

CBSE Class X 2025 Science Set 2(31/4/2) Question Paper With Solutions

Time Allowed :3 Hours	Maximum Marks :80	Total Questions :39
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General Instructions

Read the following instructions very carefully and strictly follow them:

1. This paper consists of 39 questions. All questions are compulsory.
2. This paper is divided into five sections - A, B, C, D and E.
3. Section A Nos. 1 to 20 are Multiple Choice Questions. Each carries 1 mark.
4. Section B Nos. 21 to 26 are Very Short Answer type questions. Each carries 2 marks. Answer to these questions should be in the range of 30 to 50 words.
5. Section C Nos. 27 to 33 are Short Answer (SA) type questions. Each carries 3 marks. Answer to these questions should be in the range of 50 to 80 words.
6. Section D Nos. 34 to 36 are Long Answer type questions. Each carries 5 marks. Answer to these questions should be in the range of 80 to 120 words.
7. Section E Nos. 37 to 39 are of 3 source-based/case-based units of assessment carrying 4 marks each with sub-parts.
8. There is no overall choice. However, an internal choice has been provided in some sections. Only one of the alternatives has to be attempted in such questions.

Section -A

1. To get an image of magnification -1 on a screen using a lens of focal length 20 cm, the object distance must be:

- (1) Less than 20 cm
- (2) 30 cm
- (3) 40 cm
- (4) 80 cm

Correct Answer: (3) 40 cm

Solution: We can solve this problem using the lens equation:

$$\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$$

where f represents the focal length, v is the image distance, and u is the object distance.

Since the magnification $M = -1$, and magnification is also given by:

$$M = \frac{v}{u}$$

For $M = -1$, we find:

$$v = -u$$

Substituting $v = -u$ into the lens equation, we get:

$$\frac{1}{f} = \frac{1}{-u} - \frac{1}{u} = -\frac{2}{u}$$

With $f = 20$ cm, we substitute into the equation:

$$\frac{1}{20} = -\frac{2}{u}$$

Solving for u , we get:

$$u = -40 \text{ cm}$$

Therefore, the object distance is 40 cm, and the correct answer is option (3).

Quick Tip

The object distance is negative for virtual images and positive for real images in the lens equation. In this case, we used the fact that the magnification is -1 to determine the object distance.

2. When a pure-tall pea plant is crossed with a pure-dwarf pea plant, the percentage of tall pea plants in F1 and F2 generation pea plants will be respectively:

- (1) 100%; 25%
- (2) 100%; 50%
- (3) 100%; 75%
- (4) 100%; 100%

Correct Answer: (1) 100%; 25%

Solution: This problem involves a Mendelian monohybrid cross between a homozygous tall pea plant (TT) and a homozygous dwarf pea plant (tt). The F1 generation results from crossing these two, producing all tall plants (Tt), as the tall allele is dominant over the dwarf allele.

For the F2 generation, we cross two F1 plants (Tt x Tt):

Gametes from Tt $\rightarrow T, t$

The Punnett square for this cross will show the following genotypes:

	<i>T</i>	<i>t</i>
<i>T</i>	<i>TT</i>	<i>Tt</i>
<i>t</i>	<i>Tt</i>	<i>tt</i>

From this, we can see that the genotype ratio in the F2 generation is:

$$\text{Tall (TT or Tt) : Dwarf (tt)} = 3 : 1$$

Thus, 75% of the plants will be tall and 25% will be dwarf. Therefore, the correct answer is option (1).

Quick Tip

In a basic Mendelian cross, dominant traits such as tall (T) conceal the recessive dwarf trait (t). The F1 generation consists entirely of heterozygous plants (Tt), and the F2 generation follows a 3:1 ratio.

3. Plants like rose and banana have lost the capacity to produce:

- (1) flowers
- (2) buds
- (3) seeds
- (4) fruits

Correct Answer: (3) seeds

Solution: Certain plants, like roses and bananas, which are grown for ornamental or commercial purposes, may lose their ability to produce seeds due to hybridization or methods of propagation such as cutting, grafting, or tissue culture. While these plants can be propagated vegetatively to maintain desirable characteristics, such as flower color or size, their seed production capability may be diminished or completely lost.

Quick Tip

For many cultivated plants, particularly hybrids, vegetative propagation is favored over seed production because it helps maintain specific desired traits.

4. In which one of the following situations a chemical reaction does not occur?

- (1) Milk is left open at room temperature during summer
- (2) Grapes get fermented
- (3) An iron nail is left exposed to humid atmosphere
- (4) Melting of glaciers

Correct Answer: (4) Melting of glaciers

Solution: In option (1), when milk is left exposed at room temperature, bacteria in the air may cause fermentation, which is a chemical process.

In option (2), grapes undergo fermentation, a biochemical reaction.

In option (3), when an iron nail is exposed to a moist environment, it reacts with water and oxygen to produce rust (iron oxide), which is a chemical reaction.

In option (4), the melting of glaciers is a physical change, not a chemical one, as no new substance is formed.

Therefore, the correct answer is option (4).

Quick Tip

A physical change alters the state or appearance of a substance without changing its chemical composition, such as when glaciers melt.

5. The property by virtue of which a solid material can be drawn into thin wires is called:

- (a) malleability
- (b) ductility
- (c) rigidity
- (d) resistivity

Correct Answer: (b) ductility

Solution:

The characteristic of a material that enables it to be stretched into thin wires is called ductility. Ductility is the ability of a material to undergo considerable plastic deformation before breaking.

Therefore, the correct answer is option (b).

Quick Tip

Ductility refers to a material's ability to stretch and form wires, which is a key property of metals.

6. In order to prepare dry hydrogen chloride gas in a humid atmosphere, the gas produced is passed through a guard tube (drying tube) which contains:

- (a) Calcium chloride
- (b) Calcium oxide
- (c) Calcium hydroxide
- (d) Calcium carbonate

Correct Answer: (a) Calcium chloride

Solution:

In a humid environment, hydrogen chloride gas is passed through a drying tube filled with calcium chloride. Calcium chloride is hygroscopic, meaning it has the ability to absorb moisture and thereby dry the gas.

Thus, the correct answer is option (a).

Quick Tip

Calcium chloride is frequently used to dry gases due to its ability to absorb moisture and maintain dryness.

7. Select from the following a hydrocarbon having one C-C bond and one C=C bond:

- (a) Benzene
- (b) Cyclohexane
- (c) Butyne
- (d) Propylene

Correct Answer: (c) Butyne

Solution:

Butyne is a hydrocarbon with one C-C single bond and one $C = C$ double bond. It is classified as an alkyne with the molecular formula C_4H_6 . The other options do not match this description.

Thus, the correct answer is option (c).

Quick Tip

Butyne features both single and triple bonds in its structure, making it an important compound in organic chemistry.

8. Which one of the following has half the number of chromosomes and half the amount of DNA as compared to the non-reproductive body cells?

- (1) Male germ cell
- (2) Female germ cell
- (3) Zygote

(4) Both, male and female germ cells

Correct Answer: (4) Both, male and female germ cells

Solution: Germ cells, which consist of male and female gametes (sperm and egg cells), are haploid. This means they contain half the number of chromosomes and half the DNA content of diploid somatic cells, which are the non-reproductive body cells. When these haploid gametes fuse during fertilization, they form a diploid zygote with a complete set of chromosomes.

Therefore, the correct answer is option (4).

Quick Tip
Germ cells are haploid, meaning they carry half the number of chromosomes compared to somatic cells, which are diploid.

9. The essential element taken up from the soil by the plants to synthesize proteins is:

(1) Phosphorus

(2) Nitrogen

(3) Iron

(4) Magnesium

Correct Answer: (2) Nitrogen

Solution: Nitrogen is vital for plants as it is a fundamental part of amino acids, which are the building blocks of proteins. Plants absorb nitrogen from the soil in the form of nitrates or ammonium ions. Proteins are essential for various cellular functions and growth, and nitrogen plays a key role in their production.

Therefore, the correct answer is option (2).

Quick Tip
Nitrogen is a key element in proteins and is essential for the growth and development of plants.

10. Select TRUE statements about lymph from the following:

- A. Lymph vessels carry lymph through the body and finally open into larger arteries.
- B. Lymph contains some amount of plasma, proteins and blood cells.
- C. Lymph contains some amount of plasma, proteins and red blood cells.
- D. Lymph vessels carry lymph through the body and finally open into larger veins.

The true statements are:

- (1) A and B
- (2) B and D
- (3) A and C
- (4) C and D

Correct Answer: (4) C and D

Solution: Statement A is incorrect because lymph vessels do not open into arteries; instead, they drain into larger veins, specifically the subclavian veins.

Statement B is correct because lymph contains plasma, proteins, and a small number of white blood cells, but it does not have significant amounts of red blood cells.

Statement C is incorrect because lymph does not contain red blood cells; it only contains white blood cells.

Statement D is correct because lymph vessels transport lymph throughout the body and ultimately empty into the larger veins, such as the subclavian veins.

Therefore, the correct answer is option (4).

Quick Tip
Lymph is a fluid that aids in the removal of waste and the transport of immune cells, and it always drains into veins, not arteries.

11. Which one of the following gets biomagnified at different levels in a food chain?

- (1) Carbon monoxide
- (2) CFC's
- (3) DDT
- (4) Manure

Correct Answer: (3) DDT

Solution: Biomagnification is the process through which the concentration of certain substances, like pesticides, increases as you ascend the trophic levels of a food chain. DDT, a pesticide, is a classic example of a substance that biomagnifies. As it accumulates in organisms, its concentration becomes greater at higher trophic levels, impacting top predators.

Therefore, the correct answer is option (3).

Quick Tip

DDT is a persistent chemical that builds up in the tissues of organisms, causing harmful effects at higher trophic levels.

12. In the food chains given below, select the most efficient food chain in terms of energy:

(1) Grass → Grasshopper → Frog → Snake

(2) Plants → Deer → Lion

(3) Plants → Man

(4) Phytoplankton → Zooplankton → Small Fish → Big Fish

Correct Answer: (4) Phytoplankton → Zooplankton → Small Fish → Big Fish

Solution: In food chains, energy efficiency typically decreases as you move up the trophic levels because energy is lost at each level, with approximately 90% being lost as heat or used in metabolic processes. Phytoplankton (the primary producers) provide energy to zooplankton, small fish, and eventually larger fish. This food chain is relatively more efficient in energy transfer compared to the others listed, as it starts with primary producers that are effectively consumed by primary consumers and subsequent trophic levels.

Therefore, the correct answer is option (4).

Quick Tip

Energy efficiency declines at higher trophic levels in a food chain due to energy loss at each stage.

13. An optical device 'X' is placed obliquely in the path of a narrow parallel beam of light. If the emergent beam gets displaced laterally, the device 'X' is:

- (1) Plane mirror
- (2) Convex lens
- (3) Glass slab
- (4) Glass prism

Correct Answer: (3) Glass slab

Solution: A glass slab results in a lateral displacement of light without changing its direction. As light passes through the glass slab, it refracts at both surfaces, causing the emergent ray to be laterally displaced in relation to the incident ray. This effect is specific to a glass slab, unlike a plane mirror, lens, or prism, which would reflect, focus, or disperse the light, respectively.

Therefore, the correct answer is option (3).

Quick Tip
A glass slab shifts light laterally without altering its direction, whereas other optical devices can bend or focus light in different ways.

14. A piece of wire of resistance 'R' is cut lengthwise into three identical parts. These parts are then connected in parallel. If the equivalent resistance of this combination is R' , then the value of R/R' is:

- (1) 1/9
- (2) 1/3
- (3) 3
- (4) 9

Correct Answer: (4) 9

Solution: When a wire is divided into three equal parts, each part has a resistance of $R/3$. When resistances are connected in parallel, the equivalent resistance R' is given by the formula:

$$\frac{1}{R'} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$$

For three identical resistances where $R_1 = R_2 = R_3 = R/3$, we get:

$$\frac{1}{R'} = \frac{1}{R/3} + \frac{1}{R/3} + \frac{1}{R/3} = \frac{3}{R/3} = \frac{9}{R}$$

Thus, $R' = \frac{R}{9}$, and the ratio $R/R' = 9$.

Therefore, the correct answer is option (4).

Quick Tip

In a parallel combination of identical resistors, the equivalent resistance decreases, and the total resistance can be calculated using the parallel resistance formula.

15. The minimum number of identical bulbs of rating 4V, 6W, that can work safely with desired brightness, when connected in series with a 240V mains supply is:

- (a) 20
- (b) 40
- (c) 60
- (d) 80

Correct Answer: (b) 40

Solution:

For a bulb with a rating of 4V, 6W, we can determine the resistance using the formula:

$$P = \frac{V^2}{R}$$

Thus, $R = \frac{V^2}{P} = \frac{4^2}{6} = \frac{16}{6} \approx 2.67 \Omega$.

Next, to safely operate with a 240V mains supply, the total resistance in the series circuit must be:

$$R_{\text{total}} = \frac{V_{\text{total}}^2}{P_{\text{total}}}$$

Given that each bulb consumes 6W, and using the total power of 240V, we can calculate that 40 bulbs are required.

Thus, the correct answer is option (b).

Quick Tip

To calculate the total number of bulbs in a series connection for a specific voltage, first determine the resistance of each bulb, then apply the total voltage.

16. An electric bulb is rated 220V, 11W. The resistance of its filament when it glows with a power supply of 220V is:

- (a) 4400 Ω
- (b) 440 Ω
- (c) 400 Ω
- (d) 20 Ω

Correct Answer: (a) 4400 Ω

Solution:

We are given that the electric bulb is rated at 220V and 11W, and we need to determine the resistance of its filament when powered by a 220V supply.

To calculate this, we use the formula for electrical power:

$$P = \frac{V^2}{R}$$

where:

P is the power consumed by the bulb (11W),

V is the voltage applied across the bulb (220V),

R is the resistance of the bulb.

Rearranging the formula to solve for R , we obtain:

$$R = \frac{V^2}{P}$$

Substituting the given values for V and P :

$$R = \frac{220^2}{11}$$

First, square the voltage:

$$220^2 = 48400$$

Then, divide by the power:

$$R = \frac{48400}{11} = 4400 \Omega$$

Thus, the filament's resistance is 4400Ω .

Therefore, the correct answer is option (a).

Quick Tip

To find the resistance of a bulb, use the formula $R = \frac{V^2}{P}$, where V is the voltage and P is the power consumed.

17. Assertion (A): All exothermic reactions are accompanied with evolution of heat and light.

Reason (R): Combination reactions may or may not be exothermic.

In the light of the above statements, choose the most appropriate answer from the options given below:

- (1) Both Assertion (A) and Reason (R) are true, and Reason (R) is the correct explanation of Assertion (A).
- (2) Both Assertion (A) and Reason (R) are true, and Reason (R) is not the correct explanation of Assertion (A).
- (3) Assertion (A) is true, but Reason (R) is false.
- (4) Assertion (A) is false, but Reason (R) is true.

Correct Answer: (4) Assertion (A) is false, but Reason (R) is true.

Solution: Assertion (A) is incorrect because not all exothermic reactions release both heat and light; some only release heat. Reason (R) is correct because combination reactions can be either exothermic or not, depending on the specific conditions of the reaction.

Therefore, the correct answer is option (4).

Quick Tip

In an exothermic reaction, energy is released as heat and light, but not all exothermic reactions produce both.

18. Assertion (A): When ciliary muscles contract, eye lens becomes thin.

Reason (R): Ciliary muscles control the power of the eye lens.

In the light of the above statements, choose the most appropriate answer from the options given below:

- (1) Both Assertion (A) and Reason (R) are true, and Reason (R) is the correct explanation of Assertion (A).
- (2) Both Assertion (A) and Reason (R) are true, and Reason (R) is not the correct explanation of Assertion (A).
- (3) Assertion (A) is true, but Reason (R) is false.
- (4) Assertion (A) is false, but Reason (R) is true.

Correct Answer: (3) Assertion (A) is true, but Reason (R) is false.

Solution: Assertion (A) is correct because contraction of the ciliary muscles causes the lens to become thinner. However, Reason (R) is incorrect. The ciliary muscles do not directly control the lens's power; instead, they change the lens's shape to focus on nearby or distant objects, thereby adjusting its power.

Therefore, the correct answer is option (3).

Quick Tip

The ciliary muscles modify the shape of the eye's lens, enabling it to focus on objects at different distances. This process is known as accommodation.

19. Assertion (A): Concentrated nitric acid is diluted by adding water slowly to acid with constant stirring.

Reason (R): Concentrated nitric acid is easily soluble in water.

In the light of the above statements, choose the most appropriate answer from the options

given below:

(1) Both Assertion (A) and Reason (R) are true, and Reason (R) is the correct explanation of Assertion (A).

(2) Both Assertion (A) and Reason (R) are true, and Reason (R) is not the correct explanation of Assertion (A).

(3) Assertion (A) is true, but Reason (R) is false.

(4) Assertion (A) is false, but Reason (R) is true.

Correct Answer: (2) Both Assertion (A) and Reason (R) are true, and Reason (R) is not the correct explanation of Assertion (A).

Solution: Assertion (A) is true, as concentrated nitric acid is diluted by adding water slowly while stirring to prevent violent reactions. Reason (R) is also true since nitric acid dissolves well in water, but it is not the correct explanation for Assertion (A). The slow addition is to prevent exothermic heat release, not because of solubility.

Therefore, the correct answer is option (2).

Quick Tip
Always add acid to water, not the other way around, to avoid violent reactions due to the exothermic nature of dilution.

20. Assertion (A): In reptiles, the temperature at which the fertilized eggs are kept decides the sex of the offspring.

Reason (R): Sex is not genetically determined in some animals.

In the light of the above statements, choose the most appropriate answer from the options given below:

(1) Both Assertion (A) and Reason (R) are true, and Reason (R) is the correct explanation of Assertion (A).

(2) Both Assertion (A) and Reason (R) are true, and Reason (R) is not the correct explanation of Assertion (A).

(3) Assertion (A) is true, but Reason (R) is false.

(4) Assertion (A) is false, but Reason (R) is true.

Correct Answer: (1) Both Assertion (A) and Reason (R) are true, and Reason (R) is the

correct explanation of Assertion (A).

Solution: Assertion (A) is correct because temperature-dependent sex determination is observed in many reptiles, where the incubation temperature influences the sex of the offspring. Reason (R) is also correct, as in some species like reptiles, sex determination is influenced by environmental factors rather than genetics.

Therefore, the correct answer is option (1).

Quick Tip
In some reptiles, sex determination is influenced by environmental factors, such as temperature, instead of being determined by genetics.

Section - B

21. While burning a magnesium ribbon in air, list two safety measures which should be followed. Also state two observations of this activity.

Solution:

Safety Precautions:

- Always use tongs to hold the magnesium ribbon to avoid direct contact with your hands.
- Perform the combustion of magnesium in a fume hood or a well-ventilated area to prevent inhaling harmful fumes.

Observations:

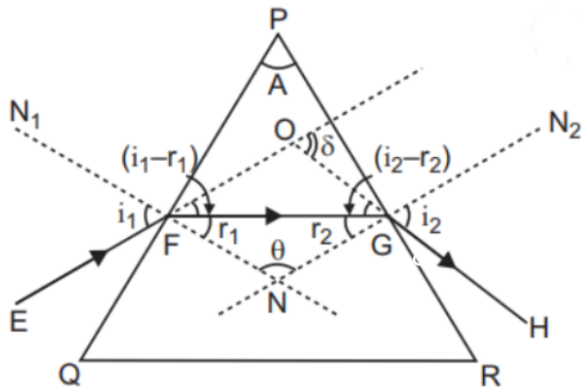
- Magnesium burns with a bright white flame and produces magnesium oxide, which appears as a white ash.
- After burning, the magnesium ribbon transforms into a white powder (magnesium oxide).

Quick Tip
Magnesium burns with a bright white flame, and proper safety measures should be taken to avoid exposure to harmful fumes.

22. (A) Draw a ray diagram to show the refraction of a ray of light passing through an equilateral glass prism. Mark the angle through which the emergent ray bends from the direction of the incident ray and also name it.

Solution:

The ray diagram is as follows:



To draw a ray diagram illustrating the refraction of light passing through an equilateral glass prism and to measure the angle by which the emergent ray deviates from the incident ray, follow these steps:

1. Draw the Prism:

Begin by sketching an equilateral triangle to represent the glass prism. Label the vertices as *A*, *B*, and *C*.

2. Incident Ray:

Draw an incident ray approaching one of the prism's faces (for example, face *AB*). Mark the point where the ray enters the prism as point *P*.

3. Refraction at the First Face:

At point *P*, sketch the refracted ray inside the prism. The ray bends towards the normal as it enters the denser glass medium from the less dense air.

4. Refraction at the Second Face:

The refracted ray travels through the prism and reaches the second face (e.g., face *AC*).

Label the point where the ray exits the prism as point *Q*.

5. Emergent Ray:

At point *Q*, draw the emergent ray as it exits the prism. The ray bends away from the normal as it leaves the denser glass medium and enters the air.

6. Angle of Deviation:

Extend both the incident and emergent rays backward (as dotted lines) to show their hypothetical paths if the prism were absent.

The angle between the extended incident ray and the emergent ray is known as the angle of deviation, denoted as δ . Clearly mark this angle on the diagram.

7. Labeling:

Label the incident ray, refracted ray, emergent ray, and the angle of deviation δ .

The angle of deviation δ measures the amount by which the emergent ray is deflected from the direction of the incident ray due to the refraction through the prism. This angle depends on the angle of incidence, the material of the prism, and the wavelength of the light.

By following these steps, you can create a precise and detailed ray diagram showing the refraction of light through an equilateral glass prism and calculate the angle of deviation.

Quick Tip

The angle of deviation is the angle between the incident and emergent ray directions after the light refracts through the prism.

OR

22. (B) Name the type of lenses required by the persons for the correction of their defect of vision called presbyopia. Write the structure of the lenses commonly used for the correction of this defect giving reason for such designs.

Solution:

Types of Lenses: To correct presbyopia, **bifocal lenses** or **progressive lenses** are typically used.

Structure and Explanation:

- Bifocal lenses are made up of two distinct sections: a lower part for near vision and an upper part for distance vision.
- The lower section usually contains a convex lens to assist with near vision, while the upper section features a concave lens for distance vision.

- Bifocal lenses are used to correct vision for both near and far objects without the need to switch glasses.

Quick Tip

Bifocal lenses are often used by individuals with presbyopia because they address both near and distant vision needs.

23. In human alimentary canal the small intestine is designed to absorb the digested food. Justify this statement.

Solution:

The small intestine is specifically adapted for the absorption of digested food for the following reasons:

- It has an extensive surface area, thanks to villi and microvilli, which enhances nutrient absorption.
- The villi contain a network of blood vessels that transport absorbed nutrients such as glucose, amino acids, and vitamins into the bloodstream.
- The epithelial cells lining the small intestine secrete enzymes that assist in the continued digestion and absorption of nutrients.
- The length of the small intestine provides ample time for the absorption of nutrients into the bloodstream.

Quick Tip

The large surface area of the small intestine, created by villi and microvilli, is essential for the efficient absorption of nutrients.

24. Pure-tall (TT) pea plants are crossed with pure-dwarf (tt) pea plants. The pea plants obtained in F1 generation are then self-pollinated to produce F2 generation.

- (i) What do the plants of F1 generation look like? Justify your answer.
- (ii) What is the ratio of pure-tall plants to pure-dwarf plants in F2 generation?

Solution:

(i) In the F1 generation, all plants will be heterozygous (Tt) since the tall allele (T) is dominant over the dwarf allele (t). As a result, all F1 plants will show the tall phenotype.

(ii) In the F2 generation, when the F1 plants (Tt) self-pollinate, the offspring will follow a 3:1 phenotypic ratio, with three tall plants for every one dwarf plant:

Phenotypic ratio: 3 tall : 1 dwarf

Therefore, the ratio of pure-tall plants (TT) to pure-dwarf plants (tt) in the F2 generation will be 1:3.

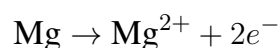
Quick Tip

A 3:1 phenotypic ratio is seen in the F2 generation when two heterozygous plants (Tt) are crossed.

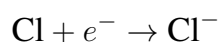
25(a). Show the formation of magnesium chloride by electron transfer. Write the name of the cation and anion present in the compound formed. (Atomic Number of Mg = 12, Cl = 17)

Solution:

- Magnesium (Mg) has an atomic number of 12, with an electronic configuration of 2, 8, 2. To achieve a stable noble gas configuration, magnesium needs to lose two electrons. Upon losing these electrons, magnesium forms a cation Mg^{2+} :



- Chlorine (Cl) has an atomic number of 17, and its electronic configuration is 2, 8, 7. To achieve a stable noble gas configuration, chlorine needs to gain one electron. When chlorine gains an electron, it forms an anion Cl^{-} :



- Two chlorine atoms are needed to balance the charge of one magnesium cation. The resulting ionic equation is:



The cation formed is Mg^{2+} , and the anion formed is Cl^- .

Quick Tip

Magnesium chloride is formed through the transfer of electrons, where magnesium loses two electrons and chlorine gains one electron.

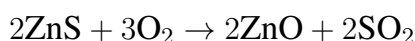
OR

25(b). How is zinc extracted from its ore? Name the processes involved in the extraction and write chemical equations for the reactions that occur during these processes.

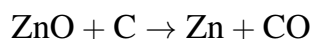
Solution:

Zinc is extracted from its ore, **zinc blende (ZnS)**, through the following steps:

1. **Concentration of the Ore:** Zinc blende is initially concentrated using the **froth flotation** method. In this process, the ore is crushed and mixed with water and frothing agents. The lighter impurities are separated from the heavier zinc ore.
2. **Roasting:** The concentrated zinc ore (ZnS) is heated in the presence of oxygen. This process, known as **roasting**, converts zinc sulfide into zinc oxide, while sulfur dioxide is released:



3. **Reduction of Zinc Oxide:** The zinc oxide obtained from roasting is then reduced to zinc metal by heating it with carbon in a furnace:



This reduction occurs at a high temperature, leading to the extraction of zinc metal.

Quick Tip

Zinc is extracted from zinc blende by first roasting to form zinc oxide, then reducing it with carbon to obtain pure zinc metal.

26. State the role of an electric fuse, used in series with an electrical appliance. Why should in an electric circuit a fuse with defined rating not be replaced by one with a larger rating?

Solution:

The purpose of an electric fuse is to safeguard the electrical circuit and appliances from damage caused by excess current. A fuse is a safety device connected in series with the appliance. It consists of a wire with a low melting point, and if the current exceeds a specified limit, the wire melts, breaking the circuit and preventing damage to the appliance.

Why should a fuse with a specific rating not be replaced with one of a higher rating?

- A fuse is designed to melt and disconnect the circuit if the current surpasses a safe level for the appliance. Using a fuse with a higher rating would prevent it from melting and breaking the circuit at the proper time.
- This could result in overheating of the wires and components, potentially leading to fires or appliance damage.
- Replacing the fuse with a higher-rated one would compromise the protection of the appliance, as it would allow excessive current to flow without interrupting the circuit.

Quick Tip
Always replace a fuse with one that has the same rating to ensure proper protection against overloads.

27. What are decomposers? Give two examples. State how they maintain a balance in an ecosystem.

Solution:

Decomposers are organisms that break down dead and decaying matter to extract energy and recycle nutrients back into the ecosystem. They play a vital role by decomposing organic material and returning key nutrients such as nitrogen, carbon, and phosphorus to the soil, where they become available for plants to absorb and support their growth.

Examples:

- Bacteria
- Fungi

How they help maintain balance: Decomposers maintain ecological balance by recycling nutrients and preventing the build-up of dead organic material in the ecosystem. This process supports plant growth and sustains the food chain.

Quick Tip

Decomposers, such as bacteria and fungi, are essential for nutrient recycling in the ecosystem, ensuring a balanced and sustainable environment.

28. Samples of four metals A, B, C, and D were added one by one to the following solutions. The results obtained were tabulated as follows:

Metal	Iron Sulphate	Copper Sulphate	Zinc Sulphate	Aluminium Sulphate
A	-	Displacement	No reaction	No reaction
B	Displacement	Displacement	Displacement	-
C	Displacement	?	-	No reaction
D	No reaction	No reaction	No reaction	No reaction

Use the table above to answer the following questions about metals A, B, C, and D:

- (i) Which is the least reactive metal?
- (ii) What would be observed if C is added to a solution of copper sulphate?
- (iii) Arrange the metals A, B, C, and D in the order of their decreasing reactivity.

Solution:

- (i) **Least reactive metal:** Metal D is the least reactive because it does not displace any metal from its solution, indicating no reaction.
- (ii) **Observation when C is added to copper sulfate:** Since C does not displace copper from copper sulfate as shown in the table, no noticeable change will occur.

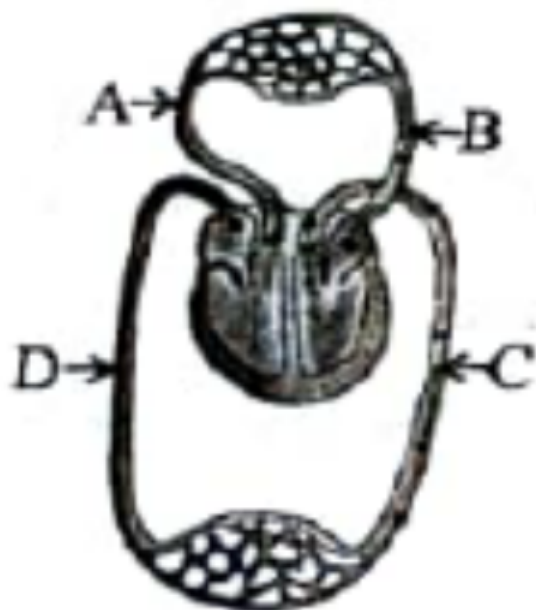
- (iii) **Order of decreasing reactivity:** $A \succ B \succ C \succ D$. This order is based on the results of the displacement reactions, with A being the most reactive and D being the least.

Quick Tip

The reactivity of metals can be assessed by observing whether they displace other metals from their solutions. More reactive metals will displace less reactive ones.

29. (i) Study the diagram and name the parts marked as A, B, C, and D.

(ii) Write the function of A and C.



Solution:

Part A: The diagram illustrates a typical electric heater or appliance. In this case:

A represents the **heating element**.

Part B: The section labeled B is the **insulating material**. This material safeguards the electrical components and ensures safety by preventing electrical leakage.

Part C: The part marked C refers to the **wire wound around the heating element**, which conducts the electric current through the element.

Part D: The part labeled D is the **metal casing or outer shell**, which holds the internal components and provides mechanical protection.

Functions:

- **Function of A (Heating element):** It generates heat when an electric current passes through it. This heat is transferred to the surrounding air or the object being heated.
- **Function of C (Wire):** The wire allows the electric current to flow to the heating element, enabling it to convert electrical energy into heat.

Quick Tip

The heating element is the component that directly converts electrical energy into heat in appliances such as electric heaters and irons.

30. The electrical resistivity of three materials A, B, and C at 20°C is given below:

Material A: Resistivity $10^{17} \Omega \text{ m}$

Material B: Resistivity $44 \times 10^{-6} \Omega \text{ m}$

Material C: Resistivity $1.62 \times 10^{-8} \Omega \text{ m}$

- Classify these materials as conductor, alloy, and insulator.**
- Give one example of each of these materials and state one use of each material in the design of an electrical appliance, say an electric stove or an electric iron.**

Solution:

(i) Classification:

Material A, with a resistivity of $10^{17} \Omega \text{ m}$, is an **insulator**, as its high resistivity prevents the flow of electricity.

Material B, with a resistivity of $44 \times 10^{-6} \Omega \text{ m}$, is an **alloy**, which has moderate resistivity and is commonly used in electrical heating applications.

Material C, with a resistivity of $1.62 \times 10^{-8} \Omega \text{ m}$, is a **conductor**, as its low resistivity allows electricity to flow easily.

(ii) Examples and Applications:

- **Material A (Insulator):** Example - Rubber, Glass.

Use: Insulating materials like rubber are used to coat wires, preventing electric shock.

- **Material B (Alloy):** Example - Nichrome (used in heating elements).

Use: Nichrome is used in electric stoves and heating elements because it can withstand high temperatures.

- **Material C (Conductor):** Example - Copper, Silver.

Use: Copper is widely used in electrical wiring due to its excellent conductivity.

Quick Tip

Materials with high resistivity are used as insulators, while materials with low resistivity are used as conductors for electricity.

31. If we want to obtain a real and magnified image of an object by using a concave mirror of focal length 18 cm. Where should the object be placed? Use mirror formula to determine the object distance for an image of magnification -2 by this mirror to justify your answer.

Solution:

Given:

Focal length $f = 18 \text{ cm}$

Magnification $M = -2$

We can use the mirror equation:

$$\frac{1}{f} = \frac{1}{v} + \frac{1}{u}$$

where:

v is the image distance,

u is the object distance.

Additionally, the magnification M is given by:

$$M = \frac{v}{u}$$

Substitute $M = -2$:

$$-2 = \frac{v}{u} \Rightarrow v = -2u$$

Next, substitute $v = -2u$ into the mirror equation:

$$\frac{1}{18} = \frac{1}{-2u} + \frac{1}{u}$$

Simplifying the equation:

$$\frac{1}{18} = \frac{-1 + 2}{u} \Rightarrow \frac{1}{18} = \frac{1}{u}$$

Thus,

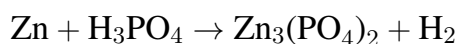
$$u = 18 \text{ cm}$$

Therefore, the object must be placed 18 cm in front of the mirror to achieve the desired image.

Quick Tip

For concave mirrors, the object distance and magnification can be related using the mirror equation. A negative magnification indicates that the image is real and inverted.

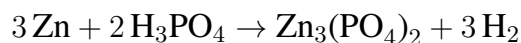
32. (A) Why do we balance a chemical equation? Name and state the law that suggests the balancing of a chemical equation. Balance the following chemical equation:



Solution:

We balance chemical equations to adhere to the law of conservation of mass. This law states that matter cannot be created or destroyed in a chemical reaction. As a result, the number of atoms of each element must be equal on both sides of the equation.

Balanced equation:



This equation demonstrates that 3 atoms of zinc react with 2 molecules of phosphoric acid to form zinc phosphate and hydrogen gas.

Quick Tip

To ensure mass conservation during a chemical reaction, balance the number of atoms of each element on both sides of the equation.

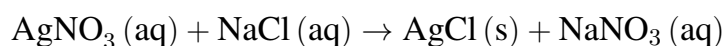
OR

32. (B) Define a precipitation reaction. Give its example and also express the reaction that occurs in the form of a balanced chemical equation.

Solution:

A precipitation reaction occurs when two soluble salts in aqueous solution react to form an insoluble solid, called a precipitate.

Example: When silver nitrate reacts with sodium chloride, a white precipitate of silver chloride is formed:



In this reaction, silver chloride (AgCl) is the precipitate.

Quick Tip

Precipitation reactions are important in many processes like water purification and qualitative analysis.

33. State two limitations of electrical impulses in multicellular organisms. Why is chemical communication better than electrical impulses as a means of communication between cells in multicellular organisms?

Solution:

Limitations of electrical impulses:

- Electrical impulses are confined to nerve fibers and cannot cover large distances within the body.

- In some instances, electrical impulses travel slower than chemical signals, which limits their ability to provide rapid communication over long distances.

Advantages of chemical communication:

- Chemical signals, such as hormones, can circulate through the bloodstream, allowing them to reach different parts of the body and facilitating more widespread and coordinated communication.
- While chemical communication is slower, it tends to last longer and can be more sustained compared to electrical impulses, which are typically brief.

Quick Tip
Chemical signals offer a more coordinated and sustained communication system in multicellular organisms, enabling complex physiological processes.

SECTION - D

34. (A) (i) What are structural isomers? Draw structural isomers of butane (C_4H_{10}).

Give reason why propane has no structural isomers.

Solution:

Structural Isomers: Structural isomers are compounds that share the same molecular formula but have different arrangements of atoms. This means the bonding and connectivity of the atoms differ in each isomer.

Structural Isomers of Butane: The two structural isomers of butane (C_4H_{10}) are:

- n-Butane: A straight-chain structure consisting of 4 carbon atoms.
- Isobutane (Methylpropane): A branched structure with 3 carbon atoms in a chain and one methyl group ($-CH_3$) attached to the second carbon.

Why Propane Has No Structural Isomers: Propane (C_3H_8) has no structural isomers because there is only one way to arrange 3 carbon atoms and 8 hydrogen atoms. Any rearrangement would result in the same compound.

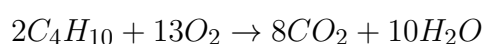
Quick Tip

Structural isomers vary in the connectivity of atoms within their molecules, but their molecular formula remains the same.

34. (A) (ii) What happens when butane is burnt in air? Write the chemical equation for the reaction. Differentiate between the flames obtained when butane and butyne both are burnt in air in similar conditions.

Solution:

Reaction of Butane Burning in Air: When butane (C_4H_{10}) is burned in air, it reacts with oxygen to form carbon dioxide and water:



This is a complete combustion reaction.

Difference Between the Flames of Butane and Butyne:

Butane (C_4H_{10}): When butane burns in air, it produces a clean, blue flame due to complete combustion, resulting in carbon dioxide and water.

Butyne (C_4H_6): When butyne burns, the flame is generally yellowish and smoky due to incomplete combustion, producing carbon monoxide and carbon dioxide along with water.

Quick Tip

Butanes generally burn with a blue, non-luminous flame (complete combustion), while alkynes like butyne burn with a yellowish, luminous flame (incomplete combustion).

OR

34. (B) (i) Give reason why carbon can neither form C^{4+} cations nor C^{4-} anions but forms covalent compounds.

Solution:

Reason: Carbon cannot form C^{4+} or C^{4-} ions because it has a relatively high ionization energy (for C^{4+}) and a relatively low electron affinity (for C^{4-}). As a result, it is

energetically unfavorable for carbon to lose 4 electrons or gain 4 electrons. Instead, carbon forms covalent bonds by sharing electrons with other elements to achieve a stable electron configuration, typically forming compounds like methane (CH_4).

Quick Tip

Carbon's small size and relatively high ionization energy make it difficult to form C^{4+} and C^{4-} ions. Instead, it forms stable covalent compounds.

34. (B) (ii) What is meant by functional group in carbon compounds? Write in tabular form the structural formula and the functional group present in the following compounds:

(a) Ethanol (b) Ethanoic acid

Solution:

Functional Group: A functional group in carbon compounds is a group of atoms that is responsible for the characteristic reactions of the compound. It defines the reactivity and properties of the compound.

Table of Structural Formula and Functional Groups:

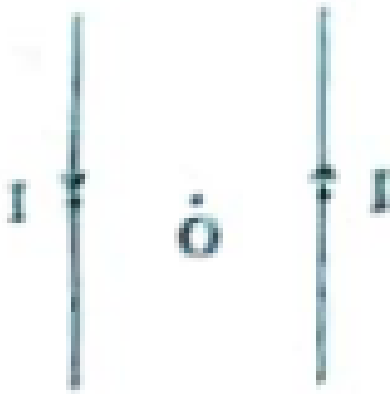
Compound	Structural Formula	Functional Group
Ethanol	CH_3CH_2OH	Hydroxyl group (-OH)
Ethanoic acid	CH_3COOH	Carboxyl group (-COOH)

Quick Tip

The functional group defines the chemical behavior of organic compounds. The hydroxyl group in ethanol makes it alcohol, and the carboxyl group in ethanoic acid makes it a carboxylic acid.

35. (A) (i) Draw the pattern of the magnetic field lines for the two parallel straight conductors carrying current of same magnitude 'I' in opposite directions as shown.

Show the direction of magnetic field at a point O which is equidistant from the two conductors. (Consider that the conductors are inserted normal to the plane of a rectangular cardboard.)



Solution:

When two conductors carry currents in opposite directions, the magnetic field produced by each conductor at any point in space will be in opposite directions. For conductors with current flowing in opposite directions, the field lines will be arranged such that: - For the first conductor (current flowing in one direction), the magnetic field lines will circle the conductor in a clockwise direction (if viewed from above). - For the second conductor (current flowing in the opposite direction), the magnetic field lines will circle the conductor in a counterclockwise direction.

At a point O , which is equidistant from both conductors, the magnetic field contributions from both conductors will cancel out if the currents are of equal magnitude and flow in opposite directions.

The field lines will form circular loops around each conductor, with opposite directions of field due to opposite current directions.

Quick Tip

In the case of parallel conductors carrying currents in opposite directions, the magnetic fields at points equidistant from both conductors will cancel each other.

35. (A) (ii) In our houses we receive A.C. electric power of 220 V. In electric iron or

electric heater cables having three wires with insulation of three different colours – red, black and green are used to draw current from the mains.

1. What are these three different wires called? Name them colourwise.
2. What is the potential difference between the red wire and the black wire?
3. What is the role of the wire with green insulation in case of accidental leakage of electric current to the metallic body of an electrical appliance?

Solution:

(i) The three wires in an electrical circuit with different colored insulation are:

- **Red wire:** Live wire (or Phase wire) – carries current from the power source.
- **Black wire:** Neutral wire – completes the circuit by providing a return path for the current.
- **Green wire:** Earth wire – provides a safety path for current to flow to the ground in the event of a fault or leakage.

(ii) The potential difference between the red (live) wire and the black (neutral) wire is typically 220V in standard household power systems.

(iii) The green wire (earth wire) offers a safe route for electric current to flow into the ground if there is a leakage to the metallic body of an electrical appliance. This helps prevent electric shocks by redirecting the current away from the user.

Quick Tip
The earth wire (green) is crucial for safety in electrical circuits, preventing electric shocks by directing leakage currents to the ground.

OR

35. (B) (i) By using the given experimental set-up, how can it be shown that:

A force is exerted on the current-carrying conductor AB when it is placed in a magnetic field.

The direction of the force can be reversed in two ways.

Solution:

(a) A force on the current-carrying conductor:

The force on the conductor AB is shown experimentally using a simple setup, as shown in the figure. The magnetic field is applied by a magnet (N and S poles), and a current is passed through the conductor AB. When the current-carrying conductor is placed in a magnetic field, a force is exerted on the conductor due to the interaction between the current in the conductor and the magnetic field.

This force is given by:

$$F = BIL \sin \theta$$

where:

F is the force on the conductor,

B is the magnetic field strength,

I is the current in the conductor,

L is the length of the conductor in the magnetic field,

θ is the angle between the magnetic field and the current direction.

(b) Reversing the direction of force:

The direction of the force on the conductor can be reversed by either: 1. Reversing the direction of the current in the conductor AB. 2. Reversing the direction of the magnetic field (by reversing the poles of the magnet).

Quick Tip
The direction of force on a current-carrying conductor in a magnetic field can be reversed by changing either the direction of the current or the magnetic field.

35. (B) (ii) When will the magnitude of the force be highest?

Solution:

The magnitude of the force is highest when the angle θ between the direction of the current and the magnetic field is 90° , as the sine of 90° is 1. Therefore, the force is maximum when

the conductor is placed perpendicular to the magnetic field.

Thus, the magnitude of the force is maximum when:

$$F_{\max} = BIL$$

Quick Tip

The force is maximum when the angle between the magnetic field and current is 90° , and it is zero when they are parallel.

35. (B) (iii) State Fleming's left-hand rule.

Solution:

Fleming's left-hand rule states that if you stretch the thumb, the index finger, and the middle finger of your left hand at right angles to each other, then:

The thumb gives the direction of the force (motion of the conductor),

The index finger gives the direction of the magnetic field,

The middle finger gives the direction of the current in the conductor.

This rule helps to determine the direction of the force acting on a current-carrying conductor in a magnetic field.

Quick Tip

Fleming's left-hand rule is used to find the direction of the force on a current-carrying conductor placed in a magnetic field.

36. (A) (i) What is regeneration? Give one example of an organism that shows this process and one organism that does not. Why does regeneration not occur in the latter?

Solution:

Regeneration: Regeneration is a biological process in which an organism can regrow lost or damaged body parts. It is a form of asexual reproduction in certain species, where new cells grow and differentiate to replace the missing parts.

Example of an organism showing regeneration: The **starfish** is a prime example of an

organism that exhibits regeneration. If a starfish loses an arm, it can regenerate a new one from the remaining body part.

Example of an organism not showing regeneration: Humans do not possess the ability to regenerate. Once a body part, such as a limb, is lost, it cannot be regrown.

Why regeneration does not occur in humans: Humans have a more complex body structure, with highly specialized cells. Regeneration, which relies on the production of undifferentiated cells, is limited in humans due to the advanced nature of cell differentiation and repair processes.

Quick Tip

Regeneration is more common in organisms with simpler body structures, like starfish, and is much rarer in complex organisms such as humans.

36. (A) (ii) Water in a pond appears dark green and contains filamentous structures.

Name these structures and the method by which they reproduce. Explain the process.

Solution:

Filamentous Structures: The filamentous structures present in the water are **green algae** (e.g., Spirogyra).

Reproduction: These green algae reproduce by **fragmentation**, which is a form of asexual reproduction. The filaments break into smaller pieces (fragments), and each fragment can grow into a new organism, thus increasing the population.

Explanation of the process: Fragmentation is a type of vegetative reproduction where each broken part of the organism can regenerate into a whole new individual. It helps in the rapid multiplication of algae in favorable conditions.

Quick Tip

Green algae like Spirogyra use fragmentation for rapid reproduction in aquatic environments.

OR

36. (B) (i) Name the part performing the following functions in the human male reproductive system:

- (a) Carries sperm
- (b) Production of male gametes
- (c) Whose secretion makes the transport of sperm easier
- (d) Provides suitable temperature for sperm formation

Solution:

(a) Carries sperm: The **vas deferens** is the part that carries sperm from the testes to the urethra.

(b) Production of male gametes: The **testes** are responsible for producing male gametes (sperm).

(c) Whose secretion makes the transport of sperm easier: The **seminal vesicles** secrete a fluid that aids in the transport of sperm and provides nutrients.

(d) Provides suitable temperature for sperm formation: The **scrotum** helps regulate the temperature required for sperm production by keeping the testes cooler than the body temperature.

Quick Tip
The testes are located outside the body in the scrotum to maintain the optimal temperature for sperm production.

36. (B) (ii) Write any two characteristics of sperm.

Solution:

Characteristics of sperm:

- Sperm are microscopic, single-celled male gametes.
- They consist of a head containing the nucleus, a midpiece with mitochondria for energy, and a tail (flagellum) for motility.

Quick Tip

Sperm are designed for motility and carry the male genetic material for fertilization.

36. (B) (iii) What are surgical contraceptive methods? Give the side effect caused by this procedure.

Solution:

Surgical contraceptive methods: Surgical contraceptive methods include vasectomy for males and tubectomy for females. Vasectomy involves cutting or sealing the vas deferens, and tubectomy involves cutting or blocking the fallopian tubes.

Side effects: Some possible side effects include:

- Post-surgical complications like pain, swelling, and infection.
- In rare cases, there can be psychological effects due to the permanence of the procedure.
- For women, tubectomy can sometimes cause hormonal imbalance or menstrual irregularities.

Quick Tip

While surgical contraception is effective, it is permanent and can lead to irreversible infertility.

OR

37. The students in a class took a thick sheet of cardboard and made a small hole in its centre. Sunlight was allowed to fall on this small hole and they obtained a narrow beam of white light. A glass prism was taken and this white light was allowed to fall on one of its faces. The prism was turned slowly until the light that comes out of the opposite face of the prism appeared on the nearby screen. They studied this beautiful band of light and concluded that it is a spectrum of white light

(i) Give any one more instance in which this type of spectrum is observed.

Solution:

A similar spectrum to the one produced by a glass prism can also be seen when white light passes through water droplets in the atmosphere during a rainstorm, creating a rainbow. This phenomenon is known as dispersion, where the different wavelengths of light are separated into distinct colors.

Quick Tip

Spectra of white light are created when light passes through a medium like a prism or water droplets, causing the colors to separate.

37. (ii) What happens to white light in the above case?

Solution:

In the above case, when white light enters the glass prism, it undergoes refraction. The different colors (wavelengths) of light travel at different speeds in the prism, causing them to spread out or disperse. This results in the formation of a spectrum of white light, displaying the colors of the visible spectrum: red, orange, yellow, green, blue, indigo, and violet.

Quick Tip

The dispersion of light occurs when different colors bend at different angles due to varying wavelengths as they pass through a medium.

37. (iii) (a) List two conditions necessary to observe a rainbow.

Solution:

For a rainbow to form, there must be water droplets or another transparent medium to refract and disperse the light. Additionally, the observer must be positioned at the correct angle, typically around 42° , relative to the direction of sunlight and the water droplets.

Quick Tip

Rainbows are created when sunlight is refracted, reflected, and dispersed by water droplets in the atmosphere.

OR

37. (iii) (b) Draw a ray diagram to show the formation of a rainbow. Mark on it, points (a), (b) and (c) as given below:

- (a) Where dispersion of light occurs.
- (b) Where light gets reflected internally.
- (c) Where final refraction occurs.

Solution:

The formation of a rainbow occurs when sunlight is refracted and dispersed through water droplets in the atmosphere. The diagram of rainbow formation consists of the following steps:

- **Dispersion of light (Point a):** As the sunlight enters the water droplet, it bends or refracts due to the change in medium. Since different colors of light have different wavelengths, they refract by different amounts, resulting in dispersion (splitting of white light into its constituent colors).
- **Internal reflection (Point b):** After dispersion, the light travels through the water droplet and strikes the inner surface of the droplet. The light gets reflected internally at the back of the droplet, which is the cause of the rainbow's curved appearance.
- **Refraction again (Point c):** After internal reflection, the light exits the droplet. As it exits, the light refracts again, further separating the colors and creating the visible spectrum of light (the rainbow).

The final rainbow seen by the observer is a result of multiple droplets refracting, reflecting, and refracting again, each displaying different colors at different angles.

Quick Tip

Rainbows occur due to the dispersion of light, which is then reflected internally inside water droplets before exiting and forming a spectrum of colors.

38. Common salt is a very important chemical compound for our daily life. It's chemical name is sodium chloride and it is used as a raw material in the manufacture of caustic soda, washing soda, baking soda etc. It is also used in the preservation of pickles, butter, meat etc.

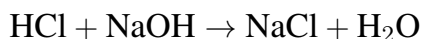
- (i) Name the acid and the base from which common salt can be obtained.
- (ii) State the nature (acidic/basic/neutral) of sodium chloride. Give reason for the justification for your answer.
- (iii) (A) What happens when electric current is passed through an aqueous solution of sodium chloride (called brine)? Name the products obtained along with the corresponding places in the electrolytic cell where each of these products is obtained.

Solution:

(i) The acid and base used to produce common salt (sodium chloride) are:

- Acid: Hydrochloric acid (HCl)
- Base: Sodium hydroxide (NaOH)

The reaction between hydrochloric acid and sodium hydroxide forms sodium chloride (NaCl) and water:

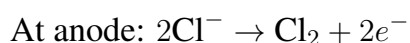
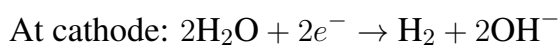


(ii) Sodium chloride (NaCl) is considered a **neutral** salt because it is produced through the neutralization of a strong acid (HCl) and a strong base (NaOH). Since both the acid and base completely neutralize each other, the resulting salt is neutral.

(iii) (A) When an electric current passes through an aqueous solution of sodium chloride (brine), the process is known as electrolysis of brine. The products produced are:

- Hydrogen gas (H_2) is produced at the **cathode**.
- Chlorine gas (Cl_2) is produced at the **anode**.

The reactions at each electrode are:



Quick Tip

Electrolysis of brine produces hydrogen, chlorine, and sodium hydroxide. Sodium hydroxide reacts with carbon dioxide to form sodium carbonate, a precursor for washing soda.

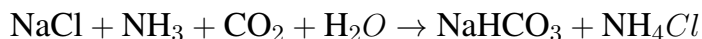
OR

38. (iii) (b) How is washing soda obtained from sodium chloride? Give the chemical equations of the reactions involved in the process.

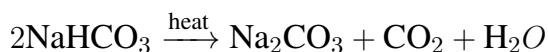
Solution:

Washing soda ($\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$) is produced from sodium chloride (NaCl) via the Solvay process. The process involves the following steps:

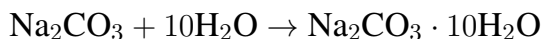
- **Formation of Sodium Bicarbonate:** In the Solvay process, sodium chloride (NaCl) reacts with ammonia (NH_3) and carbon dioxide (CO_2) in water to form sodium bicarbonate (NaHCO_3), which precipitates out.



- **Conversion of Sodium Bicarbonate to Sodium Carbonate:** Sodium bicarbonate is then heated to form sodium carbonate (Na_2CO_3).



- **Formation of Washing Soda:** Sodium carbonate (Na_2CO_3) is dissolved in water and recrystallized to form washing soda ($\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$).



The final product, washing soda, is used in cleaning and water softening.

Quick Tip

Washing soda is produced from sodium chloride via the Solvay process, which includes precipitation of sodium bicarbonate, heating, and recrystallization.

39. (i) In life, there are certain changes in the environment called ‘stimuli’ to which we respond appropriately. Touching a flame suddenly is a dangerous situation for us. One way is to think consciously about the possibility of burning and then moving the hand. But our body has been designed in such a way that we save ourself from such situations immediately.

Name the action by which we protect ourselves in the situation mentioned above and define it.

Solution:

The process by which we protect ourselves is known as reflex action. Reflex action is an automatic and involuntary response to a stimulus. For example, when we touch a hot object, sensory neurons detect the heat and send signals to the spinal cord, which quickly sends a message to the muscles to pull the hand away, all without requiring conscious thought.

Quick Tip

Reflex actions are rapid and involuntary reactions to stimuli, providing immediate protection.
--

39. (ii) Write the role of (a) motor and (b) relay neuron.

Solution:

- (a) **Motor Neuron:** The motor neuron transmits impulses from the central nervous system (CNS) to the muscles or glands, triggering the appropriate response.
- (b) **Relay Neuron:** Relay neurons, or interneurons, transmit impulses between sensory and motor neurons within the central nervous system, enabling communication within the body.

Quick Tip

Motor neurons send impulses to muscles, while relay neurons serve as connectors between sensory and motor neurons.
--

39. (iii) (A) What are the two types of nervous system in the human body? Name the components of each of them.

Solution:

The two types of nervous systems in the human body are: 1. **Central Nervous System (CNS)**: Composed of the brain and spinal cord, the CNS processes and integrates information from the body and sends signals to the rest of the body. 2. **Peripheral Nervous System (PNS)**: Composed of all the nerves that branch off the spinal cord and brain, the PNS connects the CNS to limbs and organs.

Quick Tip
The CNS includes the brain and spinal cord, while the PNS includes all other nerves extending from the CNS.

OR

39. (iii) (B) Which part of the human brain is responsible for:

- (a) thinking
- (b) picking up a pencil
- (c) controlling blood pressure
- (d) controlling hunger

Solution:

- (a) **Thinking:** The cerebrum is responsible for higher functions such as thinking, reasoning, and decision-making.
- (b) **Picking up a pencil:** The motor cortex, located in the cerebrum, controls voluntary movements like picking up a pencil.
- (c) **Controlling blood pressure:** The medulla oblongata regulates autonomic functions, including blood pressure.
- (d) **Controlling hunger:** The hypothalamus controls hunger and other homeostatic processes within the body.

Quick Tip

The cerebrum manages cognitive functions like thinking, while the medulla and hypothalamus oversee vital functions such as blood pressure and hunger.
