CBSE EXAMINATION PAPER-2025

SCIENCE

(Solved)

Time allowed : 3 hours | Maximum Marks : 90

General Instructions :

Read the following instructions carefully and follow them :

i. This question paper contains **45 questions.** All questions are **compulsory.**

ii. This question paper is divided into **5 sections.**

iii. **Section A** – questions number **1 to 3** are case based questions

iv. **Section B** – questions number **4 to 23** are multiple choice questions

v. **Section C** – questions number **24 to 31** are very short answer

vi. **Section D** – questions number **32 to 39** are short answer

vii. **Section E** – questions number **40 to 45** are long answer

viii. There is no overall choice given in the question paper. However, an internal choice has been provided in few questions.

ix. Use of calculator is NOT allowed.

Section A

Question 1. Common salt is a very important chemical compound for our daily life. Its 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.

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

[1 Marks]

Answer: Common salt or sodium chloride is obtained by the neutralisation reaction between hydrochloric acid and sodium hydroxide, where hydrochloric acid is the acid and sodium hydroxide is the base, as mentioned in the case about the formation of sodium chloride by combining hydrochloric acid and sodium hydroxide solution.

Key Points: Hydrochloric acid is the acid - Sodium hydroxide is the base - Sodium chloride is formed by their neutralisation

(2)

State the nature (acidic/basic/neutral) of sodium chloride. Give reason for the justification for your answer.

[1 Marks]

Answer: Nature of Sodium Chloride: Sodium chloride is a neutral salt.
Reason: It is formed by the neutralization of a strong acid (hydrochloric acid) and a strong base (sodium hydroxide), so it does not change the acidity or basicity of the solution. As given in the passage, sodium chloride is a neutral salt used commonly in daily life.

Key Points: Sodium chloride is a neutral salt - Formed from strong acid and strong base - Does not affect acidity or basicity of solution

(3)

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.

[2 Marks]

Answer: When electric current is passed through brine (aqueous sodium chloride), it undergoes electrolysis producing chlorine gas at the anode, hydrogen gas at the cathode, and sodium hydroxide in the solution. Chlorine gas is collected at the positive electrode (anode), hydrogen gas is collected at the negative electrode (cathode), and sodium hydroxide remains in the solution as a useful product. This process is important as sodium chloride is a key raw material for many daily use chemicals, as mentioned in the case passage.

Key Points: Electrolysis of brine - Products: chlorine gas at anode, hydrogen gas at cathode, sodium hydroxide in solution - Sodium chloride as raw material for chemicals

(4)

How is washing soda obtained from sodium chloride? Give the chemical equations of the reactions involved in the process.

[2 Marks]

Answer:

Washing soda ($Na_2CO_3 \cdot 10H_2O$) is obtained from sodium chloride by first producing sodium hydroxide and carbon dioxide through the chlor-alkali process and then reacting them. In the process, sodium chloride solution is electrolysed to form NaOH and Cl_2. Then, sodium hydroxide is reacted with carbon dioxide to form sodium carbonate (washing soda). The main reactions are:
$2NaCl + 2H_2O$ (electrolysis) $\rightarrow 2NaOH + Cl_2 + H_2$
$2NaOH + CO_2 \rightarrow Na_2CO_3 + H_2O$
$Na_2CO_3 + 10H_2O \rightarrow Na_2CO_3 \cdot 10H_2O$(washing soda). This method uses common salt as a raw material, as mentioned in the case.

Key Points: Washing soda is Na2CO3.10H2O - Obtained from sodium chloride by electrolysis and reaction with CO2 - Main reactions involve NaCl producing NaOH which reacts with CO2 to form washing soda

Question 2.

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.

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

[1 Marks]

Answer: Motor neurons play a crucial role in executing movements in response to stimuli. When we touch a flame, the sensory neurons detect the heat and transmit this information to relay neurons, which are responsible for processing the information and sending signals to the motor neurons. These motor neurons then activate the muscles in our arm, allowing us to quickly remove our hand from the danger. Relay neurons serve as intermediaries that help communicate signals between sensory neurons and motor neurons, ensuring a rapid response to stimuli without conscious thought. This reflex action protects us from harm and highlights the efficient design of our nervous system.

Key Points: 1. Motor neurons execute movement in response to stimuli. 2. Relay neurons process information from sensory neurons and signal motor neurons. 3. Both neurons work together to facilitate a quick reflex action for protection.

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

[1 Marks]

Answer: The action by which we protect ourselves in the situation of touching a flame is known as a 'reflex action.' Reflex action is an involuntary and nearly instantaneous movement in response to a stimulus. It occurs without conscious thought and helps us to respond quickly to protect our body from harm, as in the case of pulling our hand back from a flame instantly to avoid getting burned.

Key Points: reflex action - involuntary movement - response to stimulus - protects body from harm

(3)

Which part of the human brain is responsible for

(a) thinking

(b) picking up a pencil

(c) controlling blood pressure

(d) controlling hunger?

[2 Marks]

Answer: The human brain is divided into different parts, each responsible for specific functions. (a) The part of the brain responsible for thinking is the cerebral cortex, where higher cognitive functions take place. (b) Picking up a pencil involves the motor cortex, which coordinates voluntary movements. (c) Controlling blood pressure is managed by the medulla oblongata within the brainstem, which regulates various autonomic functions. (d) The hypothalamus plays a key role in controlling hunger, as it regulates appetite and energy balance.

Key Points: cerebral cortex - motor cortex - medulla oblongata - hypothalamus

(4)

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

[2 Marks]

Answer: The human body has two main types of nervous systems: the Central Nervous System (CNS) and the Peripheral Nervous System (PNS). The Central Nervous System consists of the brain and spinal cord. It is responsible for processing information and coordinating responses. The Peripheral Nervous System includes all the nerves outside the CNS, which connect the CNS to the rest of the body. It is further divided into the somatic nervous system, which controls voluntary movements, and the autonomic nervous system, which regulates involuntary functions.

Key Points: Central Nervous System (CNS): brain, spinal cord - Peripheral Nervous System (PNS): all other nerves - Somatic nervous system: voluntary control - Autonomic nervous system: involuntary control

Question 3.

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.

(1)

List two conditions necessary to observe a rainbow.

[2 Marks]

Answer: To observe a rainbow, two key conditions must be met: firstly, there needs to be sunlight or a source of white light shining in one direction. Secondly, there must be water droplets or some form of moisture in the atmosphere, like after rain, which serves to refract and reflect the light, creating the spectrum of colors visible as a rainbow.

Key Points: Presence of sunlight-Existence of water droplets

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

[1 Marks]

Answer: In the given experiment, when white light passes through a glass prism, it undergoes a phenomenon known as dispersion. The prism causes the white light to bend at different angles due to the variation in the speed of light in different colors. As a result, the light is separated into its constituent colors, which are red, orange, yellow, green, blue, indigo, and violet. This beautiful band of colors is observed on the screen. This demonstrates that sunlight is not a single color, but rather a mixture of multiple colors that can be identified and visualized through the prism.

Key Points: Dispersion of light, different angles of bending, constituent colors of white light, observation of a spectrum

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

[1 Marks]

Answer: One more instance where a similar spectrum can be observed is during the formation of a rainbow. When sunlight passes through water droplets in the atmosphere, it refracts and disperses similar to how it does when it passes through a prism. This phenomenon results in the appearance of a rainbow, which displays a beautiful spectrum of colors, similar to the one observed with the prism experiment.

Key Points: rainbow formation-sunlight refraction-water droplets-appearance of spectrum

(4)

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.

[2 Marks]

Answer: To show the formation of a rainbow through a ray diagram, I will draw a semicircular arc representing a raindrop. First, I will indicate the incoming sunlight as a straight line hitting point (a) on the surface of the droplet where dispersion of light occurs. The different colors of light split at this point due to refraction as light passes into the droplet. I will show the internal reflection at point (b) where the light bounces off the inner surface of the droplet. Lastly, I will depict the emerging light rays exiting the droplet at point (c), where final refraction occurs, spreading out to form a colorful arc of a rainbow in the sky. The diagram illustrates how each color refracts at different angles, creating a spectrum of colors visible as a rainbow.

Key Points: Draw a semicircular raindrop shape; indicate incoming sunlight; mark point (a) for dispersion; mark point (b) for internal reflection; mark point (c) for final refraction; illustrate emerging colored light rays.

Section B

Question 4.

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

[1 Marks]

(A) Grapes get fermented

(B) Milk left open at room temperature during summer

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

(D) Melting of glaciers

Explanation:

The correct answer is 'Melting of glaciers'. This is a physical change where the state of water changes from solid to liquid but the chemical composition (H_2O) remains the same. In contrast, the other options involve chemical changes where new substances are formed.

Question 5.

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

[1 Marks]

(A) Calcium carbonate

(B) Calcium hydroxide

(C) Calcium chloride

(D) Calcium oxide

Explanation:

The correct option is 'Calcium oxide' because it is a dehydrating agent that can absorb moisture from the gas, ensuring that dry hydrogen chloride gas is obtained. Calcium chloride can also absorb moisture, but for preparing dry gases, calcium oxide is generally preferred.

Question 6. The property by virtue of which solid material can be drawn into thin wire is called:

[1 Marks]

(A) Malleability

(B) Ductility

(C) Resistivity

(D) Rigidity

Explanation: The correct answer is Ductility. Ductility is the ability of metals to be drawn into thin wires, which is specifically mentioned in the provided context. For example, gold is noted as the most ductile metal, capable of being drawn into long wires.

Question 7.

Select from the following a hydrocarbon having one C–C bond and one C≡C bond:

[1 Marks]

(A) Butyne

(B) Benzene

(C) Cyclohexane

(D) Propyne

Explanation: The correct option is Propyne. Propyne has three carbon atoms with one carbon-carbon single bond (C–C) and one carbon-carbon triple bond (C≡C). This satisfies the requirement of having one C–C bond and one C≡C bond, making it an unsaturated hydrocarbon classified as an alkyne. The other options either do not satisfy this criterion or contain only single or double bonds.

Question 8. The essential element taken up from the soil by the plants to synthesize proteins is:

[1 Marks]

(A) Iron

(B) Nitrogen

(C) Phosphorus

(D) Magnesium

Explanation: Nitrogen is the correct answer as it is explicitly mentioned in the context that nitrogen is an essential element used in the synthesis of proteins and other compounds. It is absorbed by plants in the form of inorganic nitrates or nitrites, highlighting its crucial role in protein synthesis.

Question 9.

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.

[1 Marks]

(A) C and D

(B) A and B

(C) A and C

(D) B and D

Explanation: The correct statements are B and D. Lymph does contain some amount of plasma, proteins, and blood cells, but it is also noted that it contains less protein compared to blood plasma. Additionally, lymph vessels carry lymph through the body and finally open into larger veins, not arteries, which aligns with the context provided.

Question 10.

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

[1 Marks]

(A) fruits

(B) seeds

(C) flowers

(D) buds

Explanation: The correct answer is 'seeds' because the context clearly states that plants such as rose and jasmine have lost the capacity to produce seeds. This indicates that, unlike many other plants, these specific types cannot reproduce through seeds.

Question 11.

Ina bisexual flower the male gametes are present in the :

[1 Marks]

(A) anther

(B) filament

(C) ovary

(D) stigma

Explanation: The correct answer is 'anther'. The anther is the part of the stamen that is responsible for producing pollen grains, which contain the male gametes. The context mentions that the stamen is the male reproductive part and produces pollen grains, confirming that the anther is where the male gametes are located.

Question 12.

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:

[1 Marks]

(A) 100% ; 50%

(B) 100% ;100%

(C) 100% ; 25%

(D) 100% ; 75%

Explanation: When a pure tall (TT) pea plant is crossed with a pure dwarf (tt) pea plant, all F_1 generation plants are tall because the tall allele (T) is dominant over the dwarf allele (t). Thus, 100% of F_1 plants are tall. When F_1 plants (Tt) are self-crossed, the F_2 generation segregates into three genotypes: TT, Tt, and tt, resulting in a phenotypic ratio of about 3 tall : 1 dwarf plants, i.e., 75% tall and 25% dwarf. Therefore, the percentage of tall plants is 100% in F_1 and 75% in F_2 generations respectively.

Question 13.

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

[1 Marks]

(A) Less than 20 cm

(B) 40 cm

(C) 80 cm

(D) 30 cm

Explanation: The correct option is 40 cm. According to the lens formula, for an image with magnification of -1 (inverted image), the object distance should be equal to twice the focal length of the lens. With a focal length of 20 cm, the object distance is calculated as u = -2f = -2(20) = -40 cm (the negative sign indicates that the object is on the same side as the incoming light).

Question 14.

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 Marks]

(A) glass prism

(B) plane mirror

(C) convex lens

(D) glass slab

Explanation: The correct option is 'glass slab'. When light passes through a glass slab at an angle, it undergoes refraction but the emergent ray remains parallel to the incident ray, and there is a lateral displacement. This behavior matches the context provided, which describes how light interacts with a slab.

Question 15.

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 Marks]

(A) 1

(B) 9

(C) 1/3

(D) 1/9

Explanation:

When a wire of resistance R is cut into three identical parts, each part has a resistance of R/3. When these three resistors are connected in parallel, the equivalent resistance R' can be calculated using the formula 1/R' = 1/(R/3) + 1/(R/3) + 1/(R/3) = 3/(R/3) = 9/R. Therefore, R' = R/9. Thus, R/R' = R/(R/9) = 9, making the correct answer 9.

Question 16.

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

[1 Marks]

(A) 4400 Ω

(B) 20 Ω

(C) 440 Ω

(D) 400 Ω

Explanation: To find the resistance (R) of the bulb, we can use the formula P = V^2 / R, where P is the power (11 W) and V is the voltage (220 V). Rearranging this gives us R = V^2 / P = (220^2) / 11 = 48400 / 11 = 4400 Ω. Thus, the correct answer is 4400 Ω.

Question 17.

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

[1 Marks]

(A) 20

(B) 40

(C) 60

(D) 80

Explanation: To find the minimum number of bulbs, we first need to calculate the total resistance required to allow the bulbs to work correctly with the provided voltage. The power rating formula is P = V^2/R, which can be rearranged to R = V^2/P. For one bulb, R = (4^2) / 6 = 2.67 ohms. Since they are connected in series, the total resistance R_total = n * resistance of one bulb. Thus, V_total = I * R_total, converted into total voltage of 240V, solving gives n = 60. Therefore, the correct answer is 60.

Question 18.

In the food chains given below. Select the most efficient food chain in terms of energy :

[1 Marks]

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

(B) Plants → Deer → Lion

(C) Plants → Man

(D) Grass → Grasshopper → Frog → Snake

Explanation:

The most efficient food chain in terms of energy is 'Phytoplankton → Zooplankton → Small Fish → Big Fish'. This chain consists of fewer trophic levels, which generally allows for a higher retention of energy at each level. According to the context, with each step in the food chain, energy is lost significantly, so shorter chains retain more energy. The other options contain more steps, which leads to higher energy loss.

Question 19.

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

[1 Marks]

(A) Manure

(B) DDT

(C) Carbon monoxide

(D) CFC's

Explanation: DDT is correct because it is a chemical that accumulates in the bodies of organisms at each trophic level, leading to higher concentrations in top predators, including humans, due to biological magnification. This is reflected in the context, which discusses how non-degradable chemicals like pesticides enter the food chain and are progressively accumulated.

Question 20.

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.

[1 Marks]

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

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

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

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

Explanation:

Assertion (A):

In large animals, oxygen can reach different parts of the animal's body easily.
True

- Large animals have **specialized transport systems** like **blood vessels and lungs/gills**, which help oxygen reach all body parts effectively.

Reason (R):

Respiratory pigments take up oxygen from the air and carry it to body tissues.
True

- **Hemoglobin** and other respiratory pigments **bind oxygen** in the lungs/gills and help **transport it** through blood to tissues.

Relationship:

- While both statements are **true**, the **reason is not the direct explanation** for why oxygen reaches all parts of a **large animal's body** easily.
- That happens due to the **circulatory system**, not just the presence of respiratory pigments alone.

Question 21.

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.

[1 Marks]

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

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

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

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

Explanation:

Assertion (A):

In reptiles, the temperature at which the fertilized eggs are kept decides the sex of the offspring.
True

- In some reptiles like **turtles, crocodiles, and lizards**, **temperature-dependent sex determination (TSD)** occurs.
- The **incubation temperature** during a **critical period** of embryo development decides whether the offspring will be **male or female**.

Reason (R):

Sex is not genetically determined in some animals.
True

- In animals with TSD, **sex is determined by environmental factors** (like temperature), **not by sex chromosomes**.
- So, **genetic mechanisms** are **not involved** in these cases.

Relationship:

- The **Reason** correctly explains **why** temperature affects the sex in some reptiles — because **genetic determination is absent**, and **environmental factors** control sex.

Question 22.

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

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

[1 Marks]

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

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

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

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

Explanation:

Assertion (A) is false, because when ciliary muscles contract, the eye lens becomes thicker, not thinner, as this increases its curvature to focus on near objects. Reason (R) is true, as ciliary muscles

do indeed control the power of the eye lens, affecting its shape for focusing on objects at different distances.

Question 23.

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.

[1 Marks]

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

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

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

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

Explanation:

The correct procedure is to add acid slowly to water with constant stirring, not water to acid, because mixing water into concentrated acid releases a lot of heat and can cause splattering. Concentrated nitric acid is indeed easily soluble in water, which makes the reason true. Hence, Assertion (A) is false and Reason (R) is true.

Section C

Question 24.

Define oxidation. Identify and name the substance oxidized in the following reaction:

$CuO + H_2 \rightarrow Cu + H_2O$

[2 Marks]

Answer: (a) **Oxidation** means the process where a substance loses electrons or gains oxygen during a chemical reaction.
(b) In the reaction $CuO + H_2 \rightarrow Cu + H_2O$, hydrogen ($H_2$) is oxidized because it gains oxygen to form water (H_2O). So, the substance oxidized is hydrogen (H_2).

Key Points: Oxidation is loss of electrons or gain of oxygen - Hydrogen is oxidized in the reaction - Hydrogen changes into water by gaining oxygen

Question 25.

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)

[2 Marks]

Answer: Formation of magnesium chloride:

Magnesium atom (Mg) has 2 electrons in its outermost shell and chlorine atom (Cl) has 7 electrons in its outermost shell. Magnesium transfers its 2 electrons, one to each chlorine atom. This forms Mg^{2+} ion and two Cl^- ions.

Equation: $Mg \rightarrow Mg^{2+} + 2e^-$

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

These oppositely charged ions (Mg^{2+} and Cl^-) attract each other and form an ionic bond, resulting in magnesium chloride with formula $MgCl_2$.

Cation: Magnesium ion (Mg^{2+})

Anion: Chloride ion (Cl^-)

Key Points: Magnesium loses 2 electrons one to each chlorine atom - Mg forms Mg2+ ion - Chlorine forms Cl- ion by gaining 1 electron - Electrostatic attraction forms MgCl2 - Cation is magnesium ion - Anion is chloride ion

Question 26. 'Plants use a variety of techniques to get rid of waste material.' Justify this statement giving any four ways.

[2 Marks]

Answer: Plants employ several methods to eliminate waste materials. Firstly, they lose excess water through transpiration, which is crucial in regulating their internal moisture levels. Secondly, dead cell tissues, like the bark, shed serve as another waste elimination strategy. Additionally, many waste products are stored in cellular vacuoles within the plant cells, allowing for safe storage and later disposal. Lastly, oxygen produced during photosynthesis is expelled as a waste product, representing another important form of waste excretion in plants.

Key Points: Transpiration for water loss-Dead cell tissues for waste shedding-Storage of waste in vacuoles-Oxygen as a waste product

Question 27.

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

[2 Marks]

Answer: Sex determination in humans:

1. Humans have 23 pairs of chromosomes including one pair of sex chromosomes.
2. Mothers have two X chromosomes (XX), so eggs always carry X.
3. Fathers have one X and one Y chromosome (XY), so sperms carry either X or Y.
4. During fertilization:
   - If sperm carrying X fertilizes the egg (X), the child will be female (XX).
   - If sperm carrying Y fertilizes the egg (X), the child will be male (XY).
5. Therefore, the father determines the sex of the child by contributing either X or Y chromosome.

Flow chart:

Father (XY) -- produces sperm with X or Y --> Egg (X) from Mother

--X sperm + X egg = Female (XX)

--Y sperm + X egg = Male (XY)

> **Key Points: Father has XY chromosomes - Sperm can have X or Y chromosome - Mother provides X chromosome - X sperm + X egg produces female child - Y sperm + X egg produces male child - Father determines sex of child**

Question 28. Draw a ray diagram to show the refraction 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.

[2 Marks]

Answer: When light passes through an equilateral glass prism, it refracts twice. First, it bends towards the normal when entering the prism (from air to glass) at surface AB. Inside the prism, it travels straight. At surface AC, it bends away from the normal when emerging from glass to air. The emergent ray bends from the original incident ray direction by an angle called the angle of deviation (D). This angle D is the measure of how much the ray is deviated due to refraction through the prism.

> **Key Points: Light refracts twice in prism - Bends towards then away from normal - Emergent ray deviates by angle called angle of deviation**

Question 29. Name the type of lens required by persons for the correction of vision called presbyopia. Write the structure of the lenses commonly used for the correction of this defect, giving reason for such designs.

[2 Marks]

Answer: The type of lens required to correct presbyopia is a bifocal lens. Such lenses have two parts: the upper portion is a concave or sometimes plano lens for distance vision, and the lower portion is a convex lens for near vision. This design helps persons with presbyopia to see distant and near objects clearly because the eye's lens loses flexibility with age, making it difficult to focus on close objects. The convex lower part assists in focusing light from near objects on the retina.

Key Points: Lens required is bifocal lens - Upper part for distance vision - Lower part convex for near vision to correct presbyopia

Question 30. What are magnetic field lines? List two important properties of magnetic field lines.

[2 Marks]

Answer: Magnetic field lines are imaginary lines used to represent the magnetic field around a magnet. They show the direction and strength of the magnetic field. The lines come out from the North pole and go into the South pole of the magnet.

Two important properties of magnetic field lines are:

1. Magnetic field lines never cross each other.
2. The tangent to a magnetic field line at any point gives the direction of the magnetic field at that point.

Key Points: Magnetic field lines represent magnetic field - Lines go from North to South pole - Lines never cross each other - Tangent shows direction of field

Question 31.

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.

[2 Marks]

Answer: Extraction of Zinc from its Ore:

Zinc is mainly extracted from its ore zinc blende (ZnS) by the following processes:

(a) **Roasting:** The zinc sulphide ore is heated in the presence of excess air to convert it into zinc oxide. This process is called roasting.

Chemical equation:

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

(b) **Reduction of Zinc Oxide:** The zinc oxide obtained is then reduced to zinc metal by heating with carbon (coke). This process is called reduction.

Chemical equation:

$ZnO\ (s) + C\ (s) \text{ --Heat--> } Zn\ (s) + CO\ (g)$

Thus zinc is extracted from its ore by roasting followed by reduction.

Key Points: Zinc sulphide ore undergoes roasting to form zinc oxide - Zinc oxide is reduced by carbon to produce zinc metal - Chemical equations for roasting and reduction are essential

Section D

Question 32.

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:

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

[3 Marks]

Answer: (a) We balance a chemical equation to follow the law of conservation of mass, which states that matter can neither be created nor destroyed in a chemical reaction. This ensures that the number of atoms of each element on the reactant side is equal to that on the product side.
(b) The law that suggests balancing is the **Law of Conservation of Mass**. It states that mass of reactants is always equal to the mass of products in a chemical reaction.
(c) To balance $Zn + H_3PO_4 \rightarrow Zn_3(PO_4)_2 + H_2$:
Step 1: Count atoms on both sides:
Zn: Reactant=1, Product=3
H: Reactant=3, Product=2
P: Reactant=1, Product=2
O: Reactant=4, Product=8
Step 2: Balance Zn atoms by putting 3 before Zn:
$3Zn + H_3PO_4 \rightarrow Zn_3(PO_4)_2 + H_2$
Step 3: Balance PO_4 groups by putting 2 before H_3PO_4:
$3Zn + 2H_3PO_4 \rightarrow Zn_3(PO_4)_2 + H_2$
Step 4: Balance H atoms: Reactants= 2*3=6, Products= H_2 so put 3 before H_2:
$3Zn + 2H_3PO_4 \rightarrow Zn_3(PO_4)_2 + 3H_2$
All atoms are balanced now. This is the balanced equation.

> **Key Points: Balancing ensures conservation of mass - Law of Conservation of Mass states mass remains constant during reactions - Balanced equation: $3Zn + 2H_3PO_4 \rightarrow Zn_3(PO_4)_2 + 3H_2$**

Question 33. Define a precipitation reaction. Give its example and express the reaction that occurs in the form of a balanced chemical equation.

[3 Marks]

Answer: Definition: A precipitation reaction is a type of chemical reaction in which two solutions react to form an insoluble solid called a precipitate.
Example: When silver nitrate solution ($AgNO_3$) is mixed with sodium chloride solution (NaCl), a white precipitate of silver chloride (AgCl) is formed.
Reaction: $AgNO_3(aq) + NaCl(aq) \rightarrow AgCl(s) + NaNO_3(aq)$

Here, AgCl is the precipitate which is insoluble in water and appears as a white solid.
This reaction is an example of a double displacement reaction followed by the formation of a precipitate, hence a precipitation reaction.

Key Points: Definition of precipitation reaction - Formation of an insoluble precipitate - Example: AgNO3 + NaCl forming AgCl precipitate - Balanced chemical equation included

Question 34.

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

[3 Marks]

Answer: To show that metals are good conductors of heat and have high melting points, follow this activity: (a) Take a thin metal wire made of copper or aluminium and clamp it firmly on a stand. (b) Fix a small pin to the free end of the wire using wax. (c) Heat the wire near the clamp using a spirit lamp, candle, or burner.
Observation: After some time, the heat travels through the wire and melts the wax, causing the pin to fall off. This shows that heat is conducted through the metal wire.
Note: The metal wire does not melt even after heating for long, which shows that metals have high melting points.
This activity proves that metals are good conductors of heat and have high melting points as they conduct heat rapidly and do not melt easily.

Key Points: Heat travels through the metal wire - Pin falls off showing heat conduction - Metal wire does not melt showing high melting point

Question 35.

The digestion of food in human alimentary canal is a complex process. State the enzyme/salt present in the following and mention their function in the process of digestion :

(i) Saliva

(ii) Bile Juice

(iii) Pancreatic Juice

[3 Marks]

Answer: (i) Saliva: Saliva contains the enzyme salivary amylase which starts the digestion of starch into maltose in the mouth. It also moistens the food to help in easy swallowing.
(ii) Bile Juice: Bile juice contains bile salts which emulsify fats, breaking large fat globules into smaller droplets. This increases the surface area for the action of lipase enzymes, aiding fat digestion. Bile juice is produced by the liver and stored in the gall bladder.

(iii) Pancreatic Juice: Pancreatic juice contains several digestive enzymes such as pancreatic amylase (breaks down starch into maltose), pancreatic lipase (breaks down fats into glycerol and fatty acids), and proteases like trypsin (break down proteins into smaller peptides). It is secreted by the pancreas into the small intestine where it helps in the digestion of carbohydrates, proteins, and fats.

> **Key Points: Saliva contains salivary amylase which digests starch - Bile juice contains bile salts that emulsify fats - Pancreatic juice contains enzymes like amylase, lipase, and protease for digestion of carbohydrates, fats, and proteins**

Question 36.

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?

[3 Marks]

Answer: (a) Two limitations of electrical impulses in multicellular organisms are:
1. Electrical impulses can only travel through cells that are connected by nervous tissue, so they cannot reach every cell in the body.
2. After sending an electrical impulse, a cell needs time to reset before it can send another impulse, so continuous and rapid communication is not possible.
(b) Chemical communication is better than electrical impulses because chemicals released by cells can diffuse to many nearby cells, not just cells connected by nerves. This allows wider and more flexible communication. Also, chemicals can cause longer-lasting effects and regulate several processes at once, which electrical impulses cannot do efficiently.

> **Key Points: Electrical impulses limited to connected cells - Cells need recovery time after impulses - Chemical signals reach more cells and allow flexible, lasting communication**

Question 37.

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.

[3 Marks]

Answer: To obtain a virtual and magnified image using a concave mirror, the object must be placed between the focal point (F) and the mirror surface. Given:
Focal length, f = -18 cm (negative for concave mirror)
Magnification, m = +2 (positive sign indicates virtual and magnified image)
Magnification formula: m = -v / u
So, v = -m * u = -2u

Using mirror formula: 1/f = 1/v + 1/u
Substitute values: 1/(-18) = 1/(-2u) + 1/u
1/(-18) = (-1/2u) + 1/u = (-1/2u + 2/2u) = 1/(2u)
Therefore, 1/(-18) = 1/(2u) => 2u = -18 => u = -9 cm
Since object distance u is negative, the object is 9 cm in front of the mirror.
This position is between the focal point (18 cm) and the mirror (0 cm).
Hence, placing the object 9 cm in front of the concave mirror of focal length 18 cm will produce a virtual and magnified image with magnification +2.

Key Points: Object placed between focal point and mirror - Object distance is -9 cm - Image is virtual and magnified with magnification +2

Question 38.

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

(i) Classify these materials as conductor, alloy and insulator.

(ii) 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.

[3 Marks]

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

Answer: (i) Material A is a conductor because it has very low resistivity, allowing electric current to flow easily. Material B is an alloy because it has higher resistivity than pure conductors and is used in heating elements due to its resistance properties. Material C is an insulator as it has very high resistivity, preventing the flow of electric current.
(ii) Examples and uses:
Conductor - Copper: Used in electric iron for wiring because it allows efficient current flow.
Alloy - Nichrome: Used in the heating element of electric stove or electric iron because it resists oxidation at high temperatures and produces heat when current passes.
Insulator - Bakelite: Used as the handle of electric stove or iron to prevent electric shock because it does not conduct electricity.

Key Points: Material A is a conductor with low resistivity - Material B is an alloy used in heating elements due to moderate resistivity - Material C is an insulator with high

resistivity used for safety in electrical appliances

Question 39.

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

[3 Marks]

Answer: (a) **Decomposers** are organisms that break down dead plants and animals into simpler substances. They help in the process called decomposition.
(b) Two examples of decomposers are fungi and bacteria.
(c) Decomposers maintain balance in an ecosystem by breaking down dead material and releasing nutrients back into the soil. These nutrients are then used by plants to grow, thus keeping the nutrient cycle going and supporting life in the ecosystem.

Key Points: Organisms that break down dead matter - Examples: fungi and bacteria - They recycle nutrients and maintain the nutrient cycle

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Section E

Question 40.

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'.

[5 Marks]

Answer: (a) Identification of compounds A, B and C: Compound A has the molecular formula C_2H_6O because combustion of C produces 2 moles of CO_2 and 3 moles of H_2O, indicating 2 carbons and 6 hydrogens. Compound A is ethanol (C_2H_5OH). When heated with hot concentrated H_2SO_4, ethanol (A) loses water to form an alkene (B), which is ethene (C_2H_4). Compound B on addition of 1 mole hydrogen gas with nickel catalyst forms ethane (C_2H_6), which is compound C.

Structures:
A: Ethanol (C_2H_5OH) - CH_3-CH_2OH
B: Ethene (C_2H_4) - CH_2=CH_2
C: Ethane (C_2H_6) - CH_3-CH_3

(b) Chemical equations of the reactions involved:

1. Dehydration of ethanol:

CH_3-CH_2OH (A) $\rightarrow$[hot conc. H_2SO_4] CH_2=CH_2 (B) + H_2O

2. Hydrogenation of ethene:

CH_2=CH_2 (B) + H_2 $\rightarrow$[Ni catalyst] CH_3-CH_3 (C)

3. Combustion of ethane:

CH_3-CH_3 (C) + 3.5 O_2 $\rightarrow$ 2 CO_2 + 3 H_2O

(c) Role of concentrated sulphuric acid: Concentrated H_2SO_4 acts as a dehydrating agent which removes a molecule of water from ethanol (A) during heating. It also acts as an acid catalyst to speed up the elimination reaction, converting ethanol into ethene (B). It provides acidic medium and helps in protonation of hydroxyl group facilitating water removal.

Summary:

CH_3-CH_2OH (A) --hot conc. H_2SO_4--> CH_2=CH_2 (B) + H_2O

CH_2=CH_2 (B) + H_2 --Ni catalyst--> CH_3-CH_3 (C)

CH_3-CH_3 (C) + 3.5 O_2 --> 2 CO_2 + 3 H_2O

Key Points: Identification of A as ethanol - Dehydration of ethanol by conc. H2SO4 forms ethene (B) - Hydrogenation of ethene forms ethane (C) - Combustion data confirms molecular formula - Role of conc. H2SO4 as dehydrating agent and acid catalyst

Question 41.

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.

[5 Marks]

Answer: (a) Compound 'A' is acetic acid (ethanoic acid), which is commonly used as a preservative in pickles. Its molecular formula is $C_2H_4O_2$. The structure of acetic acid is

CH_3 - COOH

(b) When acetic acid reacts with ethanol, it forms an ester known as ethyl acetate – compound 'B', which has a sweet smell. The chemical equation is:

$CH_3COOH + CH_3CH_2OH \rightarrow CH_3COOCH_2CH_3 + H_2O$

Here, an acid catalyst such as concentrated H_2SO_4 is used to speed up the reaction without getting consumed. It helps in protonating the carbonyl group of acetic acid and making it more reactive towards ethanol.

(c) Compound 'A', acetic acid, can be obtained back from compound 'B' by hydrolysis in the presence of acid or base. This process breaks the ester bond and reforms acetic acid and ethanol.

(d) Acetic acid can be obtained from ethanol by oxidation. When ethanol is heated with an oxidizing agent like acidified potassium dichromate ($K_2Cr_2O_7$) or potassium permanganate ($KMnO_4$) in acidic medium, it gets oxidized first to acetaldehyde and then further oxidized to acetic acid:

$CH_3CH_2OH + [O] \rightarrow CH_3CHO \rightarrow CH_3COOH$

(e) When acetic acid reacts with washing soda (Na_2CO_3), carbon dioxide (CO_2) gas is produced along with sodium acetate and water:

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

This gas causes fizzing or effervescence.

Key Points: Acetic acid is compound A with formula C2H4O2 and structure CH3COOH - Acid catalyst speeds formation of ester B (ethyl acetate) from A and ethanol - Hydrolysis of B gives back A - Oxidation of ethanol with acidified K2Cr2O7 gives A - CO2 is produced when A reacts with washing soda

Question 42.

(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?

(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.

[5 Marks]

Answer: (i) **Regeneration** is the process by which some organisms can regrow lost or damaged body parts. This happens because special cells in their body divide and develop into the missing parts, helping the organism to recover completely. For example, **Planaria** can regenerate their body parts if cut into pieces; each piece can grow into a new complete organism. On the other hand, organisms like **earthworms** do not show this kind of regeneration fully. This is because they lack the special stem cells or organised system required for regrowth of complex structures and their cells have limited ability to multiply and differentiate into all types of tissues needed.

(ii) The dark green filamentous structures in pond water are **algae**, specifically filamentous algae such as Spirogyra. These reproduce by a method called **conjugation**. In conjugation, two filaments of algae come close, and a tube forms between adjacent cells of the two filaments. The contents of one cell (male gamete) move through this tube to fuse with the contents of the other cell (female gamete).

This fusion results in the formation of a zygote, which develops into a new filament. This process helps in sexual reproduction and increases genetic variation.

Key Points: Regeneration is regrowth of lost body parts - Planaria shows regeneration, earthworms do not - Lack of special cells prevents regeneration in some organisms - Filamentous structures in pond water are algae - Filamentous algae reproduce by conjugation - Conjugation involves fusion of cells from two filaments

Question 43.

(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

(ii) Write any two characteristics of sperms.

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

[5 Marks]

Answer: (i) Parts performing the functions in the male reproductive system:
(a) The part that carries sperm is called the **vas deferens** or sperm duct.
(b) The production of male gametes or sperms takes place in the **testes**.
(c) The secretion that makes the transport of sperms easier is produced by the **prostate gland** and **seminal vesicles**. These secretions form the semen which nourishes and helps sperms to move.
(d) The part that provides a suitable temperature for sperm formation is the **scrotum**. It keeps the testes at a temperature slightly lower than the body temperature which is important for healthy sperm production.

(ii) Two characteristics of sperms:
1. Sperms have a tail called **flagellum** that helps them to swim towards the ovum.
2. Sperms are very small and have a head containing genetic material (DNA) to fertilize the female egg.

(iii) Surgical contraceptive methods:
Surgical methods are permanent methods of birth control used to prevent the production or transport of sperms.
In males, this method is called **vasectomy**, where the vas deferens is cut and tied to stop sperm from entering semen.

Side effect: The main side effect is that vasectomy is permanent and difficult to reverse. Some men may also experience pain or swelling after the surgery.

Key Points: Vas deferens carries sperm - Testes produce male gametes - Prostate gland and seminal vesicles produce secretion for sperm transport - Scrotum maintains suitable temperature for sperm formation - Sperms have flagellum and contain DNA - Vasectomy is a surgical contraceptive method - Vasectomy causes permanent infertility and possible pain after surgery

Question 44.

(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.)

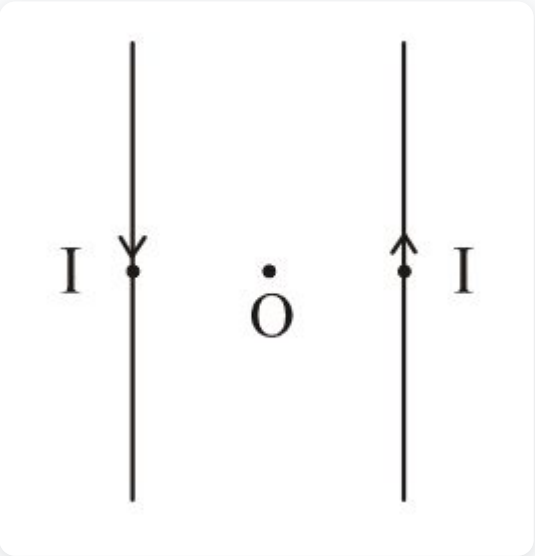
(ii) In our houses we receive A.C. electric power of 220 V. In electric iron or electric heater cables having three wires with insulation of three different colours — red, black and green are used to draw current from the mains.

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

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

(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?

[5 Marks]



Answer: (i) The magnetic field lines around two parallel conductors carrying current in opposite directions form concentric circles around each conductor. Since the currents are opposite, at point O which is equidistant from both conductors, the magnetic fields due to each wire add up in the same

direction. The direction of the magnetic field around each wire is given by the right-hand thumb rule: point your thumb in the direction of current, your curled fingers show the direction of magnetic field. The magnetic field lines between the two wires are in the same direction at point O, so the net magnetic field at O is the vector sum of both fields.

(ii) (a) The three wires are called live wire (red), neutral wire (black), and earth wire (green).

(ii) (b) The potential difference between the red wire (live) and the black wire (neutral) is 220 V.

(ii) (c) The green wire is the earth wire. Its role is to safely conduct any leakage current from the metallic body of the appliance to the ground, preventing electric shocks to the user and protecting the appliance from damage.

Key Points: Magnetic field lines form concentric circles - Currents in opposite directions produce magnetic fields adding at point O - Wires called live (red), neutral (black), earth (green) with 220 V potential difference - Earth wire provides safety by grounding leakage current

Question 45.

(i) By using the given experimental set-up. How can it be shown that:

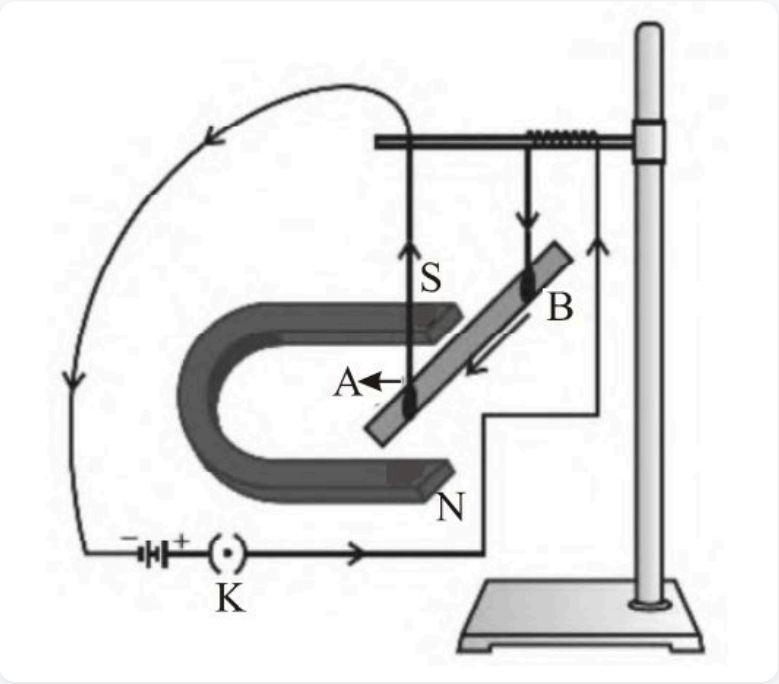
(a) a force is exerted on the current-carrying B conductor AB when it is At placed in a magnetic field.

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

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

(iii) State Fleming's left hand rule.

[5 Marks]



Answer: (i) (a) When a current-carrying conductor AB is placed between the poles of a magnet, the magnetic field interacts with the moving charges in the conductor, exerting a force on it. This force can be observed as a movement or deflection of the conductor. This shows that a force is exerted on the conductor AB in the magnetic field.

(b) The direction of force on the current-carrying conductor can be reversed in two ways:

1. By reversing the direction of the current in the conductor.
2. By reversing the direction of the magnetic field.

In both cases, the direction of force changes as predicted by Fleming's left-hand rule.

(ii) The magnitude of the force on the conductor is highest when the conductor is placed perpendicular to the magnetic field and the current is also perpendicular to the magnetic field. This means the conductor, current and magnetic field are mutually perpendicular.

(iii) Fleming’s left hand rule states that if you stretch the thumb, forefinger, and middle finger of your left hand such that they are mutually perpendicular to each other:

- The Forefinger points in the direction of the magnetic Field (from North to South).
- The seCond finger points in the direction of the Current (from positive to negative).
- The thuMb points in the direction of the Motion or the force acting on the conductor.

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

Key Points: Force on current-carrying conductor in magnetic field - Direction of force reverses when current or magnetic field is reversed - Maximum force when conductor is perpendicular to magnetic field - Fleming's left hand rule defines directions of magnetic field, current, and force