron that carries the message from the receptor to the CNS	1
12.	(c) This eliminates the need of producing plant using seeds.	1
13.	(d) Maximum in case (iii)	1

14.	(a) North to South	1
15.	(c) Increases heavily	1
16.	(d) 3Ω	1
17.	(a)	1
18.	(a)	1
19.	(c)	1
20.	(b)	1

SECTION – B

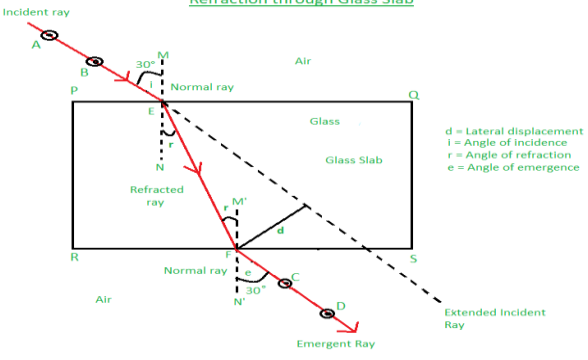
21.	<p>Yellow precipitate of lead iodide is formed. It is precipitation reaction.</p> $\text{Pb}(\text{NO}_3)_2 (\text{aq}) + 2\text{KI} (\text{aq}) \longrightarrow \text{PbI}_2 (\text{s}) + 2\text{KNO}_3 (\text{aq})$ <p>It is also called double displacement reaction.</p> <p style="text-align: center;">OR</p> <p>(a) Combination reaction (b) Displacement reaction (c) Combustion reaction (d) Decomposition reaction</p>	2
22.	<p>1.A-Dendrite, B-Axon 2.Dendrite. 3.Dendrite to cell body or cyton to axon. 4.Electrical impulse in the region of synapse.</p>	2
23.	<p>A lot of metabolic activity is continuously occurring even when we are not doing any work, e.g., heartbeat, breathing, digestion, absorption, blood circulation, etc. All of them require energy.</p>	2

24.	 <p style="text-align: center;">OR</p> <p>White light is a mixture of seven colours. The speed of different colours of white light is different in glass. So, when white light passes through a glass prism, it splits into seven colours. Red colour deviates the least.</p>	2
25.	<p>Recycling is treatment of waste material so as to make it suitable for reuse, e.g., metallic articles, broken glass, paper, etc.</p> <p>There will be reduced use of resources.</p> <p>There will be little pollution from these wastes as they are picked up for recycling as soon, they are produced.</p>	2
26.	<p>Ozone is triatomic form of oxygen, O₃. It forms a protective ozone layer in the stratosphere. Ozone layer absorbs the very harmful component of ultraviolet radiations (100 – 320 nm) and thus protect the organisms on the earth.</p>	2

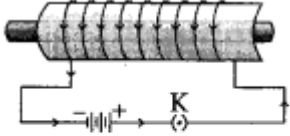
SECTION - C

Q.no. 27 to 33 are short answer questions.

27.	<p>She noticed that water started boiling even when it was not being heated. Give reason for her observation. Write the corresponding equation and name the product formed.</p> <p>A suspension of slaked lime also called calcium hydroxide is formed when water is added to quick lime.</p> $\text{CaO}(s) + \text{H}_2\text{O}(l) \longrightarrow \text{Ca}(\text{OH})_2(s) + \text{heat}$ <p style="text-align: center;">(Slaked lime)</p> <p>Since the reaction is highly exothermic, the solution started boiling although it was not being heated. The suspension of slaked lime is allowed</p>	3
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30.	<p style="text-align: center;">Refraction through Glass Slab</p>  <p> d = Lateral displacement i = Angle of incidence r = Angle of refraction e = Angle of emergence </p> <p>When a ray passes from optical rarer to denser medium, it bends towards the normal and vice versa.</p> <p>$\angle i$ = angle of incidence $\angle r$ = angle of refraction $\angle e$ = angle of emergence d = lateral displacement.</p> <p>$n = \frac{\sin i}{\sin r}$</p> <p>----- $\sin r$</p>	3
31.	<p>a) (i) The lens which can correct the vision of such a person suffering from both myopia and hypermetropia is a bifocal lens.</p> <p>(ii) A common type of bifocal lens contains both concave and convex lens. It is prepared with the upper portion consisting of a concave lens facilitating distant vision and the lower portion consisting of convex lens facilitating near vision,</p> <p>(b) The power for correcting his near vision, $P = +3 \text{ D.}$ As $P = 1/f \text{ (m)}$ \therefore Focal length of convex lens needed, $f = 1/P = 0.33 \text{ m} = +33.33 \text{ cm}$ Power required to correct distant vision</p>	3

	$P = -3D$ \therefore Focal length of concave lens, $f = (1/P) = -0.33 \text{ m} = -33.33 \text{ cm}.$	
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32.	<p>(a) Strength of magnetic field produced by a current carrying solenoid depends upon the following factors:</p> <ol style="list-style-type: none"> 1.number of turns in the coil 2.amount of current flowing through it 3.radius of coil 4.Material of core of the solenoid. <p>(b) A strong magnetic field produced inside a solenoid can be used to magnetise a piece of magnetic material, like soft iron, when placed inside the coil. The magnet so formed is called an electromagnet.</p>  <p>An electromagnet-A current-carrying solenoid coil which is used to magnetise steel rod inside it.</p> <p style="text-align: center;">OR</p> <p>Answer:</p> <p>(i) When a current carrying wire is placed in a magnetic field, it experiences a magnetic force that depends on</p> <ol style="list-style-type: none"> (a) current flowing in the conductor (b) strength of magnetic field (c) length of the conductor (d) angle between the element of length and the magnetic field. <p>(ii) Force experienced by a current carrying conductor placed in a magnetic field is largest when the direction of current is perpendicular to the direction of magnetic field.</p>	3
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		<p style="text-align: center;">OR</p> <p>Compound A is Ethanol</p> <p>Compound A = $\text{CH}_3\text{CH}_2\text{OH}$</p> <p>$\text{CH}_3\text{CH}_2\text{OH}$ (in the presence of conc. H_2SO_4) $\rightarrow \text{CH}_2 = \text{CH}_2 + \text{H}_2\text{O}$</p> <p>Compound B is Ethene</p> <p>Compound B is $\text{CH}_2 = \text{CH}_2$</p> <p>$\text{CH}_2 = \text{CH}_2$ (in the presence of Ni) $\rightarrow \text{C}_2\text{H}_6$</p> <p>Compound C = $\text{CH}_3 - \text{CH}_3$</p>	
3 5.		<p>i. Number of chromosomes in both the gametes are equal hence a number of chromosomes in a female gamete of tobacco plant is 24. Combining both numbers of chromosomes in a zygote is 48.</p> <p>ii. Meiosis is a way of cell division in which a number of chromosomes get halved. After fertilization chromosomes become equal to that of somatic cells. After fertilization Mitosis takes place for the rest of the stages of life. Hence chromosomes remain constant.</p> <p style="text-align: center;">OR</p> <p>(a) Yeast (b) Fermentation (c) Fungi (d) Hydra (e) Multicellular: Y (Hydra); Unicellular: X (Yeast)</p>	5

SECTION - E

37.	<p>i. Sodium and Potassium</p> <p>ii. As element X forms an oxide which is basic in nature, element X is a metal.</p> <p>iii. The ash obtained after burning magnesium ribbon in air is magnesium oxide which is basic in nature. So it turns red litmus blue.</p> <p>iv. Hydrogen</p>	4
38.	<p>i. Tallness is dominant over shortness.</p> <p>ii. Flowers X and Y have the same colour because their genotype consists of a dominant allele. The dominant allele expresses itself even in the presence of a recessive allele. X and Y both have the same colour because they both have dominant allele B.</p> <p>iii. All the traits are independently inherited.</p> <p style="text-align: center;">OR</p> <p>iii. Black hair (heterozygous)</p>	4 (1+2+1)
39.	<p>i. Concave mirrors form erect and enlarged images when held closer to the cavity.</p> <p>ii. Concave mirror forms a real and inverted image at 2F of the object kept at 2F.</p> <p>iii. Let the mirror be placed at a distance x from wall</p> <p>By using</p> $I/O = -v/u$ <p>i.e., $-9/+3 = -(-x)/-(x-3)$</p> $9(x-3) = 3x$ $3x-9 = x$ $2x = 9$ $x = 4.5 \text{ m.}$	4 (1+1+2)

KENDRIYA VIDYALAYA SANGATHAN
ERNAKULAM REGION
CLASS X SCIENCE (086)
SAMPLE PAPER-2 (2022-23)

MAX. MARKS: 80

MARKING SCHEME

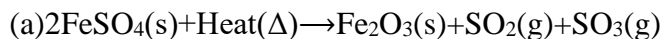
TIME ALLOWED- 3 HOURS

1. (c)
2. (d)
3. (c)
4. (c)
5. (c)
6. (d)
7. (c)
8. (a)
9. (d)
10. (b)
11. b) Phototropism
12. d) 1Ω
13. (c) It stores the urine till urination.
14. (c) parallel inside the solenoid and circular at the ends.
15. b
16. b) the current will change its direction continuously
17. D
18. C
19. D
- 20.c) It stores the urine till urination.
20. (c) parallel inside the solenoid and circular at the ends.
21. b
22. b) the current will change its direction continuously
23. D
24. C
25. D
26. A

SECTION B

27.

- i. Green colour of FeSO_4 disappears which means a change in state and colour occurs.
- ii. The reddish brown solid is formed and a gas is generated during this process.



OR

22.a) At cathode
hydrogen

At anode: oxygen.

(b) This is because water contains two parts of hydrogen element as compared to one part of oxygen element by volume.

22. Diffusion is a slow process.

In multicellular organisms, the cells are not in direct contact with the outside environment as in unicellular organisms.

a) In desert plants the stomata open at night.

They take in carbon dioxide at night, and it is stored in the form of an intermediate which is used during day for photosynthesis

28. Receptor → Sensory neuron → Brain → Motor neuron → Eye → Eye muscle contracts.

29. a. Organism A

b. Human being

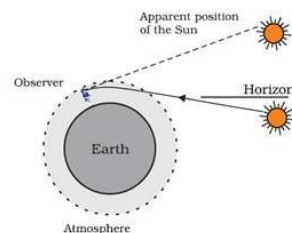
30. Due to atmospheric refraction, the stars seem to be higher in the sky than they actually are.

Light from a star is refracted as it leaves space (a vacuum) and enters the earth's atmosphere. Air higher up in the sky is rarer but that nearer the earth's surface is denser. So, as the light from a star comes down, the dense air bends the light more. Due to this refraction of star's light, the star appears to be at a higher position.

OR

The sun seems to rise two minutes before the actual sunrise and two minutes after the actual sunset due to the phenomenon of atmospheric refraction.

During sunrise and sunset, when the sun is just below the horizon, the light from the sun, while coming towards the earth, suffers refraction from a rarer to a denser layer and so it bends towards the normal at each refraction. Due to the continuous bending of light at different successive layers, the sun can be seen even when its actual position is just below the horizon.



31. Improper disposal of waste will serve as a breeding ground for mosquitoes and will create favorable conditions for the spread of various diseases.

Improper disposal of waste will release harmful gases in the environment. It will make

the environment unclean and unhygienic for normal living of the organisms.
The waste will flow to water bodies along with the rain water and become a threat to aquatic organisms.

SECTION C

27.(i) Exothermic reactions release heat or energy. When you or we breathe out, breath is warmer. This is happened for respiration reaction of our body. Carbohydrates present in food are broken down to form glucose. This glucose combines with oxygen in the cells of our body and provides energy.

(i) Nitrogen dioxide is the reddish-brown gas evolved when Lead Nitrate is heated strongly. Lead nitrate on heating decomposes to lead monoxide, nitrogen dioxide and oxygen.



(ii) When fats and oils are oxidised they become rancid and their smell and taste changes, which is why, they are flushed with nitrogen gas because nitrogen is an inert gas and prevents the oxidation of the food.

28. (i) Hydrated salt is a salt with water as the water of crystallization whereas Anhydrous salt is the salt that gives away its water of crystallization.

(ii) Soda ash is the active ingredient in washing soda. The chemical name for it is sodium carbonate, chemical formula Na_2CO_3 . It is more basic, that is, less acidic.

(iii) Baking soda is pure sodium bicarbonate, whereas baking powder also contains an acid, such as cream of tartar, and cornstarch. Baking soda is a raising agent that contains one or more acid ingredients, such as cocoa powder or buttermilk. Baking powder is better for recipes that contain little or no acid ingredients.

29 a: Pepsin

b: HCl (Hydrochloric Acid)

c: Mucus

d: The main function of pepsin is to digest proteins

e: The main function of HCl is to create an acidic environment, kill microbes and activate inactive pepsinogen into an active form.

f: Mucus protects the wall of the stomach from the acidic effect of acid.

OR

The Leaves of a healthy plant coated with Vaseline would not stay healthy because Vaseline coating will block the stomata. In a plant, there will be no intake of carbon dioxide from the

surrounding to carry out the process of photosynthesis because the pores of stomata are blocked by the Vaseline.

30. Formula used

Given,

focal length, $f = -15\text{cm}$

object distance, $u = -10\text{cm}$

Image distance, $v = ?$

Finding position of the image

By using the image formula

$$1/f = 1/v + 1/u$$

$$\Rightarrow 1/-15 = 1/v + 1/-10$$

$$\Rightarrow 1/v = 1/10 - 1/15$$

$$\Rightarrow 1/v = 1/30$$

So, $v = 30\text{cm}$

Hence, Image will be formed at 30cm.

Finding size of the image

By using the formula for the magnification of the image

We have

$$m = -v/u$$

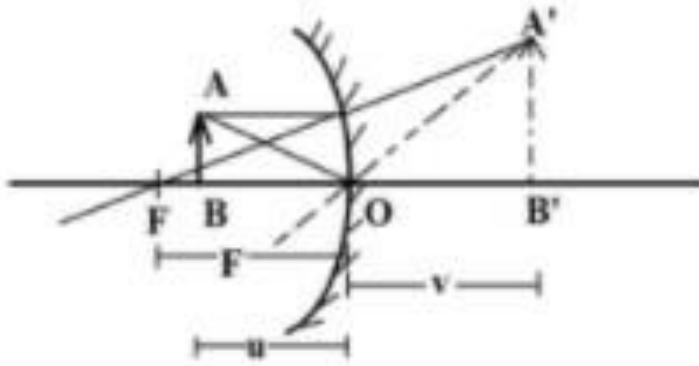
$$\Rightarrow m = -30/-10$$

$$\Rightarrow m = 3$$

So, the image will be highly magnified in size.

Finding nature of the image

The image will be Virtual and Erect in nature as v and m is positive.



31. a) If the magnitude of current is increased, then the deflection of the compass will increase as the electric field created by the wire in turn creates a magnetic field which deflects the compass needle.

b) If it is displaced from the wire then the deflection will decrease as the magnetic field becomes weaker with increase in distance.

OR

(a) On increasing current, the force on the rod increases given that $F \propto i$. Hence, the displacement of the rod will increase.

(b) On inserting a strong horseshoe magnet, the force increases given that $F \propto B$. Hence, the displacement of the rod increases.

(c) On increasing the length, the force on the rod increases ($F \propto L$). Hence, the displacement of the rod increases.

32. Use lens formula and focal length formula.

Step 1:

Let us use lens formula here

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

Here v and u are positions of the image and object with respect to lens.

Magnification is the ratio of size of the image and the size of the object.

$$m = \frac{v}{u}$$

Here since the image is inverted image, $m = -1$

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

$$V = -u$$

Step 2:

Given that the image is formed at a distance of 50cm from the lens. And since the image is real, $v = +50\text{cm}$ and $u = -50\text{cm}$

Substitute these values in the lens formula we get

$$1/f = 1/50 - 1/ -50$$

$$1/f = 2/50 = 1/25$$

$$F = 25\text{cm}$$

So, focal length is 25cm

Step 3:

Power of the lens $P = 1/f$

$$P = 1/25 \times 10^{-2} \text{m}^{-1}$$

$$P = 100/25 = 4\text{m}^{-1}$$

$$1\text{m}^{-1} = 1\text{D}$$

$$\text{So, } P = 4\text{D}$$

Thus power of the lens is 4D.

Note:

Note that the focal length of a convex lens is always positive and the focal length of a concave lens is always negative. Therefore, with this data we can identify an unknown lens.

The solution can be remembered as a point that when the object distance is $2f$, the image distance is also $2f$ and the sizes of the image and the object are the same.

33. DDT is an insecticide and is a non-biodegradable compound. Once this insecticide is sprayed in the environment, it stays for very long time and through food chain accumulates into the organisms

According to the concept of bio magnification, the accumulation of a non-biodegradable pollutant increases at every trophic level and is maximum at the highest trophic level. Since, man occupies the apex of the ecological pyramid, DDT contamination is found maximum in man.

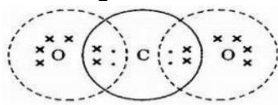
SECTION D

34.

- i. Carbon has 4 electrons in its outermost shell. It cannot lose 4 electrons to form C^{4+} cation because very high energy is required to remove 4 electrons leaving behind a carbon cation with 6 protons in its nucleus holding onto just 2 electrons. It also cannot gain 4 electrons to form C^{4-} anion because it is difficult for 6 protons to hold onto 10 electrons.
- ii. ionic compounds: Ionic/Electrovalent Bonds.
Carbon compounds: Covalent bonds.
- iii. There are no charged particles in carbon compounds and hence poor conductors of electricity.

OR

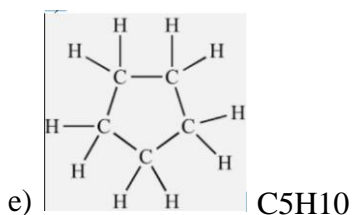
a) Z is CO_2 its electron dot structure is



b) C_2H_2 , ethyne

c) Acetylene

d) 15



Its chemical formula is C_5H_{10}

35.

a. The appearance of variations among the progeny formed by sexual reproduction is due to the following reasons:

- (i) Sexual reproduction takes place by the combination of two germ cells produced by two different individuals. Fusion of the male and female gametes.
- (ii) Each time zygote is formed by the new combination of variants.

b. (i) A \Rightarrow Pollen grains

(ii) Pollen grains, i.e., 'A' reach part 'B', i.e., stigma of the carpel by the process of pollination. Pollination is carried out by insects (like bees, butterfly, etc.), birds, wind, water, etc.

(iii) 'C' \Rightarrow Pollen tube

Pollen tube grows downward through the style towards the female gamete in the ovary. Pollen tube helps the male gamete reach the egg or ovule (female gamete).

(iv) 'D' \Rightarrow Fertilised egg or Zygote

The fertilized egg (or zygote) divides several times to form an embryo within the ovule.

OR

(a) The secretions from seminal vesicles and prostate glands lubricate the sperms and provide a fluid medium for easy transport of sperms.

In human being testes perform dual function:

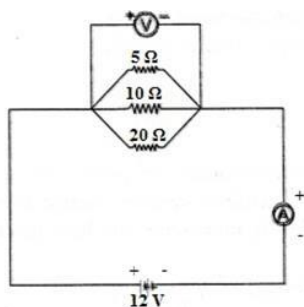
- (i) Production of sperm
- (ii) Secretion of male hormone testosterone.

- b) (i) Pregnancy
- (ii) Menstruation

36.

a) The current will be high if resistance is low. p and l for both wires A & B are same but area of cross-section (A) of wire A is- more than the wire B. Therefore, the resistance of wire A is less than the resistance of wire B. Hence, ammeter A1 connected in series with the wire A will indicate higher reading for current.

b)



c) If domestic lights are connected in series, then all lights will be switched off even when only one light fuses.

SECTION E

37. (i) The arrangement of metals in a vertical column in the order of decreasing reactivities is called reactivity series. The reactivity series follows the order:



From this it is clear that Cu is more reactive than Silver, so, copper will be able to displace silver from the salt solution.

(ii) Nickel is more reactive than both tin and lead hence can replace them from their salt solution gold copper and mercury are all less reactive than lead and tin.

OR

(ii) Metal is copper. The process is corrosion, Basic copper carbonate $[CuCO_3 \cdot Cu(OH)_2]$.

For real and inverted image, the magnification will be negative. $\therefore m = \frac{-2}{3}$.

We know that, $m = \frac{v}{u}$

$$\Rightarrow \frac{-2}{3} = \frac{12}{u}$$

$$\Rightarrow u = \frac{12 \times 3}{-2} = -18 \text{ cm}$$

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

$$\Rightarrow \frac{1}{12} - \frac{1}{-18} = \frac{1}{f}$$

$$\Rightarrow \frac{5}{36} = \frac{1}{f}$$

$$\Rightarrow f = \frac{36}{5} = 7.2 \text{ cm}$$

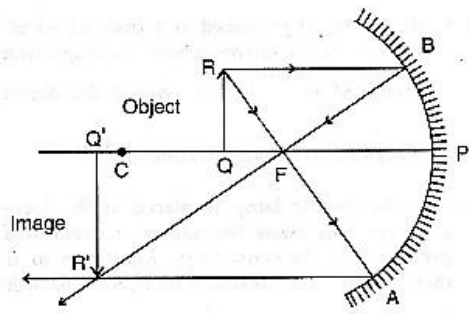
Therefore the focal length is 7.2 cm.

OR

(iv) (i) He should use a concave mirror because the only concave mirror can form real images.

(ii) To get the magnified image on the wall, the candle should be placed between C and F of the concave mirror.

(iii)



(iv) Yes. When the candle is placed between infinity and the center of curvature in front of a concave mirror, a diminished image is formed.

KENDRIYA VIDYALAYA SANGATHAN

ERNAKULAM REGION

CLASS X SCIENCE (086)

SAMPLE PAPER-3 (2022-23)

MAX. MARKS: 80

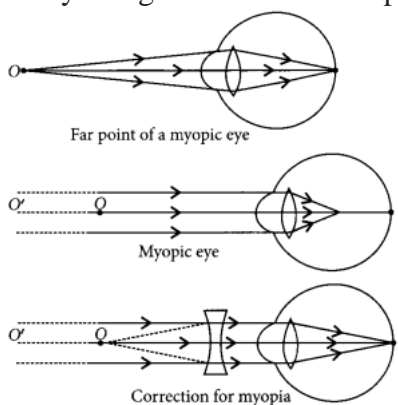
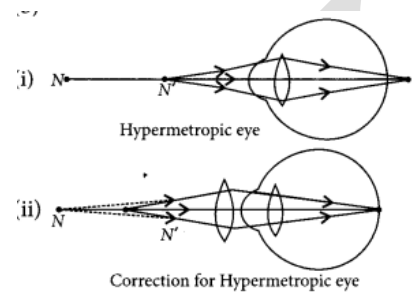
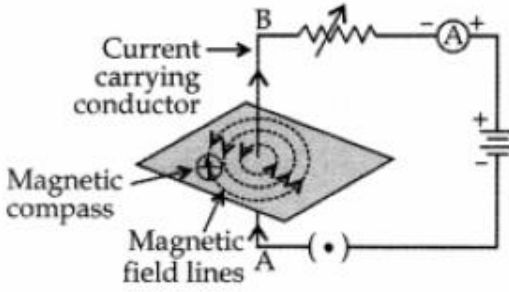
MARKING SCHEME

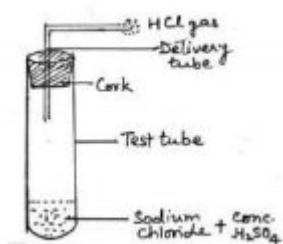
TIME ALLOWED- 3 HOURS

QNo	Value Points	Marks
SECTION- A		
1.	(c) $< 1 \Omega$	1
2.	(a) Lungs \rightarrow pulmonary vein \rightarrow left atrium \rightarrow left ventricle \rightarrow aorta \rightarrow body cells	1
3.	(c) Option c	1
4.	(c) (i), (ii) and (iv)	1
5.	(b) 110 W	1
6.	(a) Olfactory receptors \rightarrow dendritic tip of a nerve cell \rightarrow axon \rightarrow nerve ending \rightarrow release of signal dendritic tip of other nerve cell.	1
7.	(d) Sodium $>$ Magnesium $>$ Zinc $>$ Iron	1
8.	(c) Ketone	1
9.	c) Plumule, cotyledon and radicle	1
10.	a) the size of pupil will decrease, and less light will enter the eye	1
11.	(c) by breaking down the nutrients of bread and then absorbing them	1
12.	(d) (i) and (iv)	1
13.	(c) Magnesium ribbon burns with brilliant white light	1
14.	(b) Lactic acid + Energy	1
15.	(b). Real, inverted, diminished with point size	1
16.	(d) combination of X and Y chromosome from either of its parents	1
17.	(c) A is true but R is false	1
18.	(c) A is true but R is false.	1
19.	(d) A is False but R is true	1
20.	(d) A is False but R is true	1
SECTION-B		
21.	a. It is because they do not form ions. b. Propanone	2
22.	Eggshells contain calcium carbonate. Calcium carbonate reacts with nitric acid to form calcium nitrate and carbon dioxide gas. $\text{CaCO}_3(\text{s}) + \text{HNO}_3(\text{aq}) \rightarrow \text{CaNO}_3(\text{aq}) + \text{CO}_2(\text{g}) + \text{H}_2\text{O}(\text{l})$ OR	2

	<p>Baking soda (NaHCO_3) liberates carbon dioxide gas on heating, confirmed by passing it in lime water. Whereas on heating washing soda $\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$ water of crystallisation is given out, the salt becomes anhydrous.</p> <p>Reaction:</p> $2 \text{NaHCO}_3 \rightarrow \text{Na}_2\text{CO}_3 + \text{H}_2\text{O} + \text{CO}_2$ $\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O} \rightarrow \text{Na}_2\text{CO}_3 + 10 \text{H}_2\text{O}$															
23.	<table border="1"> <tr> <td>Beating of heart</td> <td>Reflex actions</td> </tr> <tr> <td>Involuntary actions are the actions which are not controlled by our will.</td> <td>Reflex actions are the sudden action in response to something.</td> </tr> <tr> <td>They do not need any kind of stimulus to work.</td> <td>They required stimulus for its action.</td> </tr> <tr> <td>These actions are regulated by the brain.</td> <td>These actions are regulated by the spinal cord.</td> </tr> <tr> <td>They do not involve skeletal muscle.</td> <td>They do involve skeletal muscle.</td> </tr> <tr> <td>These actions are performed throughout one's life.</td> <td>These actions are produced in response to an event of an emergency.</td> </tr> <tr> <td>This action may be quick or slow.</td> <td>Reflex actions are always quick.</td> </tr> </table>	Beating of heart	Reflex actions	Involuntary actions are the actions which are not controlled by our will.	Reflex actions are the sudden action in response to something.	They do not need any kind of stimulus to work.	They required stimulus for its action.	These actions are regulated by the brain.	These actions are regulated by the spinal cord.	They do not involve skeletal muscle.	They do involve skeletal muscle.	These actions are performed throughout one's life.	These actions are produced in response to an event of an emergency.	This action may be quick or slow.	Reflex actions are always quick.	<p>$\frac{1}{4} \times$ 4=2</p>
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24.	<p>As per 10% law of flow of energy in an ecosystem only 10% of energy is received by the next trophic level. Hence, in the given food chain: If 100 .J of energy is available to lion, the plants or producers have 10,000 J of energy available to them.</p> <p style="text-align: center;"> Plants → Deer → Lion 10, 000 J 1000 J 100 J </p>	2														
25.		2														
26.	<p>(a) As the amount of magnetic field strength is directly proportional to the amount of current, so the deflection of compass needle increases.</p> <p>(b) Since magnetic field strength at a point is inversely proportional to the distance from the wire. Hence deflection of compass decreases when it is displaced away from the conductor</p> <p style="text-align: center;">OR</p> <p>(a) When the amount of current in the coil P is changed, an induced current will induce in the coil Q due to change in magnetic field lines i.e., magnetic flux.</p>	2														

	(b) If both the coils are moved in the same direction with the same speed, then there is no net change in magnetic flux. Hence there will be no deflection in the galvanometer	
SECTION- C		
27.	<p>(a) Zinc metal reacts with copper sulphate solution and forms colourless zinc sulphate and reddish-brown copper metal.</p> $\text{Zn (s)} + \text{CuSO}_4 \text{ (aq)} \rightarrow \text{ZnSO}_4 \text{ (aq)} + \text{Cu (s)}$ <p>(b) Aluminium metal reacts with dilute hydrochloric acid to form aluminium chloride and hydrogen gas.</p> $2 \text{Al (s)} + 6 \text{HCl (aq)} \rightarrow 2 \text{AlCl}_3 \text{ (aq)} + 3 \text{H}_2 \text{ (g)}$ <p>(c) Silver is less reactive than copper. Hence, no reaction will occur.</p>	1+1+1
28.	<p>(a) Female reproductive system</p> <p>(b) Tubectomy –Cutting and ligating the oviduct of a woman.</p> <p>(c) Used as a contraceptive method to avoid pregnancy.</p>	1+1+1
29.	<p>Man 5 J, sheep 5 x 10 = 50 J, plants 50 x 10 = 500 J</p> <p style="text-align: center;">OR</p> <p>It is a food chain that is depicting 10% law of energy.</p> <p>Waste plastic articles, polythene bags, many pesticides like DDT</p>	3
30.	<p>a) Copper glance (Cu_2S) when heated in air gets partially oxidised to copper oxide which further reacts with the remaining copper glance to give copper metal</p> <p>b)</p> $\begin{array}{ccccccc} \text{Cu}_2\text{S (s)} & + & 3\text{O}_2 & \xrightarrow[\text{Heating}]{\text{Roasting}} & 2\text{Cu}_2\text{O} & + & 2\text{SO}_2\text{(g)} \\ \text{Copper (I)sulphide} & & \text{Oxygen (from air)} & & \text{Copper (I)oxide} & & \text{Sulphur dioxide} \end{array}$ $\begin{array}{ccccccc} 2\text{Cu}_2\text{O} & + & \text{Cu}_2\text{S (s)} & \xrightarrow[\text{Heated in absence of air}]{\text{Reduction}} & 6\text{Cu} & + & \text{SO}_2 \\ \text{Copper (I)oxide} & & \text{Copper (I)sulphide} & & \text{Copper metal} & & \text{Sulphur dioxide} \end{array}$	1 2
31.		3
32.	Myopia is also known as near-sightedness. A person with myopia can see nearby objects clearly but cannot see distant objects distinctly.	3

	<p>Myopia can be corrected by using concave lens of appropriate focal length.</p>  <p style="text-align: center;">OR</p> <p>a) Hypermetropia is caused due to following reasons: (i) Shortening of the eyeball (ii) Focal length of crystalline lens is too long.</p> 	
33.	 <p>i) Strength of the magnetic field produced by a straight current carrying wire at a point is inversely proportional to the distance of that point from the wire. (ii) Strength of the magnetic field is directly proportional to the current passing in the wire.</p>	3
34.	<p>a) Dilution of acid is highly exothermic reaction. If water is added to a concentrated acid, the heat generated may cause the mixture to splash out and cause burns. Therefore concentrated acid should be added to water in small amounts with constant stirring.</p> <p>b)</p>	2+1+1 +1



(b)(i) In Wet litmus paper the litmus paper show change in colour

(ii) HCl solution , it is due to the formation of H⁺ ion on in the water / H₃O⁺ (Hydronium ions)

OR

a) Diagram +explanation

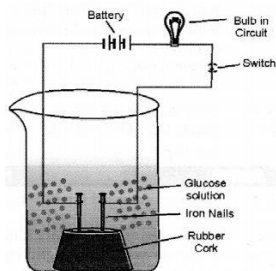
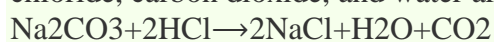


FIGURE : GLUCOSE SOLUTION IN WATER DOES NOT CONDUCT ELECTRIC CURRENT.

b) When dilute hydrochloric acid reacts with sodium carbonate then sodium chloride, carbon dioxide, and water are formed.



35. a) i) Green

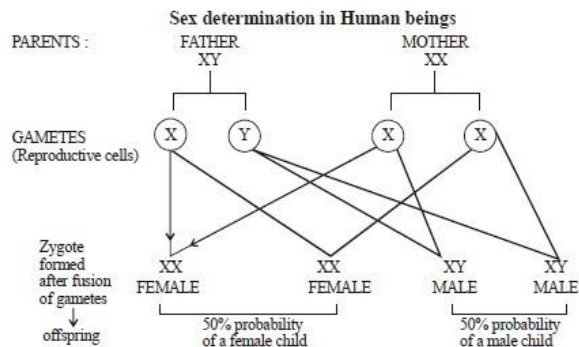
ii) 25%

iii) 1:2

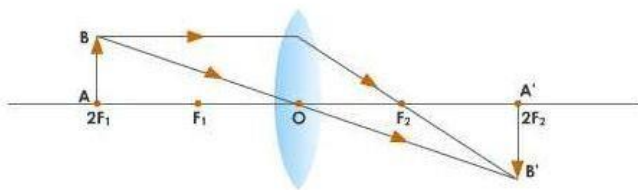
(b) Sex determination in human beings is by XY method, sex chromosomes are X and Y chromosomes. The number of chromosomes in human being is 46. Females are homogametic AA XX and males are heterogametic, AA XY. The Y-chromosome determines the maleness in human beings.

$\frac{1}{2} * 3 = 1 \frac{1}{2}$

The Sex of a newborn child is a matter of chance and none of the parents may be considered responsible for it.



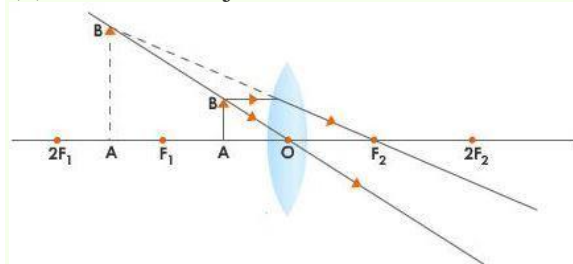
36. (a) When the Object is Placed at $2F_1$



The image is -

- Formed at $2F_2$
- Real
- Inverted
- Same size as the object

(b) When the Object is Placed between F_1 and O:



The image is -

- Formed on the same side of the lens
- Virtual

$1 \frac{1}{2} + 1$
 $\frac{1}{2} + 2$

- Erect
- Magnified

b) $f = -15 \text{ cm}$, $m = +2$ (Positive because image is virtual)
 $\therefore m = -v/u \Rightarrow v = -2u$. By using mirror formula

$$1 - 15 = 1(-2u) + 1u \Rightarrow u = -7.5 \text{ cm}$$

OR

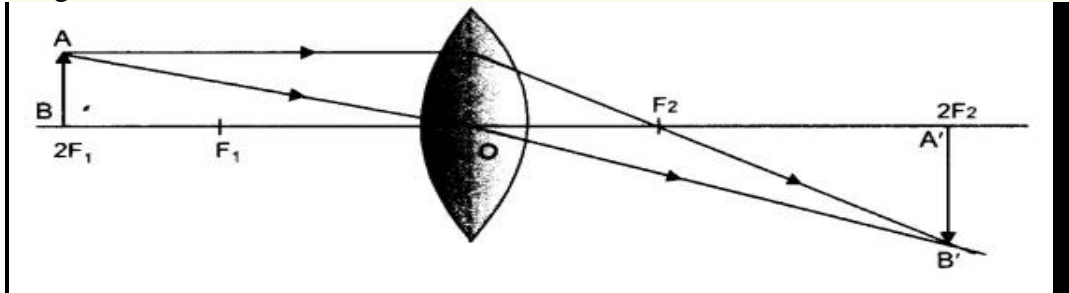
$f = +10 \text{ cm}$, $v = +20 \text{ cm}$ as image is real and inverted.

Height of the object = 2 cm (say +ve)

Using $f_1 = v_1 - u_1$, we get

$$u_1 = v_1 - f_1 = +20 - 10 = 20 - 10 = 10 \text{ cm} (=2f)$$

Image will be of the same size as that of object (as $u = v$) and hence, the height of the image

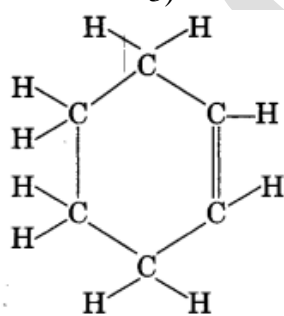


37.

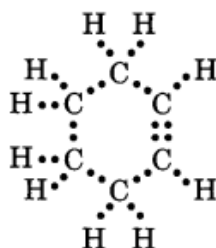


2) Because it has only 2 C atoms.

3)



(Cyclohexene)



OR

1+1+2

	<div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;"> $\begin{array}{ccccccc} & \text{H} & & \text{H} & & \text{H} & & \text{H} & & \text{H} \\ & & & & & & & & & \\ \text{H} & - \text{C} & - & \text{C} & - & \text{C} & - & \text{C} & - & \text{C} & - & \text{H} \\ & & & & & & & & & \\ & \text{H} & & \text{H} & & \text{H} & & \text{H} & & \text{H} \end{array}$ <p>Pentane</p> </div> <div style="text-align: center;"> $\begin{array}{ccccccc} & \text{H} & & \text{H} & & \text{H} & & \text{H} \\ & & & & & & & \\ \text{H} & - \text{C} & - & \text{C} & - & \text{C} & - & \text{C} & - & \text{H} \\ & & & & & & & \\ & \text{H} & & & & \text{H} & & \text{H} \\ & & & \text{H} - \text{C} - \text{H} & & & & \\ & & & & & & & \\ & & & \text{H} & & & & \end{array}$ <p>Isopentane</p> </div> <div style="text-align: center;"> $\begin{array}{ccccccc} & & & \text{H} & & & \\ & & & & & & \\ & & & \text{H} - \text{C} - \text{H} & & & \\ & & & & & & \\ & \text{H} & & & & \text{H} & \\ & & & & & & \\ \text{H} & - \text{C} & - & \text{C} & - & \text{C} & - & \text{H} \\ & & & & & & & \\ & \text{H} & & & & \text{H} & & \\ & & & \text{H} - \text{C} - \text{H} & & & & \\ & & & & & & & \\ & & & \text{H} & & & & \end{array}$ <p>Neopentane</p> </div> </div>	
38.	<p>1) The scrotum lies outside of the body between the thighs, exposing the testes to a lower temperature than the rest of the body. This lower temperature is necessary for the adequate maturation and development of sperm.</p> <p>2) Production of sperm and releases the hormone testosterone</p> <p>3) sperm- testis ova- ovary</p> <p style="text-align: center;">OR</p> <p>In secondary sexual characteristics, the body parts develop special features which make it easier to distinguish a boy and a girl. The secondary sexual characteristics in males are: (1) Hairs grow on face in the form of beard and moustache. (2) Shoulders and chest broadens</p>	1+1+2
39.	<p>1) It must have high resistivity so that it produces more heat even if low current is flowing through it.</p> <p>It must have high melting point so that it does not melt even at high temperatures.</p> <p>2) The amount of heat produced by the heater is calculated as follows:</p> $Q = I^2 RT$ <p>substituting the values in the equation, we get</p> $Q = 10^2 \times 300 \times 30 \times 60 = 54000000 \text{ J or } 54000 \text{ KJ}$ <p>3) doubled</p> <p>OR</p> $Q = I^2 R t$ $= 0.25 \times 10 \times 300$ $= 750 \text{ J}$	1+1+2

**KENDRIYA VIDYALAYA SANGATHAN ERNAKULAM
REGION**

**SAMPLE PAPER 4 SCIENCE (086) 2022 - 23
ANSWER KEY**

SECTION A

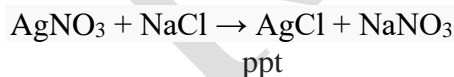
(20x1=20)

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

SECTION B

(6x2=12)

21. The reaction between AgNO_3 and NaCl is an example for precipitation reaction since it results in the formation of precipitate of AgCl .



22 (a) The relaxation of gut muscles to move the partially digested food downwards throughout the alimentary canal is called peristaltic movement.

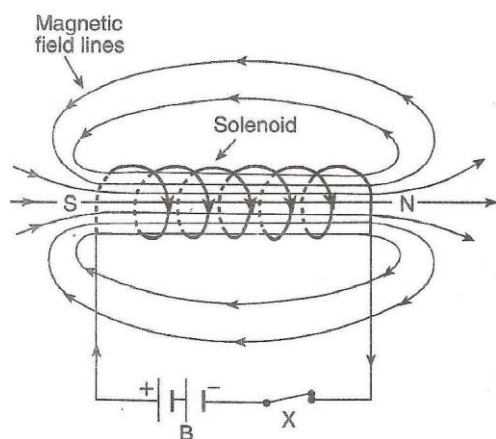
(b) In desert plants, stomata open at night and take in carbon dioxide (CO_2). Stomata remain closed during daytime to prevent the loss of water by transpiration. They take carbon dioxide during the night time and convert it into intermediate product of photosynthesis. During the day time in the presence of sunlight this intermediate compound is converted into the final product of photosynthesis.

23. Any two differences can be taken.

Xylem	Phloem
1. Xylem conducts water and dissolved minerals from roots to leaves and other parts.	1. Phloem conducts prepared food material from leaves to other parts of plant in dissolved form.
2. In xylem, the transport of material takes place through vessels and tracheids which are dead tissues.	2. In phloem, transport of material takes place through sieve tubes with the help of companion cells, which are living cells.
3. In xylem upward movement of water and dissolved minerals is mainly achieved by transpiration pull. It is caused due to suction created by evaporation of water molecules from the cells of a leaf.	3. In translocation, material is transferred into phloem tissue using energy from ATP. This increases the osmotic pressure that moves the material in the phloem to tissues which have less pressure.

24 a) Growth of pollen tube towards the ovule due to chemical stimulus during the process of fertilisation in a flower is an example of chemotropism.

25. A coil of many circular turns of insulated copper wire wrapped closely in the shape of a cylinder is called a solenoid,



26. Ozone (O_3) molecule formed by three atoms of oxygen.

In the upper layers of stratosphere oxygen molecule is acted upon by the ultraviolet rays, which splits the molecular oxygen into atomic oxygen, which in turn combines with oxygen molecule to form O_3 molecule

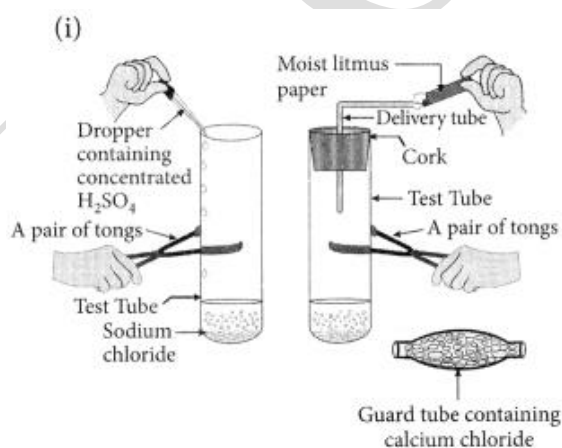


At the higher levels of the atmosphere, ozone performs an essential function. It shields the surface of the earth from ultraviolet (UV) radiations from the sun. These radiations are highly damaging to organisms. Ultraviolet rays can cause skin cancer.

SECTION C

(7x3= 21)

27



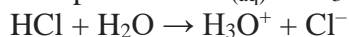
(i)

Preparation of hydrogen chloride gas

(ii) There is no change in the colour of 'dry' blue litmus paper but 'moist' blue litmus paper turns red if brought near the mouth of the test tube.

This shows that HCl gas does not show acidic behaviour in absence of water but it shows acidic behaviour in presence of water.

(iii) When HCl gas dissolves in water, forms hydrochloric acid solution i.e., $\text{HCl}_{(\text{aq})}$ which then produces $\text{H}^+_{(\text{aq})}$ or $\text{H}_3\text{O}^+_{(\text{aq})}$ ions.



Due to the presence of H^+ or H_3O^+ it shows acidic nature.

28. (a) Displacement reaction.
(b) Combination reaction.
(c) Double displacement reaction.
(d) Displacement reaction or redox reaction.

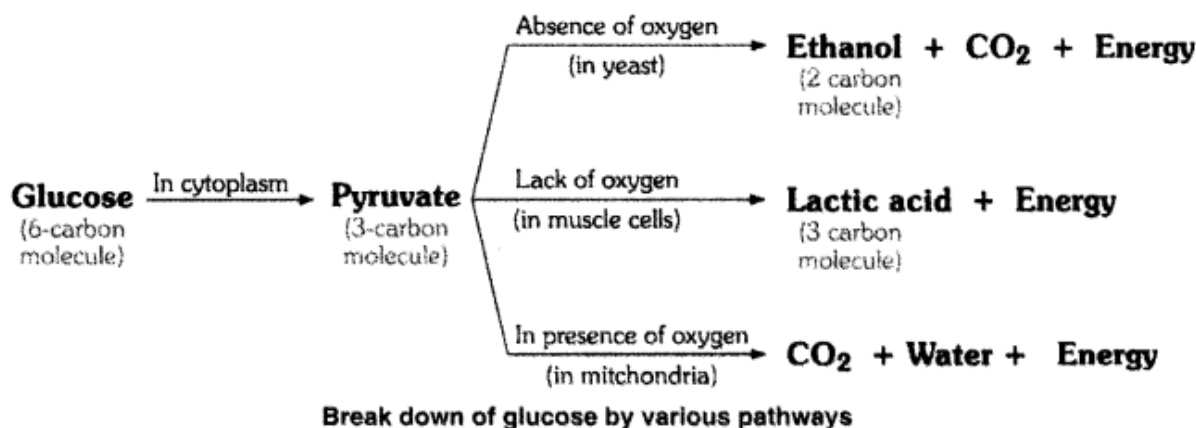
29. Stomach's muscular wall contains gastric glands. These glands secrete gastric juices which contain dilute hydrochloric acid, mucus and two protein digesting enzymes rennin and pepsin.

OR

Ans. First step of breakdown of glucose (6 carbon molecules) takes place in the cytoplasm of cells of all organisms. This process yields a three carbon molecule compound called pyruvate.

Further break down of pyruvate takes place in different ways in different organisms.

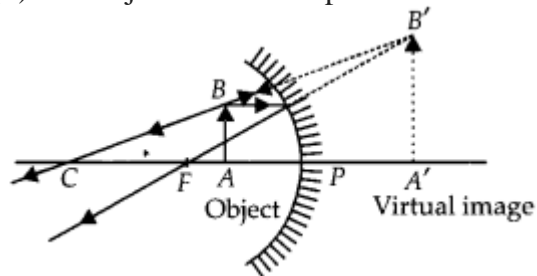
- (i) Anaerobic respiration : The anaerobic respiration in plants (like yeast) produces ethanol and carbon dioxide as end products.
(ii) Aerobic respiration : In aerobic respiration break down of pyruvate takes place in presence of oxygen to give rise three molecules of carbon dioxide and water. The release of energy in aerobic respiration is much more than in anaerobic respiration.
(iii) Lack of oxygen : Sometimes, when there is lack of oxygen especially during physical exercise, in our muscles, pyruvate is converted into lactic acid (3 carbon molecule compound). Formation of lactic acid in muscles causes cramp.



30. Positive value of the magnification indicates that image is virtual and erect.

(i) Since the image is magnified, the mirror is concave.

(ii) The object is between pole and focus of the mirror as shown



31. A solenoid behaves like a magnet in the following ways.

The magnetic field produced by a current carrying solenoid is very much similar to that of a bar magnet.

Like a bar magnet, one end of the solenoid has N-polarity while the other end has S-polarity.

To determine the north and south poles, we bring N-pole of the bar magnet near one end of the solenoid. If there is an attraction, then that end of the solenoid has south polarity and the other has north polarity. If there is a repulsion, then that end of the solenoid has north polarity and the other end has south polarity because similar poles repel each other.

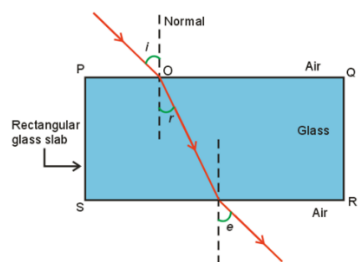
32. Refraction of light: The change in the direction of propagation of light as it passes obliquely from one transparent medium to another is called refraction of light. Refraction occurs as the velocity of light is different in different media.

Laws of refraction:

Laws of refraction of light:

→ The incident ray and the refracted ray are on the opposite sides of the normal to the surface at the point of incidence and all the three, i.e., the incident ray, the refracted ray and the normal are in the same plane.

→ For a given pair of media, the ratio of the sine of the angle of incidence to the sine of the angle of refraction is constant (Snell's law). This constant is called the refractive index of the second medium with respect to the first medium.



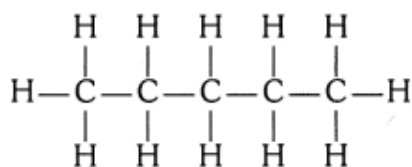
33. The damage to the ozone layer is a cause for concern because if the ozone layer in the atmosphere disappears completely, then all the extremely harmful ultraviolet radiations coming from the sun would reach the earth. These ultraviolet radiations would cause skin cancer and other ailments in men and animals and also damage the plants.

In an attempt to protect the ozone layer, the United Nations Environment Programme (UNEP) unanimously forged an agreement among its member countries to freeze CFC production at 1986 levels.

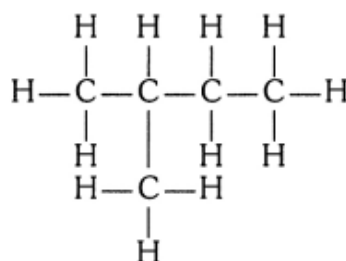
SECTION D

(3x5=15)

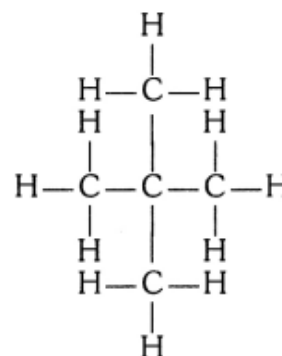
34.(a) Three possible structures of saturated hydrocarbon having five carbon atoms in its molecule is given below.



n-pentane



Iso-pentane



Neo-pentane

(b) Isomers

(c) C_5H_{12} , Pentane

(d) C_5H_8 Pentyne

35. (a) Leishmania and Plasmodium reproduce by fission (asexual mode of reproduction).

(b) (i) Leishmania reproduce by binary fission in which the parent organism splits to form two new organisms.

(ii) Plasmodium reproduce by multiple fission in which the parent organism splits to form many new organisms at the same time.

(c) The method of producing new plants from the different vegetative parts of the plant like root, stem, leaves etc are known by the name vegetative propagation.

(d)

1.Plants grown by vegetative propagation grow much faster than those grown from seeds.

2.A large number of plants can be produced by the method of vegetative propagation.

3.The plants grown by vegetative propagation usually need less attention in their early years than the plants grown from seeds.

4.Seedless plants can also be grown from this method.

OR

a. Bacterial infections. Gonorrhoea, Syphilis

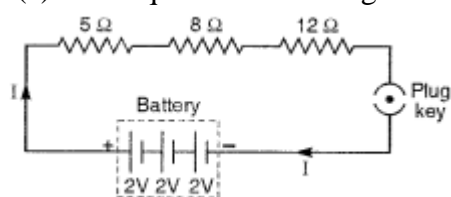
b. viral infections. Warts, AIDS (Acquired Immuno Deficiency Syndrome)

c. Role of placenta. After implantation, a disc like special tissue develops between the uterus wall and the embryo called placenta.

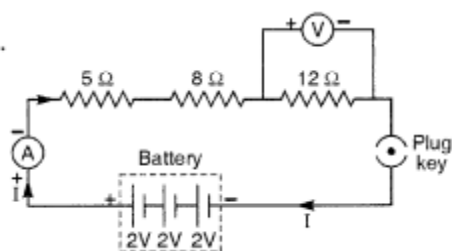
The exchange of nutrients, oxygen and waste products between the embryo and the mother takes place through the placenta.

d. If the egg does not get fertilised (due to non-availability of sperms in the female body) then the thick and soft inner lining of uterus along with the blood vessels and the dead egg comes out of the vagina in the form of bleeding called menstruation.

36. (a) The required circuit diagram is shown below



(b) The changed circuit diagram is shown



$$\text{Total voltage, } V = 3 \times 2 = 6V$$

$$\text{Total resistance, } R = 5\Omega + 8\Omega + 12\Omega = 25\Omega$$

$$\text{Reading of ammeter, } I = \frac{V}{R} = \frac{6}{25} = 0.24 \text{ A}$$

$$\text{Reading of voltmeter, } V = IR = 0.24 \times 12 = \mathbf{2.88 \text{ V}}$$

(c) (i) We can get a total resistance of 4Ω by connecting the 2Ω resistance in series with the parallel combination of 3Ω and 6Ω .

$$\text{So } R = R_1 + \frac{R_2 R_3}{R_2 + R_3} = 2 + \frac{3 \times 6}{3 + 6} = 4 \Omega$$

(ii) We can obtain a total resistance of 1Ω by connecting resistors of 2Ω , 3Ω and 6Ω in parallel.

$$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} = \frac{1}{2} + \frac{1}{3} + \frac{1}{6} = \frac{1}{1} \quad \text{or } R = 1 \Omega.$$

SECTION E

(3x4=12)

37. i) Absolute refractive index (n_m) = speed of light in air / speed of light in medium
or c/v 1 mark

ii) Refractive index of benzene (n_m) = 1.50
speed of light in air (c) = $3 \times 10^8 \text{ m/s}$

Therefore speed of light in benzene (v) = speed of light
in air / refractive index of benzene

$$= 3 \times 10^8 \text{ m/s} / 1.50$$

$$= 2 \times 10^8 \text{ m/s}$$

1 mark

iii) medium with lowest refractive index = Air = 1.003

medium with highest refractive index = Diamond = 2.42

2 mark

38.i) Dihybrid cross

0.5 mark

ii) 9:3:3:1

0.5 mark

iii) RRYy, rryy

1 mark

iv) Law of independent assortment, because during gamete production each Character assortment independent from other. 1 mark

39.i) Sodium

1 mark

ii) Magnesium

1 mark

iii) Metals and non-metals together form ionic bond by donating and accepting electrons. 1 mark

iv) Gold is a non-reactive metal and because of this reason it is found in free state in the earth. 1 mark

**KVS ERNAKULAM REGION
SCIENCE(086)**

MARKING SCHEME SAMPLE PAPER-5

<u>Q.No</u>	<u>QUESTION</u>	<u>Marks</u>
1.	b) Single displacement reaction	1
2.	b) X = HCl , Y = Na ₂ CO ₃ , Z = CO ₂	1
3.	d) All the above	1

4.	c) Both maternal and paternal DNA	1
5	(b) C_3H_4	1
6	c) C and D	1
7.	d) Parent Acid : H_2SO_4 , Parent base - $Mg(OH)_2$, Nature - Acidic	1
8.	(c) carbon dioxide is exhaled during respiration	1
9.	(c)	1
10	(d) Test tube B as HCl will activate pepsin for breakdown of protein into simple molecules.	1
11	(b) Phototropism	1
12	a) variation in the genetic material	1
13	(d) Parallel combination, which results in a net resistance of 0.5Ω .	1
14	OPTION B	1
15	(b) They are inversely related to each other.	1
16	c) R	1
17	OPTION d) A is False but R is true	1
18	OPTION b) Both A and R are true and R is not the correct explanation of A	1
19	OPTION c) A is true but R is false	1
20	OPTION a) Both A and R are true and R is the correct explanation of A	1

21.	Slaked lime is the substance which reacts with chlorine to give bleaching powder. $\text{Ca(OH)}_2 + \text{Cl}_2 \rightarrow \text{CaOCl}_2 + \text{H}_2\text{O}$	2
22.	A large amount of adrenaline is secreted in its body and the following changes takes place in its body (1) The heart beat increases (2) More oxygen supply to its muscles (3) Breathing rate increases	1 $\frac{1}{2}$ $\frac{1}{2}$
23.	(a) In cloudy days photosynthesis is reduced due to low light intensity (b) When stomata gets blocked due to dust, photosynthesis decreases by reducing gaseous exchange.	1 1
24	Solder is made up of lead and tin. It has low melting point, therefore, it is used for soldering (welding) electrical wires. OR a) a) Pure silver rod will be used as cathode and impure silver rod will be used as anode. b). AgNO_3 (aq) can be used as electrolyte.	1 1
25	a) protein b) starch c) protein d) fats Food is crushed into small pieces ,it mixes with the saliva and the enzyme amylase converts starch to sugar.	1 1
26	a) Dispose ,household waste, chemical waste, hospital waste in landfills. b) broken plastic articles such as bucket ,bowl, cup, plate should be sent to plastic processing factories.(or any other way to dispose them)	1 1
27	(i) It is a combination reaction. Example: $\text{CaO} + \text{H}_2\text{O} \rightarrow \text{Ca(OH)}_2$ (ii) It is a single displacement reaction. Example: $\text{Fe} + \text{CuSO}_4 \rightarrow \text{FeSO}_4 + \text{Cu}$	$\frac{1}{2}$ 1 $\frac{1}{2}$ 1
28	Hydrogen gas is not evolved when a metal reacts with nitric acid because nitric acid is a strong oxidizing agent. It oxidises the hydrogen gas produced to water and itself gets reduced.	3
29		3

	<p>The plant kept in continuous light will live longer because in light plant can perform photosynthesis and able to produce oxygen whereas the plant in darkness will die due to the lack of oxygen.</p> <p style="text-align: center;">Or</p> <p>It is due to the accumulation of lactic acid during anaerobic break down of glucose when oxygen supply is unable to match the requirement.</p>	
30	<p>(i) He should use a convex lens to get the real image</p> <p>(ii) (a) For magnified image candle flame should be placed between F and 2F. (b) To get diminished image candle flame should be placed beyond 2F of the lens.</p> <p>(iii) Any one ray diagram of the above case.</p>	<p>1</p> <p>½</p> <p>½</p> <p>1</p>
31	<p>a) For a human eye with normal vision the far point is at infinity and near point is 25 cm from the eye.</p> <p>b) The child is suffering from myopia. The child should use concave lens of suitable focal length.</p>	1+2
32	<p>a) It is defined as the space surrounding the magnet in which magnetic force can be experienced.</p> <p>b) As the amount of magnetic field strength is directly proportional to the amount of current, so the deflection of compass needle increases.</p> <p>(c) Since magnetic field strength at a point is inversely proportional to the distance from the wire. Hence deflection of compass decreases when it is displaced away from the conductor.</p>	<p>1</p> <p>1</p> <p>1</p>
33	<p>a) by the combination of two molecular oxygen in the presence of high energy UV radiations</p> <p>B) Ozone layer is the ozone rich area in the stratospheric layer of atmosphere which acts as a protective shield by preventing harmful UV radiations from entering the Earth surface. Hence, the depletion of ozone layer is a cause of concern.</p> <p>C) CFCs or Chlorofluorocarbons are potent compounds that release active chlorine in the atmosphere which reacts with ozone molecules present there to convert them to oxygen. This results in thinning of ozone layer. Hence, excessive use of CFCs is a cause of concern.</p>	<p>1</p> <p>1</p> <p>1</p>
34	<p>Structural formula is $\text{CH}_3\text{CH}_2\text{COOCH}_3$</p> <p>$\text{CH}_3\text{CH}_2\text{COOCH}_3 + \text{NaOH} \rightarrow \text{CH}_3\text{CH}_2\text{COONa} + \text{CH}_3\text{OH}$</p> <p>Products are sodium propanoate and methanol.</p>	<p>1</p> <p>1</p> <p>1</p>

	<p>Saponification is the process in which an ester is treated with sodium hydroxide to form sodium salt of acid and alcohol .</p> <p style="text-align: center;">Or</p> <p>The compound formed belong to esters.</p> <p>It has pleasant fruity smell.</p> <p>$\text{CH}_3\text{COOH} + \text{C}_2\text{H}_5\text{OH} \rightarrow \text{CH}_3\text{COOC}_2\text{H}_5 + \text{H}_2\text{O}$</p> <p>Conc. H_2SO_4 acts as a dehydrating agent.</p> <p>Esters are used as flavouring agents in ice creams and cold drinks.</p> <p>They are used in perfumes</p>	<p>2</p> <p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p>
35	<p>A) Causative agent of the disease Kala-azar is Leishmania. It reproduces asexually by binary fission.</p> <p>B) Heridity is controlled by units called, factors or genes</p> <p>Binary fission-(i) The parent organism, splits to form two new organisms, e.g., Amoeba, Paramecium. (ii) The nucleus of the parent body divides only once to produce two nuclei</p> <p>Multiple fission- (I)The parent organism splits to form many new organisms at the same time, e.g., Plasmodium. (II)The nucleus of the parent body divides repeatedly to produce many nuclei.</p> <p>C) ANY TWO advantages of vegetative propagation:</p> <ul style="list-style-type: none"> • The characters of the parent plants are preserved hence a good variety produced can be propagated by vegetative means. • The plants, which do not produce viable seeds or produce very few seeds, can be reproduced by this method. For example, banana, potato, grapes, sugarcane, rose, orange, etc. • It is an easier, quicker and cheaper method of propagation. • It is easier to get rid of pathogen from any part of plant by vegetative propagation. 	<p>1</p> <p>2</p> <p>2</p>
36	<p>A) It states that the potential difference V, across the ends of a given metallic wire in an electric circuit is directly proportional to the current flowing through it, provided its temperature remains the same. Mathematically,</p>	<p>1</p>

	<p>$V \propto I$ $V = RI$ where R is resistance of the conductor.</p> <p>B) Resistance of a conductor depends upon the following factors: 1) Length of the conductor : (Greater the length (l) of the conductor more will be the resistance (R). $R \propto l$</p> <p>2) Area of cross section of the conductor: (Greater the cross-sectional area of the conductor, less will be the resistance. $R \propto \frac{1}{A}$</p> <p>3) Nature of conductor.</p> <p>C) SI unit of resistivity is $\Omega \text{ m}$.</p>	<p>1+1+1</p> <p>1</p>
37	<p>(i) Element B and D can react to form ionic compounds.</p> <p>(ii) He said so because metal react with acids present in the pickle and produce poisonous substances. Pickle can be stored in glass or plastic containers.</p> <p>(iii) The statement 'a' is correct because Zinc is more reactive than iron and can displace iron from ferrous sulphate. Or The positively charged ions produced by losing one or more electrons is called cations. Example: sodium ion The negatively charged ions produced by gaining one or more electrons is called anions. Example : Chloride ion.</p>	<p>1</p> <p>1</p> <p>2</p>
38	<p>A) the study of heredity and variations is known as Genetics. OR A) Pisum sativum</p> <p>B) His observations regarding the occurrence of contrasting characters in various generations of garden pea led him to interpret that these are controlled by units which he called, factors or genes.</p>	<p>1</p> <p>1</p>

	<p>c) Mendel carried out crosses with two traits to see the interaction and basis of inheritance between them.</p> <p>d) (c) Law of segregation and Law of dominance</p> <p>OR</p> <p>d) Mendel took pea plants with contrasting characteristics – tall plant and dwarf (short) plant. On cross pollination, he got all tall plants in F1 generation. Then by self pollination of F1 tall plants, he produced second generation (F2) consisting of tall and short plants in the ratio of 3 : 1. Then he concluded that, 'T' (tall) trait is dominant while 't' trait for shortness is recessive.</p>	<p>1</p> <p>1</p>
39	<p>A) At focus</p> <p>B) at 2 F on the other side</p> <p>C) no, as the image formed will be virtual</p> <p>OR</p> <p>C) 12 cm</p>	<p>1</p> <p>1</p> <p>2</p>