CBSE Class 10th

Science

Question Paper and Answer Key 2025 with Detailed Solution

OBJECTIVE

Q1. In which one of the following situations a chemical reaction does not occur?

(a) Milk is left open at room temperature during summer

(b) Grapes get fermented

(c) An iron nail is left exposed to humid atmosphere

(d) Melting of glaciers

Ans.

Explanation:
A chemical reaction involves the formation of new substances with different properties. Let's analyze each option:
- (a) Milk is left open at room temperature during summer → A chemical reaction occurs because the milk undergoes spoiling due to bacterial action.
- (b) Grapes get fermented → A chemical reaction occurs as sugars in grapes convert into alcohol due to fermentation.
- (c) An iron nail is left exposed to a humid atmosphere → A chemical reaction occurs as iron reacts with oxygen and moisture to form rust (iron oxide).

- (d) Melting of glaciers → No chemical reaction occurs because melting is a physical change, where water changes from solid to liquid without forming a new substance.

Thus, melting of glaciers is a physical change, not a chemical reaction.

Hence, the answer is the option (d).

Q2. In order to prepare dry hydrogen chloride gas in 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

Ans.

Explanation:
To prepare dry hydrogen chloride (HCl) gas in a humid atmosphere, the gas must be passed through a drying agent that absorbs moisture. Let's analyze the options:
- (a) Calcium chloride ($CaCl_2$) → A strong hygroscopic substance (absorbs water) and is commonly used as a drying agent. ✓ Correct Answer
- (b) Calcium oxide (CaO) → Also absorbs moisture but reacts with acidic gases like HCl, forming calcium hydroxide.
- (c) Calcium hydroxide ($Ca(OH)_2$) → A base that would react with HCl, neutralizing it and forming calcium chloride and water.
- (d) Calcium carbonate ($CaCO_3$) → Reacts with HCl_r producing carbon dioxide (CO_2) and water, making it unsuitable for drying HCl gas.

Thus, anhydrous calcium chloride ($CaCl_2$) is the best choice for removing moisture without reacting with HCl gas.

Hence, the answer is the option (a).

Q3. 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

Ans.

Explanation:
- Ductility is the property of a material that allows it to be drawn into thin wires without breaking. Metals like gold, silver, and copper are highly ductile. Correct Answer
- Malleability refers to the ability of a material to be hammered or rolled into thin sheets without breaking (e.g., gold, aluminum).
- Rigidity refers to the resistance of a material to deformation under applied force. A highly rigid material does not easily bend or stretch.
- Resistivity is the measure of how strongly a material opposes the flow of electric current. It is related to electrical properties, not mechanical properties.

Thus, the correct answer is ductility.

Hence, the answer is the option (b).

Q4. Select from the following a hydrocarbon having one $C - C$ bond and one $C = C$ bond :
(a) Benzene
(b) Cyclohexane
(c) Butyne
(d) Propyne

Ans.

Explanation:
We need to identify a hydrocarbon that contains:
- One C-C single bond
- One C≡C triple bond

Let's analyze each option:
1. (a) Benzene $(C_6H_6) \rightarrow$ Contains an aromatic ring with alternating single and double bonds, but no $C \equiv C$ triple bond.
2. (b) Cyclohexane $(C_6H_{12}) \rightarrow$ A fully saturated cyclic compound with only $C - C$ single bonds, no $C \equiv C$ triple bond.
3. (c) Butyne $(C_4H_6) \rightarrow$ There are two isomers:
- 1-Butyne $(CH \equiv C - CH_2 - CH_3) \rightarrow$ Has one $C \equiv C$ triple bond and a $C - C$ single bond
- 2-Butyne $(CH_3 - C \equiv C - CH_3) \rightarrow$ Only has a triple bond between two central carbons, no clear CC single bond separately.
- Since the isomer is not specified, we need a more certain choice.
4. (d) Propyne $(C_3H_4, CH \equiv C - CH_3) \rightarrow$ Clearly has:
- One CEC triple bond between the first two carbon atoms
- One C-C single bond between the second and third carbon atoms
Correct Answer

Hence, the answer is the option (d).

Q5. The essential element taken up from the soil by the plants to synthesize proteins is :
(a) Phosphorus
(b) Nitrogen
(c) Iron
(d) Magnesium

Ans.

Explanation:
- Nitrogen (N) is an essential nutrient required for plants to synthesize proteins because it is a major component of amino acids, which are the building blocks of proteins.
- Plants absorb nitrogen from the soil primarily in the form of nitrate (NO_3^-) or ammonium (NH_4^+) ions.
- Nitrogen is also a key component of chlorophyll, nucleic acids (DNA, RNA), and enzymes, making it crucial for plant growth.

Why not the other options?
- (a) Phosphorus (P): Important for ATP, DNA, and RNA synthesis, but not directly for protein formation.
- (c) Iron (Fe): Essential for chlorophyll synthesis and enzyme activation, but not a primary component of proteins.
- (d) Magnesium (Mg): A key component of chlorophyll and enzyme activation, but does not directly contribute to protein synthesis.

Hence, the answer is the option (b).

Q6. 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 :
(a) A and B
(b) B and D
(c) A and C
(d) C and D

Ans.

Explanation:
1. (A) Lymph vessels carry lymph through the body and finally open into larger arteries. X False
- Lymph vessels do not open into arteries. Instead, they drain into veins (specifically, the subclavian veins near the heart).
2. (B) Lymph contains some amount of plasma, proteins, and blood cells. True
- Lymph is a clear, yellowish fluid that contains plasma, proteins (though in lower amounts than blood plasma), and white blood cells (WBCs, mainly lymphocytes).
3. (C) Lymph contains some amount of plasma, proteins, and red blood cells (RBCs). X False
- Lymph does not contain red blood cells (RBCs). RBCs are present in blood but absent in lymph, making lymph colorless.
4. (D) Lymph vessels carry lymph through the body and finally open into larger veins. ∨ True
- Lymphatic vessels ultimately drain into larger veins, specifically the subclavian veins, allowing lymph to re-enter the bloodstream.

Hence, the answer is the option (b).

Q7. Plants like rose and banana have lost the capacity to produce
(a) flowers
(b) buds
(c) seeds
(d) fruits

Ans.

Explanation:
- Plants like rose and banana commonly reproduce vegetatively rather than through seeds.
- Banana plants are mostly sterile because they are cultivated varieties that do not produce viable seeds. Instead, they reproduce through suckers or rhizomes.
- Roses are often propagated through cuttings, grafting, or layering, as commercial varieties do not rely on seed formation for reproduction.
- These plants still produce flowers, buds, and fruits, but their seeds are either absent or non-viable.

Why not the other options?
- (a) Flowers → Both rose and banana plants produce flowers for reproduction.
- (b) Buds → They develop buds for vegetative propagation and new growth.
- (d) Fruits → Banana plants produce edible fruits, and roses can form rose hips (fruiting bodies).

Hence, the answer is the option (c).

Q8. In a bisexual flower the male gametes are present in
(a) anther
(b) ovary
(c) stigma
(d) filament

Ans.

Explanation:
In a bisexual flower (a flower that has both male and female reproductive organs):
- The male reproductive part is the stamen, which consists of:
- Anther → Produces pollen grains, which contain male gametes (sperm cells).
Correct Answer
- Filament → Supports the anther but does not contain gametes.
- The female reproductive part is the carpel (pistil), which consists of:
- Ovary → Contains ovules (female gametes/egg cells).
- Stigma → Receives pollen but does not contain gametes.

Hence, the answer is the option (a).

Q9. When a pure-tall pea plant is crossed with a pure-dwarf pea plant, the percentage of tall pea plants in F_1 and F_2 generation pea plants will be respectively :
(a) 100%; 25%
(b) 100%; 50%
(c) 100%; 75%
(d) 100%; 100%

Ans.

Explanation:
This is a Mendelian monohybrid cross where tallness (T) is dominant over dwarfness (t).
1. Parental Cross (P generation):
- A pure tall (TT) pea plant is crossed with a pure dwarf (tt) pea plant.
- The F F generation will inherit one allele from each parent, making all plants Tt (heterozygous tall).
- Since **T** is dominant, all F_1 plants are tall (100\%).
2. F_2 Generation (Self-crossing of F_1 plants $Tt \times Tt$):
- The offspring will have the following genotype distribution: TT, Tt, Tt, and tt.
- Three out of four plants (TT and Tt) will be tall (75\%), and one out of four (tt) will be dwarf (25\%).

Thus, the percentage of tall plants in F_1 is 100%, and in F_2 is **75%**.

Hence, the answer is the option (c).

Q10. To get an image of magnification -1 on a screen using a lens of focal length 20 cm , the object distance must be :
(a) Less than 20 cm
(b) 30 cm
(c) 40 cm
(d) 80 cm

Ans.

Explanation:
To get an image of magnification -1 , the following conditions must be met:
- The negative sign in magnification (m = −1) indicates the image is real and inverted.
- $|m| = 1$ means the image size is equal to the object size.
- This happens when the object is placed at twice the focal length (2f) of a convex lens.

Given:
- Focal length $(\mathbf{f}) = 20$ cm
- Object distance $(\mathrm{u}) = ?$

From lens formula:

$$m = \frac{-v}{u}$$

For magnification $-\mathbf{1}$, we set:

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

Using the lens formula:

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

Since $\mathbf{v} = \mathbf{u}$, we substitute:

$$\frac{1}{20} = \frac{1}{u} - \frac{1}{u} = \frac{2}{u}$$
$$u = 2f = 2 \times 20 = 40 \text{ cm}$$

Thus, the object distance must be 40 cm to obtain a real, inverted image of the same size on a screen.

Hence, the answer is the option (c).

Q11. An optical device ' X ' is placed obliquely in the path of a narrow beam of light. If the emergent beam gets displaced laterally, the device ' X ' is :
(a) plane mirror
(b) convex lens
(c) glass slab
(d) glass prism

Ans.

Explanation:
- When a narrow beam of light passes obliquely through an optical device and experiences lateral displacement (i.e., it shifts sideways but remains parallel to the original direction), the device must be a glass slab.
- A glass slab causes the light to undergo refraction at both entry and exit surfaces, resulting in a parallel shift (lateral displacement) without changing the direction of the emergent beam.

Why not the other options?
- (a) Plane mirror → It reflects light but does not cause lateral displacement of the transmitted beam.
- (b) Convex lens → It bends the light rays, causing convergence or divergence, but does not produce parallel lateral displacement.
- (d) Glass prism → A prism deviates light at an angle, changing its direction, rather than just shifting it laterally.

Hence, the answer is the option (c).

Q12. 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 :

(a) $1/9$

(b) $1/3$

(c) 3

(d) 9

Ans.

Explanation:

1. Initial Resistance of the Wire:
- Let the total resistance of the original wire be **R**.
- Resistance **R** is proportional to the length of the wire:

$R \propto L$

2. Cutting the Wire into Three Equal Parts:
- Since resistance is directly proportional to length, when the wire is cut into three identical parts, the resistance of each part becomes:

$R_{\text{part}} = \frac{R}{3}$

3. Connecting These Three Parts in Parallel:
- The formula for the equivalent resistance R' of resistors in parallel is:

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

- Since all three resistors have the same resistance $\frac{R}{3}$, we substitute:

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

4. Finding R/R' :

$\frac{R}{R'} = \frac{R}{(R/9)} = 9$

Hence, the answer is the option (c).

Q13. An electric bulb is rated 220 V; 11 W. The resistance of its filament when it glows with a power supply of 220 V is :

(a) 4400Ω

(b) 440Ω

(c) 400Ω

(d) 20Ω

Ans.

Explanation:
The resistance of the filament when the bulb is glowing can be calculated using Ohm's Law and the power formula:

Step 1: Given Data
- Voltage, V = 220 V
- Power, P = 11 W
- Resistance, R = ?

Step 2: Using the Power Formula
We use the formula relating power, voltage, and resistance:

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

Rearrange to solve for R:

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

Step 3: Substituting the Values

$$R = \frac{(220)^2}{11}$$
$$R = \frac{48400}{11}$$
$$R = 440\Omega$$

Thus, the resistance of the filament is 440Ω.

Hence, the answer is the option (b).

Q14. The minimum number of identical bulbs of rating $4\text{ V}; 6\text{ W}$, that can work safely with desired brightness, when connected in series with a 240 V mains supply is :
(a) 20
(b) 40
(c) 60
(d) 80

Ans.

Explanation:
To determine the minimum number of bulbs that can be connected in series with a **240V** mains supply, we need to ensure each bulb operates at its rated voltage (4 V) and power (6 W).

- Bulb rating: 4 V, 6 W
- Mains supply voltage: 240 V
- Number of bulbs in series: N

Using the power formula:

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

Rearrange to solve for R:

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

Substituting the values for one bulb:

$$R_{\text{bulb}} = \frac{(4)^2}{6} = \frac{16}{6} = \frac{8}{3}\Omega$$

For safe operation, the total voltage across all bulbs in series must equal the mains supply voltage:

$$N \times V_{\text{bulb}} = V_{\text{mains}}$$
$$N \times 4 = 240$$
$$N = \frac{240}{4} = 60$$

Thus, a minimum of 60 bulbs is needed for the total voltage to match 240 V. However, to ensure each bulb operates at its rated power, we check the total resistance.

The total resistance of N bulbs in series is:

$$R_{\text{total}} = N \times R_{\text{bulb}}$$

Substituting values:

$$R_{\text{total}} = 60 \times \frac{8}{3} = 160\Omega$$

The current drawn from the mains supply:

$$I = \frac{V_{\text{mains}}}{R_{\text{total}}} = \frac{240}{160} = 1.5 \text{ A}$$

Power supplied:

$$P_{\text{total}} = V_{\text{mains}} \times I = 240 \times 1.5 = 360W$$

Each bulb consumes 6 W , so the total number of bulbs needed:

$$N = \frac{360}{6} = 80$$

Hence, the answer is the option (d).

Q15. In the food chains given below. Select the most efficient food chain in terms of energy :
(a) Grass → Grasshopper → Frog → Snake
(b) Plants → Deer → Lion
(c) Plants → Man
(d) Phytoplankton → Zooplankton → Small Fish → Big Fish

Ans.

Explanation:
- In an ecosystem, energy is transferred from one trophic level to another. However, only about 10\% of the energy is passed on at each level, while **90%** of the energy is lost as heat, respiration, and other biological processes (10% Rule of Energy Transfer).
- The shorter the food chain, the more efficient it is, as less energy is lost in transfer.

Analyzing the Given Food Chains:
1. (a) Grass → Grasshopper → Frog → Snake
- 4 trophic levels → Energy loss at each step
- Least efficient
2. (b) Plants → Deer → Lion
- 3 trophic levels → More energy lost
3. (c) Plants → Man
- Only 2 trophic levels → Least energy loss
- Most efficient
4. (d) Phytoplankton → Zooplankton → Small Fish → Big Fish
- 4 trophic levels → More energy loss

Since option (c) has only two trophic levels, it is the most energy-efficient food chain.

Hence, the answer is the option (c).

Q16. Which one of the following gets biomagnified at different levels in a food chain?
(a) Carbon monoxide
(b) CFC's
(c) DDT
(d) Manure

Ans.

Explanation:
Biomagnification refers to the increase in concentration of a toxic substance as it moves up the food chain. This happens because the substance is not easily broken down and accumulates in organisms.

Analyzing the Given Options:
1. (a) Carbon monoxide (CO)
- CO is a gas that affects oxygen transport in the blood but does not accumulate in organisms or get biomagnified.

2. (b) CFCs (Chlorofluorocarbons)
- CFCs damage the ozone layer, but they do not accumulate in organisms through the food chain.
3. (c) DDT (Dichlorodiphenyltrichloroethane)
- Persistent pesticide that accumulates in fatty tissues of organisms.
- As it moves up the food chain, its concentration increases, causing toxic effects (e.g., thinning of bird eggshells, reproductive issues).
4. (d) Manure
- Organic material that decomposes and does not biomagnify.

Since DDT accumulates in organisms and increases in concentration at higher trophic levels, it is the correct answer.

Hence, the answer is the option (c).

Question Nos. 17 to 20 consist of two statements - Assertion (A) and Reason (R). Answer these questions selecting the appropriate option (a), (b), (c) and (d) as given below :
(a) Both, Assertion (A) and Reason (R) are true, and Reason (R) is the correct explanation of Assertion (A).
(b) Both, Assertion (A) and Reason (R) are true, and Reason (R) is not the correct explanation of Assertion (A).
(c) Assertion (A) is true, but Reason (R) is false.
(d) Assertion (A) is false, but Reason (R) is true.

Q17. Assertion (A): In large animals, oxygen can reach different parts of the animal's body easily.
Reason (R): Respiratory pigments take up oxygen from the air and carry it to body tissues.

Ans.

Explanation:
- Assertion (A) is false because in large animals, oxygen cannot easily diffuse to all parts of the body due to their size. Instead, they require a specialized circulatory system to transport oxygen efficiently.
- Reason (R) is true because respiratory pigments (like hemoglobin in blood) bind oxygen in the lungs (or gills) and transport it to body tissues, ensuring efficient oxygen supply.

Since Assertion (A) is false but Reason (R) is true, the correct answer is:
(d) Assertion (A) is false, but Reason (R) is true.

Hence, the answer is the option (c).

Q18. 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.

Ans.

Explanation:
- Assertion (A) is true: While diluting concentrated nitric acid (HNO_3), water should never be added to the acid. Instead, acid should be added slowly to water with constant stirring. This is because adding water to a concentrated acid can cause exothermic splashing, leading to accidents.
- Reason (R) is also true: Concentrated nitric acid is highly soluble in water, which allows it to mix well when diluted.

However, the solubility of nitric acid in water is not the reason for the need to add acid to water slowly. The real reason is to prevent splashing and heat buildup.

Since both statements are true, but the reason is not the correct explanation of the assertion, the correct answer is:
(b) Both, Assertion (A) and Reason (R) are true, and Reason (R) is not the correct explanation of Assertion (A).

Hence, the answer is the option (b).

Q19. Assertion (A) : In reptiles, the temperature at which the fertilized eggs are kept decides the sex of the offsprings.

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

Ans.

Explanation:
- Assertion (A) is true: In many reptiles, such as crocodiles, turtles, and some lizards, the temperature at which fertilized

eggs are incubated determines the sex of the offspring. This phenomenon is called Temperature-Dependent Sex Determination (TSD).
- Example: In turtles, warmer incubation temperatures produce females, while cooler temperatures produce males.
- Reason (R) is also true: In some animals, sex is not determined by genetic factors (chromosomes) but rather by environmental conditions, such as temperature. This is seen in reptiles, some fish, and amphibians.

Since the reason correctly explains the assertion, the correct answer is:
(a) Both, Assertion (A) and Reason (R) are true, and Reason (R) is the correct explanation of Assertion (A).

Hence, the answer is the option (a).

Q20. Assertion (A) : When ciliary muscles contract, eye lens becomes thin.
Reason (R): Ciliary muscles control the power of the eye lens.

Ans.

Explanation:
- Assertion (A) is false: When ciliary muscles contract, the eye lens becomes thicker (more convex), increasing its focal power. This helps in focusing on near objects (accommodation).
- On the other hand, when ciliary muscles relax, the lens becomes thinner (less convex), helping focus on distant objects.
- Reason (R) is true: Ciliary muscles do control the power of the eye lens by adjusting its curvature, allowing us to focus on objects at different distances.

Since Assertion (A) is false but Reason (R) is true, the correct answer is:
(c) Assertion (A) is false, but Reason (R) is true.

Hence, the answer is the option (c).

SECTION B

**Question Nos. 21 to 26 are very short answer type questions. Each question carrics 2 marks.**

Q21. 21. Define oxidation. Identify and name the substance oxidised in the following reaction: $CuO + H_2 \rightarrow Cu + H_2O$

Ans.

Definition of Oxidation:
Oxidation is a chemical process in which a substance gains oxygen or loses electrons during a reaction. It can also be defined as the increase in oxidation state of an element.

Identifying the Oxidized Substance in the Reaction:

$CuO + H_2 \rightarrow Cu + H_2O$
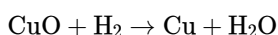
- Copper(II) oxide (CuO) loses oxygen and gets reduced to copper (Cu).|
- Hydrogen (H_2) gains oxygen and forms water (H_2O), meaning hydrogen is oxidized.

Substance Oxidized:
- Hydrogen (H_2) is oxidized because it gains oxygen to form water (H_2O).

Final Answer:
Oxidation is the gain of oxygen or loss of electrons. In the given reaction, hydrogen (H_2) is oxidized.

Q22. (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 $Mg = 12, Cl = 17$)
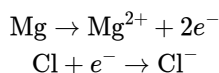
Ans.

Formation of Magnesium Chloride by Electron Transfer

- Magnesium (Mg) (Atomic Number $= 12$) $\rightarrow 2, 8, 2$
- Chlorine (Cl) (Atomic Number $= 17$) $\rightarrow 2, 8, 7$

- Magnesium loses 2 electrons to form a Mg^{2+} ion.

- Each chlorine atom gains 1 electron to form two Cl⁻ions.
- The oppositely charged Mg^{2+} and Cl⁻ions attract each other to form magnesium chloride ($MgCl_2$).

$$Mg \rightarrow Mg^{2+} + 2e^-$$
$$Cl + e^- \rightarrow Cl^-$$

Since two chlorine atoms are needed to balance the charge of one Mg^{2+} ion, the final reaction is:

$$Mg + 2Cl \rightarrow MgCl_2$$
- Cation: Magnesium ion $\left(Mg^{2+}\right)$
- Anion: Chloride ion (Cl)
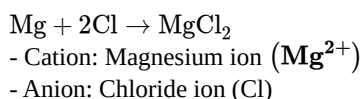
OR

(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.

Ans.

Extraction of Zinc from Its Ore

Zinc is usually extracted from zinc blende (ZnS) or calamine ($ZnCO_3$) using the following steps:
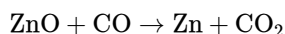1. Concentration of Ore (Froth Flotation Process)
- Zinc blende (ZnS) is concentrated by froth flotation, where impurities are removed.
2. Roasting (Conversion to Oxide)
- Zinc sulfide (ZnS) is heated in air to form zinc oxide (ZnO) and sulfur dioxide (SO_2).

$$2ZnS + 3O_2 \rightarrow 2ZnO + 2SO_2$$
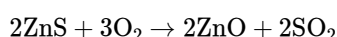
3. Reduction (Extraction of Zinc Metal)
- Zinc oxide is reduced with carbon (C) or carbon monoxide (CO) in a furnace to obtain zinc metal.

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

OR

$$ZnO + CO \rightarrow Zn + CO_2$$
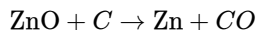
Final Answer:
- Processes involved:
1. Froth flotation (concentration)
2. Roasting (conversion to oxide)
3. Reduction (extraction of Zn metal)

Q23. "Plants use a variety of techniques to get rid of waste material." Justify this statement giving any four ways.

Ans.

Plants, like animals, produce waste materials during their metabolic activities. However, they use a variety of techniques to eliminate or manage these waste products efficiently. Here are four ways in which plants get rid of waste materials:
1. Shedding of Leaves and Bark
- Waste products, including toxic substances, accumulate in old leaves and bark.
- When plants shed leaves and bark, they also eliminate these waste materials.
2. Storage of Waste in Vacuoles
- Some waste materials are stored in cell vacuoles in the form of crystals (e.g., calcium oxalate in rubber plants).
- This prevents toxicity while keeping the waste isolated within the plant cells.
3. Excretion through Stomata and Lenticels
- Plants release excess oxygen (O_2) and water vapor (transpiration) through stomata (on leaves) and lenticels (on stems).
- Harmful gases, like carbon dioxide (CO_2) from respiration, are also removed through these openings.

4. Waste Elimination through Root Exudation
- Some plants release waste chemicals into the soil through their roots.

- These waste products may include organic acids, resins, and tannins, which sometimes act as a defense mechanism against herbivores.

Final Justification:
Plants have developed multiple mechanisms like leaf shedding, vacuole storage, gas exchange, and root exudation to efficiently manage and remove waste materials. This helps them maintain homeostasis and healthy growth.

Q24. Explain with the help of a flow chart that in human beings father is responsible for the sex (male or female) of the child.

Ans.

Explanation: How the Father Determines the Sex of the Child
In human beings, sex is determined by the sex chromosomes. Humans have 46 chromosomes (23 pairs) in each cell, with one pair being the sex chromosomes.
- Males (Father) have XY sex chromosomes.
- Females (Mother) have XX sex chromosomes.
- The mother always passes an X chromosome to the child.
- The father can pass either an X or a Y chromosome through the sperm.

Thus, the father's sperm determines the sex of the child:
- If the father's sperm carries an **X** chromosome, the child will be female (XX).
- If the father's sperm carries a Y chromosome, the child will be male (XY).

Q25. (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.

Ans.

 Refraction of Light through an Equilateral Glass Prism

Ray Diagram:
- When a light ray enters an equilateral glass prism, it bends towards the normal at the first surface due to refraction.
- Inside the prism, the light ray travels in a different direction.
- As the light exits the prism, it bends away from the normal at the second surface.
- The angle between the original incident ray and the emergent ray is called the angle of deviation (δ).
> Label the following in the diagram:
1. Incident ray (before entering the prism)
2. Refracted ray (inside the prism)
3. Emergent ray (after exiting the prism)
4. Angle of deviation (δ) (between the extended incident ray and the emergent ray)

OR

(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.

Ans.

(B) Correction of Presbyopia

What is Presbyopia?
- Presbyopia is an age-related vision defect where a person has difficulty focusing on both near and distant objects.
- It occurs due to the loss of flexibility in the eye lens and weakening of ciliary muscles.

Type of Lenses Used:
- Bifocal lenses are used to correct presbyopia.

Structure of Bifocal Lenses:
- Upper part: Concave lens (for distant vision)
- Lower part: Convex lens (for near vision)
, Reason for This Design:
- Since presbyopia affects both near and distant vision, bifocal lenses provide two focal lengths in a single lens-convex for

near vision and concave for distant vision.
Final Answer: Bifocal lenses, consisting of a concave lens on top and a convex lens at the bottom, are used for correcting presbyopia.

Q26. What are magnetic field lines. List two important propertics of magnetic field lines.

Ans.

Magnetic Field Lines
Magnetic field lines are imaginary lines used to represent the magnetic field around a magnet. These lines indicate the direction and strength of the magnetic field.
- They originate from the north pole and end at the south pole outside the magnet.
- Inside the magnet, they move from south to north, forming a closed-loop.

Two Important Properties of Magnetic Field Lines:
1. Magnetic field lines never intersect
- If they did, it would mean that the magnetic field has two different directions at the same point, which is impossible.
2. The closer the field lines, the stronger the magnetic field
- Where the field lines are densely packed, the magnetic field is stronger (e.g., near the poles).
- Where the field lines are far apart, the field is weaker.

Conclusion: Magnetic field lines help visualize the strength and direction of a magnetic field, and they always form closed loops.

Q27.

(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 :

$$Zn + H_3PO_4 \rightarrow Zn_3(PO_4)_2 + H_2$$
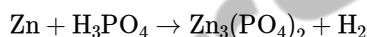
Ans.

(A) Balancing a Chemical Equation

Why Do We Balance a Chemical Equation?
A chemical equation must be balanced to satisfy the Law of Conservation of Mass, which states that mass can neither be created nor destroyed in a chemical reaction. This means the number of atoms of each element should be equal on both reactant and product sides.
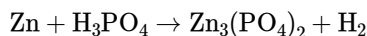
Law Suggesting the Balancing of Chemical Equations
Law of Conservation of Mass:
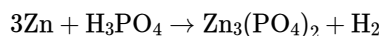"The total mass of reactants is always equal to the total mass of products in a chemical reaction."

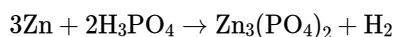Balancing the Given Equation
Unbalanced equation:

$$Zn + H_3PO_4 \rightarrow Zn_3(PO_4)_2 + H_2$$

Step-by-step balancing:
1. Balance Zn atoms: There are 3 Zn atoms in $Zn_3(PO_4)_2$, so place **3Zn** on the reactant side:

$$3Zn + H_3PO_4 \rightarrow Zn_3(PO_4)_2 + H_2$$
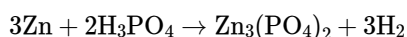
2. Balance Phosphate (PO_4) groups: There are **2** phosphate groups in $Zn_3(PO_4)_2$, so place **2H₃PO₄** on the reactant side:

$$3Zn + 2H_3PO_4 \rightarrow Zn_3(PO_4)_2 + H_2$$

3. Balance Hydrogen atoms: There are **6H** atoms from $2H_3PO_4$ molecules. Since H_2 forms in pairs, place $3H_2$ on the product side:

$$3Zn + 2H_3PO_4 \rightarrow Zn_3(PO_4)_2 + 3H_2$$

Balanced Equation:

$$3Zn + 2H_3PO_4 \rightarrow Zn_3(PO_4)_2 + 3H_2$$
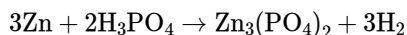
OR

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

Ans.

(B) Precipitation Reaction

Definition:
A precipitation reaction is a type of chemical reaction in which two aqueous solutions react to form an insoluble solid (precipitate). The precipitate separates out from the solution.

Example of a Precipitation Reaction:
When barium chloride ($BaCl_2$) reacts with sodium sulfate (Na_2SO_4), an insoluble white precipitate of barium sulfate ($BaSO_4$) is formed.

Balanced Chemical Equation:

$$BaCl_2 + Na_2SO_4 \rightarrow BaSO_4 \downarrow + 2NaCl$$
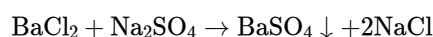
Here, $BaSO_4$ is the precipitate (denoted by " $\downarrow$ ").
Conclusion: Precipitation reactions result in the formation of an insoluble substance from a chemical reaction in solution.

Q28. Design an activity to show that metals are good conductors of heat and have high melting points.

Ans.

Activity to Demonstrate That Metals Are Good Conductors of Heat and Have High Melting Points

Objective:
To show that metals conduct heat efficiently and have high melting points compared to other materials.

Materials Required:
- A metal rod (e.g., copper, aluminum, or iron)
- A wooden stick (for comparison)
- Small wax pieces
- Matchsticks
- Candle or spirit lamp
- Clamp stand or tongs

Procedure:

Step 1: Set Up the Experiment
1. Take a metal rod and a wooden stick of similar length.
2. Fix them side by side using a clamp stand or hold them with tongs.
3. Attach small blobs of wax at equal distances along both rods.
4. Stick matchsticks to the wax blobs so they stay in place.

Step 2: Heat the Rods
5. Light a candle or spirit lamp and heat one end of both the metal rod and wooden stick at the same time.
6. Observe how the heat travels through the rods.

Step 3: Observe Heat Conduction
7. On the metal rod, the wax melts quickly, and the matchsticks fall off one by one, indicating that metals are good conductors of heat.
8. On the wooden stick, the wax melts much more slowly or not at all, as wood is a poor conductor of heat.

Step 4: Observe High Melting Points
9. Continue heating the metal rod. Even after prolonged heating, the metal does not melt, proving that metals have high melting points.

Observations:
- The metal rod conducts heat quickly, melting the wax and causing matchsticks to fall off in sequence.
- The wooden stick does not conduct heat well, so the wax takes much longer to melt (if it melts at all).
- Despite continuous heating, the metal rod does not melt, proving its high melting point.

Q29. The digestion of food in human alimentary canal is a complex process. Siate the enzyme/salt present in the following and mention their function in the process of digestion:
(i) Saliva
(ii) Bile Juice
(iii) Pancreatic Juice

Ans.
The digestion of food in the human alimentary canal involves various enzymes and digestive secretions that help in breaking down complex food molecules into simpler forms for absorption. Below are the enzymes and salts present in different digestive juices and their functions:
(i) Saliva
- Enzyme Present: Salivary Amylase (Ptyalin)
- Function:
- Salivary amylase breaks down starch (complex carbohydrate) into maltose (a simpler sugar).
- It helps in the initial digestion of carbohydrates in the mouth.
(ii) Bile Juice
- Salt Present: Bile Salts (Sodium Glycocholate and Sodium Taurocholate)
- Function:
- Bile has no digestive enzymes, but its bile salts help in the emulsification of fats (breaking large fat globules into smaller droplets), making it easier for lipase to act on them.
- It also neutralizes acidic chyme from the stomach, providing an alkaline medium for enzyme action in the small intestine.

(iii) Pancreatic Juice
- Enzymes Present \& Their Functions:
1. Trypsin - Helps in the digestion of proteins by breaking them down into smaller peptides.
2. Pancreatic Amylase - Continues the digestion of starch into maltose.
3. Lipase - Helps in the digestion of fats (lipids) into fatty acids and glycerol.

Q30. 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?

Limitations of Electrical Impulses in Multicellular Organisms:
1. Short-lived Effect: Electrical impulses act quickly, but their effects are short-lived. This is not suitable for processes that require prolonged responses, such as growth or metabolism.
2. Limited Transmission Pathway: Electrical impulses travel only through neurons, which limits communication to specific pathways. They cannot reach every cell in the body directly.

Why is Chemical Communication Better than Electrical Impulses?
- Chemical communication (via hormones) allows signals to be transmitted through the bloodstream, reaching all target cells, even those not directly connected to neurons.
- It has a long-lasting effect, making it more suitable for processes like growth, development, and homeostasis.
- It can regulate slow and widespread activities, such as digestion and reproduction, which electrical impulses cannot efficiently control.

Q31. If we want to obtain a virtual 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 produced by this mirror to justify your answer.

Ans.

Given Data:
- Focal length of concave mirror $= f = -18$ cm (negative because it is concave)
- Magnification $= m = +2$ (positive, meaning the image is virtual and erect)
- Mirror formula:

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

- Magnification formula for mirrors:

$$m = \frac{-v}{u}$$

Rearrange the magnification formula:

$$v = -m \cdot u$$

Substituting $m = +2$:

$$v = -(2u) = -2u$$

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

Substituting $f = -18$ cm and $v = -2u$:

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

Taking LCM on the right-hand side:

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

Cross multiplying:

$$2u = 18$$
$$u = 9 \text{ cm}$$

To obtain a virtual and magnified image of magnification +2 using a concave mirror of focal length 18 cm, the object should be placed at 9 cm from the mirror (between the pole and focus, i.e., $0 < u < f$).

This justifies that when an object is placed between the focus and the pole of a concave mirror, the image formed is virtual, erect, and magnified.

Q32. The electrical resistivity of three materials A, B and C at 20° | Material |

Material	Resistivity (Ωm)
A	10^{17}
B	44×10^{-6}
C	1.62×10^{-8}

Ans.

(i) Classification of Materials

1. Material A has an extremely high resistivity $\left(10^{17}\Omega m\right)$, indicating it is an insulator (e.g., rubber, glass, or plastic).
2. Material B has a moderate resistivity $\left(44 \times 10^{-6}\Omega m\right)$, suggesting it is a semiconductor (e.g., silicon or germanium).
3. Material C has a very low resistivity $\left(1.62 \times 10^{-8}\Omega m\right)$, meaning it is a good conductor (e.g.r copper or silver).
- **A** is an insulator.
- **B** is a semiconductor.
- C is a conductor.

Material Type	Example	Use in Electrical Appliance
Conductor (C)	Copper	Used in wiring of an electric stove/iron due to its low resistivity and high conductivity.
Alloy (B)	Nichrome	Used in heating elements of electric stove/iron as it has high resistivity and does not oxidize easily.
Insulator (A)	Bakelite	Used in handles and body of electric stove/iron as it is a bad conductor of electricity and heat-resistant.

This classification helps determine the applications of these materials in electrical circuits and devices.

- Conductors are used for efficient current flow.
- Alloys are used for controlled heating (high resistance).
- Insulators are used for safety and protection.

Q33. What are decomposers? Give two examples. State how they maintain a balance in an ecosystem.

Ans.

Decomposers are
Decomposers are organisms that break down dead plants, animals, and organic waste into simpler substances like nutrients, which are then released back into the environment. They play a crucial role in recycling nutrients in ecosystems.

Examples of Decomposers:
1. Bacteria - Example: Pseudomonas, which breaks down organic matter.
2. Fungi - Example: Mushrooms (Saprophytic fungi like Rhizopus and Penicillium help in decomposition).

Role of Decomposers in Maintaining Ecological Balance:
1. Nutrient Recycling: Decomposers break down complex organic matter into simple nutrients, which are absorbed by plants, ensuring continuous nutrient cycling.
2. Cleaning the Environment: They help in the decomposition of dead organisms and waste materials, preventing their accumulation.
3. Energy Flow in Food Chains: They release nutrients back into the soil, making them available for producers (plants), ensuring the flow of energy in an ecosystem.
4. Carbon and Oxygen Cycle: They help in the breakdown of organic matter, releasing carbon dioxide back into the atmosphere, aiding in the carbon cycle.

Q34 (A) A carbon compound 'A' on heating with excess conc. H_2SO_4 forms a compound ' B ', which on addition of one mole of hydrogen gas in the presence of nickel catalyst forms a compound ' C '. ' C ' on combustion in air forms 2 moles of carbon dioxide and 3 moles of water. Identify ' A ', ' B ' and ' C ' and write their structures. Give chemical equations of the reactions involved. Also state the role of concentrated sulphuric acid in the formation of ' B ' from ' A '.

Ans.

Given Clues:
1. Compound A on heating with excess concentrated H_2SO_4 forms Compound B.
- Concentrated H_2SO_4 is a dehydrating agent, which suggests that **A** is an alcohol, and **B** is an alkene formed by dehydration.
2. Compound B reacts with one mole of hydrogen in the presence of Ni catalyst to form Compound C.
- This indicates that B is an alkene and C is an alkane (formed by hydrogenation).
3. Compound C on combustion forms 2 moles of CO_2 and 3 moles of H_2O.
- The combustion reaction suggests that C contains two carbon atoms.
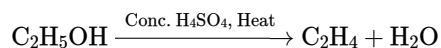- General combustion formula for hydrocarbons:

$$C_xH_y + O_2 \rightarrow xCO_2 + \frac{y}{2}H_2O$$
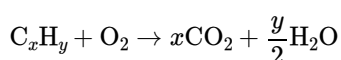
- If $2CO_2$ and $3H_2O$ are produced, then C_2H_6 (ethane) fits the equation.

Identified Compounds:
- $A = $ Ethanol (C_2H_5OH)
- **B** $= $ Ethene (C_2H_4)
- C $= $ Ethane (C_2H_6)

1. Dehydration of Ethanol to form Ethene:

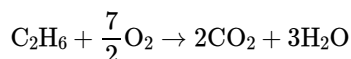$$C_2H_5OH \xrightarrow{\text{Conc. H}_4\text{SO}_4,\ \text{Heat}} C_2H_4 + H_2O$$

Role of Conc. H_2SO_4 :
- Acts as a dehydrating agent, removing a water molecule from ethanol to form ethene.
2. Hydrogenation of Ethene to form Ethane:
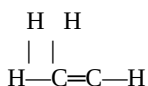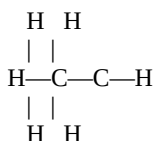
$$C_2H_4 + H_2 \xrightarrow{\text{Ni catalyst, Heat}} C_2H_6$$

3. Combustion of Ethane:

$$C_2H_6 + \frac{7}{2}O_2 \rightarrow 2CO_2 + 3H_2O$$

1. Ethanol $(A - C_2H_5OH)$

```
  H  H
  |  |
H—C—C—OH
  |  |
  H  H
```

2. Ethene $(B - C_2H_4)$

```
  H  H
  |  |
H—C=C—H
```

3. Ethane $(C - C_2H_6)$

```
  H  H
  |  |
H—C—C—H
  |  |
  H  H
```
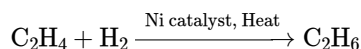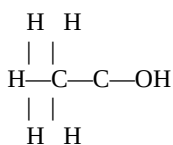
OR

(B) A carbon compound ' A ' is widely used as a preservative in pickles and has a molecular formula $C_2H_4O_2$. This compound reacts with ethanol to form a sweet smelling compound ' B '. (i) Identify the compound ' A ' and write its structure. (ii) Write the chemical equation for the reaction of ' A ' with ethanol to form compound ' B '. State the role of presence of an acid in the reaction. (iii) How can we get compound ' A ' back from ' B '? (iv) How can ' A ' be obtained from ethanol? (v) Name the gas produced when compound 'A' reacts with washing soda.

Ans.

- The given molecular formula $C_2H_4O_2$ suggests it could be an acid or an ester.
- The compound is widely used as a preservative in pickles, which indicates it is acetic acid (CH_3COOH).
- Acetic acid (A) reacts with ethanol to form a sweet-smelling compound, which suggests ester formation.

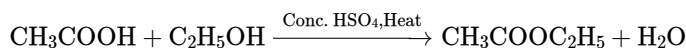Compound $\mathbf{A}$ = Acetic **Acid** (CH_3COOH)
(i) Structure of Acetic Acid (A):

```
    O
    ‖
CH₃ — C — OH
```
(Acetic Acid)
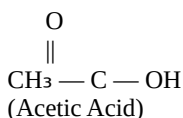
(ii) Reaction of Acetic Acid with Ethanol to form Ester (B)

The reaction between acetic acid (A) and ethanol (C_2H_5OH) forms ethyl acetate (B) $(C_2H_5OOCCH_3)$, which has a sweet smell.

Chemical Equation:

$$CH_3COOH + C_2H_5OH \xrightarrow{\text{Conc. HSO}_4,\text{Heat}} CH_3COOC_2H_5 + H_2O$$

Role of Acid (H_2SO_4) :
- Concentrated sulphuric acid (H_2SO_4) acts as a catalyst and a dehydrating agent, removing water and driving the reaction forward.

Compound B = Ethyl Acetate $(CH_3COOC_2H_5)$
(iii) How can we get Compound 'A' back from 'B'?
- The ester ethyl acetate (B) can be hydrolyzed back to acetic acid (A) by heating with dilute acid or alkali.
- This reaction is called acidic or basic hydrolysis.

Equation (Acidic Hydrolysis):

$$CH_3COOC_2H_5 + H_2O \xrightarrow{\text{Di. HCl}} CH_3COOH + C_2H_5OH$$
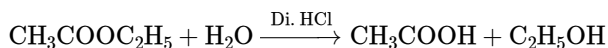
Reverse reaction using dilute acid gives back acetic acid.
(iv) How can 'A' (Acetic Acid) be obtained from Ethanol?
- Acetic acid is obtained by the oxidation of ethanol (C_2H_5OH) using an oxidizing agent like alkaline $KMnO_4$ or acidified $K_2Cr_2O_7$.

Chemical Equation:

$$C_2H_5OH + 2[O] \xrightarrow{\text{Alkaline KMnO}_4} CH_3COOH + H_2O$$

Oxidation of ethanol produces acetic acid.
(v) Name the Gas Produced When 'A' Reacts with Washing Soda
- Washing soda = Sodium carbonate (Na_2CO_3)
- Acetic acid reacts with sodium carbonate to produce carbon dioxide (CO_2) gas.

Equation:

$$2CH_3COOH + Na_2CO_3 \rightarrow 2CH_3COONa + CO_2 + H_2O$$

Gas produced = Carbon dioxide (CO_2).

Compound $\mathbf{A}$ = Acetic Acid (CH_3COOH)
Compound B = Ethyl Acetate $(CH_3COOC_2H_5)$
Role of Acid in Esterification = Catalyst \& Dehydrating Agent
Hydrolysis of B gives back A
Acetic Acid is obtained by oxidizing ethanol
Acetic Acid reacts with washing soda to produce CO_2 gas

Q35. (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 oceur in the latter?

Ans.

Regeneration is the process by which certain organisms regrow lost or damaged body parts from the remaining body fragments. It occurs through the division and differentiation of specialized cells.

Example of an Organism That Shows Regeneration:
△ Planaria (a flatworm) - If a Planaria is cut into pieces, each piece can regenerate into a complete organism.

Example of an Organism That Does Not Show Regeneration:
Humans - Humans do not show complete regeneration; they can heal wounds, but a lost limb cannot regrow.

Why Does Regeneration Not Occur in Humans?
- Higher animals, like humans, have complex body organization with specialized tissues and organ systems.
- Their cells are not pluripotent (capable of forming all body parts), unlike simple organisms like Planaria.
- Instead of regeneration, humans rely on wound healing and tissue repair mechanisms.

(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.

Ans.

The filamentous structures seen in a pond are likely filamentous algae, such as Spirogyra. These structures appear dark green due to the presence of chlorophyll, which enables them to perform photosynthesis.
Name of the structures: Spirogyra (a filamentous green alga)
Method of reproduction: Fragmentation
Process of Fragmentation in Spirogyra
- Spirogyra reproduces asexually through fragmentation under favorable conditions.
- The filament breaks into smaller fragments, and each fragment grows into a new filament by repeated cell division and elongation.
- This process allows rapid multiplication and helps algae spread over large water surfaces.

Steps in Fragmentation:
1. A Spirogyra filament accidentally breaks due to water currents, mechanical injury, or aging.
2. Each broken fragment contains intact cells that continue to divide and grow.
3. The fragments elongate and form new complete filaments, leading to the growth of more algae.
This is why ponds with algae appear green and spread rapidly.

OR

(B)

(i) Name the part performing following functions in human male reproductive system :
(a) Carries sperm
(b) Production of male gametes
(c) Whose secretion makes the transport of sperms easier
(d) Provide suitable temperature for sperm formation

Ans.

(a) Carries sperm → Vas deferens (sperm duct)
(b) Production of male gametes → Testes
(c) Secretion that makes sperm transport easier → Prostate gland \& Seminal vesicles
(d) Provides suitable temperature for sperm formation → Scrotum (keeps testes at a lower temperature for proper sperm production)

(ii) Write any two characteristics of sperms.

Ans.

1. Motility → Sperms have a tail (flagellum) that helps them swim toward the egg for fertilization.
2. Haploid nucleus → Sperms contain a haploid (n) set of chromosomes (23 in humans), which combine with the egg's chromosomes to form a diploid zygote.

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

Surgical Contraceptive Methods:
1. Vasectomy (in males):
- The vas deferens is cut and tied, preventing sperm from mixing with semen.
- It is a permanent method of contraception.
2. Tubectomy (in females):
- The fallopian tubes are cut and tied, preventing the egg from reaching the uterus.

Side Effects of Surgical Contraception:
- Hormonal imbalances (in some cases)
- Risk of infection or complications from surgery
- Not easily reversible
- May cause psychological effects due to permanent infertility

Q36.(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.)

$$\int xe^x \, dx$$

Using integration by parts: $\int u \, dv = uv - \int v \, du$

Let $u = x$ so that $du = dx$,
and $dv = e^x dx$ so that $v = e^x$.

Then, $\int xe^x \, dx = xe^x - \int e^x \, dx$

$= xe^x - e^x + C$

Final Answer: $xe^x - e^x + C$

Ans.

Explanation:
1. Applying the Right-Hand Thumb Rule:
- Point your right-hand thumb in the direction of the current.
- The curling of your fingers around the conductor shows the direction of the magnetic field.
2. Direction of Magnetic Field:
- For the left conductor, the current is going into the plane (downward), so the magnetic field around it is clockwise.
- For the right conductor, the current is also going into the plane, so its magnetic field is also clockwise.
3. Magnetic Field at Point O:
- Since **O** is equidistant from both conductors, the magnetic field due to both conductors will be equal in magnitude but opposite in direction.
- Due to symmetry, the net magnetic field at O cancels out to zero.

Conclusion:
Your reasoning is correct-the net magnetic field at point O is zero due to equal and opposite magnetic fields. You can also mention that if the currents were in the same direction, the magnetic field would add up instead of canceling.

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

(a) What are these three different wires called? Name them colourwise.

Ans.

1. Red Wire $\rightarrow$ Live (Phase) Wire
2. Black Wire $\rightarrow$ Neutral Wire
3. Green Wire $\rightarrow$ Earth (Ground) Wire

(b) What is the potential difference between the red wire and the black wire?

Ans.

The potential difference between the Live (Red) wire and the Neutral (Black) wire is 220V in household circuits.

(c) 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?

Ans.

- The Green wire (Earth wire) provides a safety path for electric current in case of accidental leakage.
- If a fault occurs and the metallic body of an appliance becomes live, the earth wire directs the leakage current safely into the ground.
- This prevents electric shocks and reduces the risk of fire hazards.

(B).

(i) By using the given experimental set-up. How can it be shown that :
(a) a force is exerted on the current-carrying conductor AB when it is placed in a magnetic field.

Ans. (a) A force is exerted on the current-carrying conductor AB when it is placed in a magnetic field?
- The setup consists of a U-shaped magnet and a current-carrying conductor AB suspended between its poles.
- When the switch K is closed, current flows through the conductor AB.
- Observation: The conductor moves either upward or downward, proving that a force is acting on it.
- This force is due to the interaction between the magnetic field of the magnet and the magnetic field produced by the current in the conductor.
- This confirms that a current-carrying conductor experiences a force when placed in a magnetic field.

(b) the direction of force can be reversed in two ways.

Ans. The direction of force acting on the conductor can be reversed in two ways:
1. Reversing the direction of current in the conductor AB.
- If the battery terminals are reversed, the current direction changes, and the conductor moves in the opposite direction.
2. Reversing the direction of the magnetic field.
- If the poles of the magnet are interchanged (North and South are swapped), the direction of force also reverses.

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

Ans.

- The force is given by $F = BIL \sin \theta$, where:
- B = Magnetic field strength
- I = Current in the conductor
- L = Length of the conductor in the field
- θ = Angle between conductor and magnetic field
- The force will be maximum when the conductor is perpendicular to the magnetic field, i.e., when

$$\theta = 90° \, (\sin 90° = 1)$$

(iii) State Fleming's left hand rule.

Ans.

Fleming's Left-Hand Rule states:
"If you stretch the thumb, forefinger, and middle finger of your left hand such that they are mutually perpendicular, then:"
- Forefinger represents Magnetic Field (B) (from North to South).
- Middle finger represents Current (I) (from positive to negative).
- Thumb represents Force (F) or Motion of the conductor.

This rule helps in determining the direction of motion of a current-carrying conductor in a magnetic field.
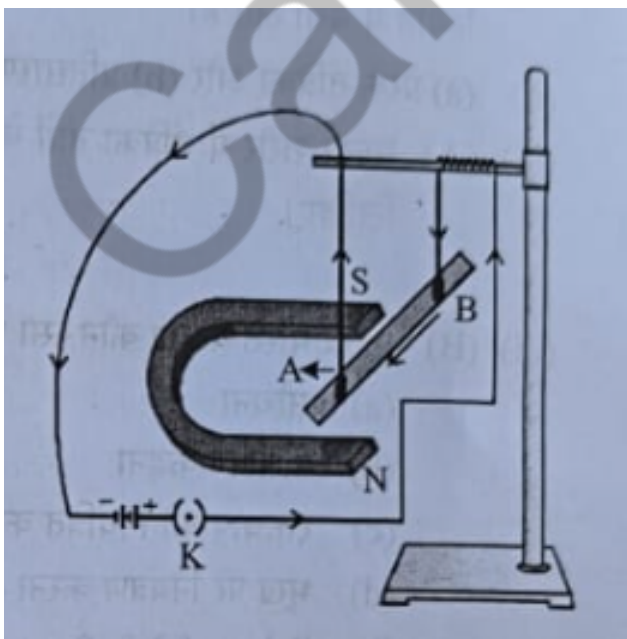
Q37. Common salt is a very important chemical compound for our daily life. It's chemical name is sodium chloride and it is used as a raw material in the manufacture of caustic soda, washing soda, baking soda etc. It is also used in the preservation of pickles, butter, meat etc.

(i) Name the acid and the base from which common salt can be obtained.

Ans.

- Acid: Hydrochloric acid (HCl)
- Base: Sodium hydroxide (NaOH)
- Sodium chloride ($\mathbf{NaCl}$) is formed by the neutralization reaction between hydrochloric acid and sodium hydroxide:

$$NaOH + HCl \rightarrow NaCl + H_2O$$
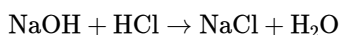
(ii) State the nature (acidic/basic/neutral) of sodium chloride. Give reason for the justification for your answer.

Ans. - Sodium chloride ($\mathbf{NaCl}$) is neutral in nature.
- This is because it is formed from a strong acid (HCl) and a strong base (NaOH), which completely neutralize each other.
- Aqueous solution of NaCl does not change the color of litmus paper, indicating that it is neutral.

(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.

Ans. - The process is called Electrolysis of Brine.
- When electric current is passed through aqueous NaCl (brine solution), it decomposes to form three products:
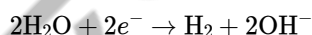1. Chlorine gas (Cl_2) $\rightarrow$ Liberated at the anode (positive electrode)
2. Hydrogen gas (H_2) $\rightarrow$ Liberated at the cathode (negative electrode)
3. Sodium hydroxide ($\mathbf{NaOH}$) $\rightarrow$ Remains in solution

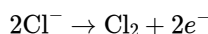(iii) (B) How is washi chemical equation of the reactions involved in the process.

Ans.

Electrolysis of Brine:
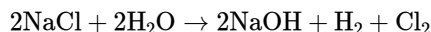At the Cathode (Reduction reaction):

$$2H_2O + 2e^- \rightarrow H_2 + 2OH^-$$

(Hydrogen gas is produced at the cathode)
At the Anode (Oxidation reaction):

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

(Chlorine gas is released at the anode)
Overall Reaction:

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

Final Products:
- Chlorine gas (Cl_2) $\rightarrow$ At the Anode
- Hydrogen gas (H_2) $\rightarrow$ At the Cathode
- Sodium hydroxide ($NaOH$) $\rightarrow$ Remains in the solution

Q38.

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.
(i) Name the action by which we protect ourself in the situation mentioned above and define it.

Ans.

The action by which we protect ourselves from dangerous situations like touching a flame is called a Reflex Action. Definition: A reflex action is an automatic, quick, and involuntary response to a stimulus that does not involve conscious thought. It is controlled by the spinal cord rather than the brain.

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

Ans.

(a) Motor Neuron:
- Carries impulses from the central nervous system (CNS) (spinal cord or brain) to the effector organs (muscles or glands).
- In this case, it sends signals to the hand muscles to pull the hand away from the flame.
(b) Relay Neuron:
- Found in the spinal cord; connects the sensory neuron to the motor neuron.
- Acts as a bridge to transfer impulses quickly without involving the brain.

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

Ans.

1. Central Nervous System (CNS)
- Components: Brain and Spinal Cord
- Function: Controls and processes information, coordinates reflexes and voluntary actions.
2. Peripheral Nervous System (PNS)
- Components: Cranial nerves, spinal nerves, autonomic nervous system
- Function: Transmits signals between the CNS and the rest of the body.

OR

(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

Ans.

(a) Thinking → Cerebrum (responsible for intelligence, reasoning, and decision-making)
(b) Picking up a pencil → Cerebellum (controls voluntary muscle movements and balance)
(c) Controlling blood pressure → Medulla oblongata (regulates involuntary functions like heart rate and breathing)
(d) Controlling hunger → Hypothalamus (regulates hunger, thirst, and body temperature)

Q39.

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.

Ans.

A similar spectrum of white light is observed in a rainbow, where sunlight passes through water droplets in the atmosphere, undergoing dispersion, internal reflection, and refraction, creating a band of colors.

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

Ans.

When white light passes through the glass prism:
1. Dispersion occurs → The prism splits white light into its component colors (VIBGYOR) because different colors have different speeds in glass.
2. Refraction occurs → The light bends as it enters and exits the prism due to the change in medium (air to glass and glass to air).

3. Spectrum is formed → The colors spread out on the screen in the order Violet, Indigo, Blue, Green, Yellow, Orange, and Red (VIBGYOR).

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

Ans.

1. Sunlight and Rainfall Must Coexist → A rainbow is seen when sunlight enters raindrops in the atmosphere while the observer stands with their back to the sun.
2. Observer's Angle → The light must undergo dispersion, internal reflection, and refraction at an angle of about $42°$ for the rainbow to be visible.

OR

(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.

Ans.
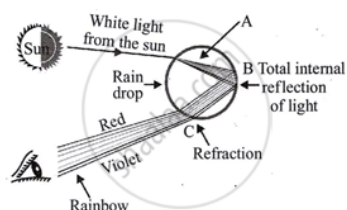
This figure depicts the development of a rainbow as a result of light dispersion.
- Dispersion happens at point ' A ' because white light splits into colors at this point.
- Internal reflection happens at point(s) B and B′ when light is divided into many colors or beams and reflected.