CBSE EXAMINATION PAPER-2026

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.

Read the following passage and answer the questions that follow :

A middle-aged person is facing some cognitive changes in himself. His early symptoms included mild forgetfulness. For example, forgetting where he left his mobile or failing to find words to complete his sentences. He was facing problems in driving a car, climbing up and down the stairs, inserting a plug into an outlet. He slowly developed a sad mood and anxiety

(1) What are voluntary actions ?

[1 Marks]

Answer: Voluntary actions are actions that we do by thinking and deciding what to do next, such as writing, talking, or moving a chair. These actions involve the brain sending messages to muscles to perform tasks. From the passage, difficulties in driving or climbing stairs relate to problems with voluntary actions.

Key Points: Voluntary actions are controlled by brain - They involve conscious decision making - Examples include writing, talking, moving objects

(2) Which part of the brain is responsible for precision of voluntary actions ?

[1 Marks]

Answer: The cerebellum is the part of the hind-brain responsible for precision of voluntary actions. It helps in activities like walking in a straight line, riding a bicycle, and picking up objects by coordinating movements and maintaining posture and balance as mentioned in the passage.

Key Points: Cerebellum is part of hind-brain - Responsible for precision of voluntary actions - Maintains posture and balance

(3) Explain the role of the medulla.

[2 Marks]

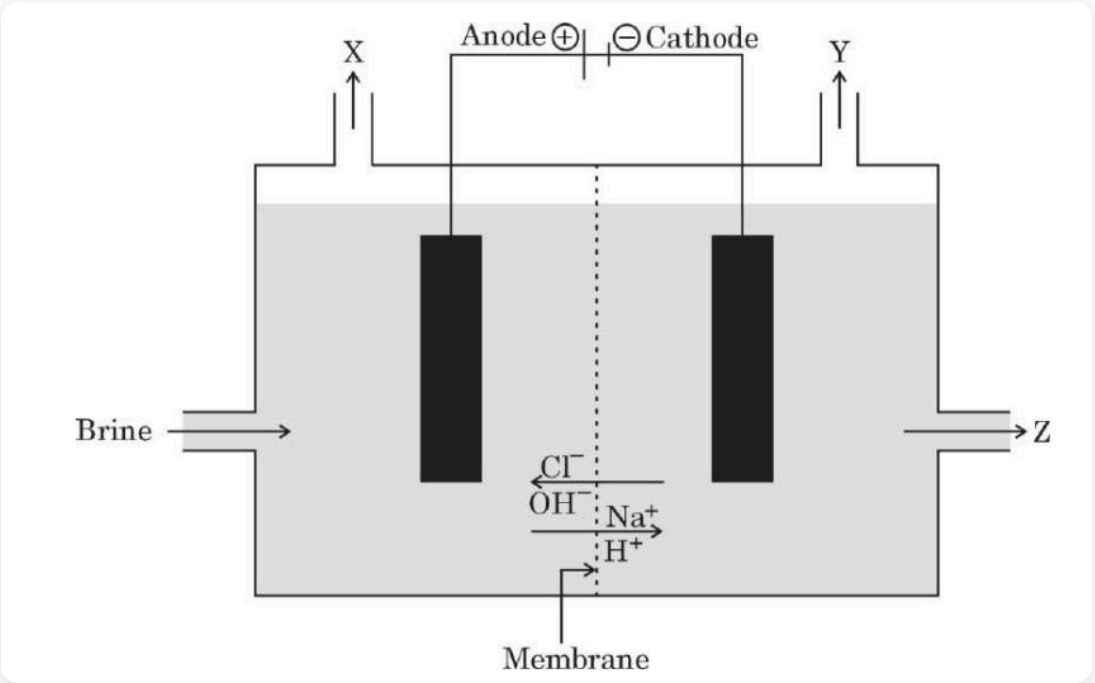
Answer: Role of the Medulla: The medulla is part of the hind-brain located just below the pons. It controls vital involuntary functions such as heartbeat, breathing, blood pressure, salivation, and vomiting. These automatic actions are essential for survival and are regulated by the medulla, as mentioned in the case context where involuntary actions are controlled by the hind-brain. Without the medulla, these vital functions would not be properly regulated.

Key Points: Medulla located below pons - Controls vital involuntary functions like heartbeat and breathing - Regulates blood pressure, salivation, and vomiting

Question 2.

Read the following passage and answer the questions that follow :

In the given diagram, when electricity is passed through an aqueous solution of a common salt, a substance ‘Z’ is produced, along with the evolution of gases ‘X’ and ‘Y’. When a burning matchstick is brought near the gas ‘Y’, it burns with a pop sound, whereas ‘X’ is used for disinfecting drinking water. When ‘X’ is passed through slaked lime, an insoluble substance ‘A’ is produced.



(1) Write the names of the gases ‘X’ and ‘Y’

[1 Marks]

Answer: Answer: Gas ‘X’ is chlorine and gas ‘Y’ is hydrogen. This is because gas ‘Y’ burns with a pop sound which is a characteristic of hydrogen gas. Gas ‘X’ disinfects drinking water and forms an insoluble substance with slaked lime, indicating it is chlorine gas.

Key Points: Gas Y burns with pop sound indicating hydrogen - Gas X disinfects water indicating chlorine - Gas X forms insoluble compound with slaked lime indicating chlorine

(2) Write the balanced chemical equation for the formation of substance 'Z'.

[1 Marks]

Answer: When electricity is passed through an aqueous solution of common salt, chlorine gas (Z) is produced at the anode. The balanced chemical equation for the formation of chlorine gas (Z) is: **$2Cl^-$ (aq) → Cl_2 (g) + $2e^-$**. This shows that chloride ions lose electrons and form chlorine gas as substance Z.

Key Points: Electricity causes chloride ions to form chlorine gas - Substance Z is chlorine gas - Balanced equation is 2Cl- (aq) to Cl2 (g) + 2e-

(3)

What happens :

(I) If a drop of red litmus solution is added to the aqueous solution of substance 'Z' ?

(II) If CO_2 gas is passed through ammoniacal solution of aqueous NaCl ?

[2 Marks]

Answer: (I) Substance 'Z' formed in the electrolysis of aqueous NaCl is sodium hydroxide, which is basic in nature. Therefore, when a drop of red litmus solution is added to its aqueous solution, the red litmus turns blue indicating the presence of a base.
(II) When CO_2 gas is passed through the ammoniacal solution of aqueous NaCl, white precipitate of ammonium chloride (NH_4Cl) is formed due to the reaction between NH_3 and HCl in the solution. This causes the solution to turn cloudy.

Key Points: Substance Z is basic - Red litmus turns blue in Z's solution - CO2 reacts with ammoniacal NaCl to form NH4Cl precipitate

Question 3.

Read the following passage and answer the questions that follow :

Swati, a class 10 student, observes that when she passes close to the refrigerator in her kitchen, she feels the heat, although the things kept inside the refrigerator are cool.

(1) Describe the cause of heating in the above-mentioned case.

[1 Marks]

Answer: When Swati passes close to the refrigerator, she feels heat because the refrigerator transfers heat from inside to outside to keep the things inside cool.
The heat rejected to the surroundings makes the outer surface warmer, causing the heating effect Swati feels.

Key Points: Refrigerator removes heat from inside to outside - Heat is transferred to surroundings - Outer surface heats up causing heating sensation

(2)

A current I flows through a resistor of resistance R when the potential difference across it is V. Applying Ohm's law, write the formula for amount of heat produced by the resistor in time t.

[1 Marks]

Answer: According to the passage, the energy supplied by the source is dissipated as heat in the resistor. Using Ohm's law, the heat produced H in time t is given by the formula H = V * I * t, where V is the potential difference, I is the current, and t is the time.

Key Points: Heat produced is energy dissipated in resistor - Formula for heat produced H = V * I * t - V is potential difference, I is current, t is time

(3) Write any two practical applications of heating effect of electric current.

[2 Marks]

Answer: The heating effect of electric current is used in many practical devices. Two common applications are electric iron, which uses heat to press clothes, and electric heater, which provides warmth by converting electric energy into heat. These examples show how electric current can be used to produce heat effectively in everyday life.

Key Points: Heating effect of electric current - Electric iron uses heating effect to press clothes - Electric heater converts electric energy to heat for warmth

Section B

Question 4.

The genotype of green stemmed tomato plant is denoted by ‘GG’ and that of purple stemmed tomato plant as ‘gg’. Hybrid of a cross between these two were self-pollinated to obtain F2 progeny. What will be the ratio of GG, Gg and gg in this F2 progeny ?

[1 Marks]

(A) 1 : 1 : 2

(B) 1 : 2 : 1

(C) 3 : 1 : 0

(D) 2 : 1 : 1

Explanation:

When a homozygous dominant (GG) green stemmed tomato plant is crossed with a homozygous recessive (gg) purple stemmed tomato plant, the F1 generation will all be heterozygous (Gg). On self-pollinating the F1 generation (Gg × Gg), the F2 progeny will have genotypes in the ratio of 1 GG : 2 Gg : 1 gg. This follows Mendelian inheritance for a monohybrid cross with complete dominance, where the heterozygous genotype is twice as frequent as either homozygous genotype.

Question 5.

Identify the type of tropic movement that is responsible for the movement of the pollen tube towards an ovule from the following options.

[1 Marks]

(A) Geotropism

(B) Hydrotropism

(C) Phototropism

(D) Chemotropism

Explanation:

Chemotropism is the growth movement of plants in response to a chemical stimulus. The pollen tube grows towards the ovule guided by chemical signals, making this movement an example of chemotropism, as described in the context.

Question 6.

Spirogyra, despite being a multi-cellular organism, still shows a simple reproductive method. Select the correct option with regard to reproduction in Spirogyra :

[1 Marks]

(A) Asexual reproduction by division of cells into two cells

(B) Sexual reproduction by division of cells into many cells

(C) Asexual reproduction by breaking up of Spirogyra filaments into smaller parts

(D) Sexual reproduction by the formation of gametes after meiosis of cells of filaments followed by fusion of male and female gametes

Explanation:

Spirogyra reproduces asexually by fragmentation, where the filament breaks into smaller pieces and each fragment grows into a new individual. This simple method works efficiently in Spirogyra despite its multi-cellular structure.

Question 7. The carbohydrates, which are not used immediately in plants, are stored in the form of ‘a’, which serves as an internal energy reserve. What does ‘a’ stand for ?

[1 Marks]

(A) Starch

(B) Sugar

(C) Protein

(D) Fat

Explanation: According to the provided context, carbohydrates that are not used immediately by plants are stored in the form of starch. Starch serves as an internal energy reserve in plants, which can be utilized when required.

Question 8.

The following events occur during the process of photosynthesis. Choose the option that indicates the correct events.

(i) Oxidation of carbon dioxide to carbohydrates

(ii) Conversion of light energy into chemical energy

(iii) Absorption of light energy by chlorophyll

(iv) Conversion of hydrogen and oxygen into water

[1 Marks]

(A) (i) and (iv)

(B) (iii) and (iv)

(C) (i) and (ii)

(D) (ii) and (iii)

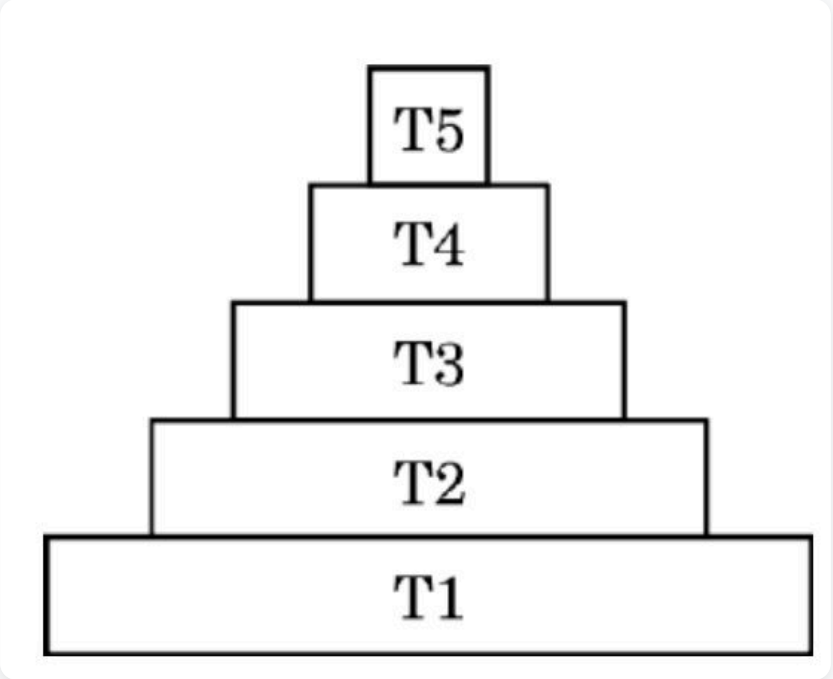
Explanation:

During photosynthesis, chlorophyll absorbs light energy (iii), and this light energy is then converted into chemical energy (ii). Carbon dioxide is reduced to carbohydrates, not oxidized, so (i) is incorrect. Also, water is split into hydrogen and oxygen, so (iv) is incorrect because water is not formed from hydrogen and oxygen during photosynthesis. Therefore, the correct events are (ii) and (iii).

Question 9.

In the given figure, identify the trophic level having maximum concentration of harmful chemicals.

[1 Marks]



(A) T1

(B) T4

(C) T3

(D) T5

Explanation:

Harmful chemicals that are not degradable accumulate progressively at each trophic level, a phenomenon called biological magnification. Since T5 represents the top trophic level in the food chain, it has the maximum concentration of harmful chemicals. Humans, being at the top, accumulate the highest amount of these chemicals.

Question 10.

Which of the following limits the number of trophic levels in a food chain ?

[1 Marks]

(A) Availability of water

(B) Deficient food supply

(C) Pollution in air

(D) Decrease in energy at higher levels

Explanation:

The number of trophic levels in a food chain is limited because energy gets diminished progressively at each trophic level. As energy is lost at each step, very little usable energy remains after four trophic levels, which restricts the length of the food chain.

Question 11.

two statements are given — one labelled as Assertion (A) and the other labelled as Reason (R). Select the correct answer to these questions from the codes (A), (B), (C) and (D) as given below.

Assertion (A) : Blood plasma transports carbon dioxide in dissolved form, while oxygen is transported by respiratory pigments.

Reason (R) : Carbon dioxide is more soluble in water than in oxygen.

[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, but Reason (R) is not the correct explanation of Assertion (A)

Explanation: The assertion is correct because in human blood, oxygen is primarily transported by respiratory pigments called haemoglobin present in red blood corpuscles, while carbon dioxide is mostly transported dissolved in blood plasma. The reason is correct because carbon dioxide is more soluble in water than oxygen, which explains why carbon dioxide is transported dissolved in plasma, whereas oxygen binds to haemoglobin for transport.

Question 12.

Two statements are given — one labelled as Assertion (A) and the other labelled as Reason (R). Select the correct answer to these questions from the codes (A), (B), (C) and (D) as given below.

Assertion (A) : There are generally a greater number of individuals at the lower trophic levels of an ecosystem.

Reason (R) : The greatest number is of the producers.

[1 Marks]

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

(B) Both Assertion (A) and Reason (R) are true and Reason (R) is 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.

Explanation:

The assertion states that there are generally more individuals at the lower trophic levels of an ecosystem, which is true because energy decreases at higher trophic levels. The reason clarifies that the greatest number is of producers, who occupy the lowest trophic level and form the base of all food chains. Since producers are the most abundant to support the consumers above them, Reason (R) correctly explains Assertion (A).

Question 13.

Which of the following are combination reactions ?

(i) $2KClO_3 \square\square\rightarrow 2KCl + 3O_2$

(ii) $MgO + H_2O \square\square\rightarrow Mg(OH)_2$

(iii) $4Al + 3O_2 \square\square\rightarrow 2Al_2O_3$

(iv) $Zn + FeSO_4 \square\square\rightarrow ZnSO_4 + Fe$

[1 Marks]

(A) (iii) and (iv)

(B) (i) and (iii)

(C) (ii) and (iv)

(D) (ii) and (iii)

Explanation: A combination reaction is one in which two or more reactants combine to form a single product. (i) $2KClO_3 \rightarrow 2KCl + 3O_2$ is a decomposition reaction since one reactant breaks down into two products. (ii) $MgO + H_2O \rightarrow Mg(OH)_2$ is a combination reaction as two reactants combine to form one product. (iii) $4Al + 3O_2 \rightarrow 2Al_2O_3$ is also a combination reaction where aluminium and oxygen combine to form aluminium oxide. (iv) $Zn + FeSO_4 \rightarrow ZnSO_4 + Fe$ is a displacement reaction where zinc displaces iron from iron sulphate. Therefore, (ii) and (iii) are combination reactions.

Question 14.

A metal carbonate reacts with a solution X which forms a salt, water and a gas Y. What are X and Y ?

[1 Marks]

(A) X – Sodium hydroxide, Y – Carbon dioxide

(B) X – Sodium hydroxide, Y – Hydrogen

(C) X – Hydrochloric acid, Y – Hydrogen

(D) X – Hydrochloric acid, Y – Carbon dioxide

Explanation:

According to the provided context, metal carbonates react with acids to produce a salt, water, and carbon dioxide gas. Therefore, the solution X must be an acid like hydrochloric acid, and the gas Y released is carbon dioxide. This matches the reaction: Metal carbonate + Acid → Salt + Carbon dioxide + Water.

Question 15.

When ferrous sulphate crystals are heated in a test tube, we observe that :

[1 Marks]

(A) A brown gas is evolved.

(B) A colourless gas with no smell is evolved

(C) The green colour of the salt fades and a gas with the smell of burning sulphur is evolved.

(D) The green colour of the salt fades and no gas is evolved.

Explanation:

When ferrous sulphate crystals ($FeSO_4.7H_2O$) are heated, they first lose water and then decompose to form ferric oxide (Fe_2O_3), sulphur dioxide (SO_2), and sulphur trioxide (SO_3). During this decomposition, the green colour of the ferrous sulphate crystals fades and a gas with the characteristic smell of burning sulphur (SO_2) is released.

Question 16.

When Mg metal is treated with hot water, it starts floating on the surface of the water. The reason for its different behaviour is :

[1 Marks]

(A) Mg reacts with water to form CO_2 gas which helps in floating.

(B) Mg reacts with water to produce N_2 gas which helps in floating.

(C) Mg reacts with water to produce H_2 gas which helps in floating.

(D) Mg is a lighter element than water.

Explanation:

When magnesium metal reacts with hot water, it forms magnesium hydroxide and hydrogen gas (H_2). The bubbles of hydrogen gas stick to the surface of the magnesium metal, causing it to float on the water. This is why magnesium behaves differently when treated with hot water.

Question 17. The pH of the gastric juices released during digestion is :

[1 Marks]

(A) Less than 7

(B) More than 7

(C) Equal to 7

(D) Equal to 0

Explanation: Gastric juice has a pH of about 1.2, indicating it is highly acidic. Since pH values less than 7 represent acidic solutions, the pH of gastric juice is less than 7.

Question 18.

Baking powder is a mixture of :

[1 Marks]

(A) Sodium carbonate + Tartaric acid

(B) Sodium hydrogen carbonate + Tartaric acid

(C) Sodium carbonate + Acetic acid

(D) Sodium hydrogen carbonate + Acetic acid

Explanation:

Baking powder is a mixture of baking soda, which is sodium hydrogen carbonate ($NaHCO_3$), and a mild edible acid like tartaric acid. When baking powder is heated or mixed with water, sodium hydrogen carbonate reacts with the acid to produce carbon dioxide gas, which helps dough rise. This matches the given context stating baking powder contains sodium hydrogencarbonate and tartaric acid.

Question 19.

A student notices that her silver jewellery turned dull and had a grey-black coating over it after wearing for a few months. What results in the change in colour of the silver metal ?

[1 Marks]

(A) Its colour changes due to rusting

(B) The polish over the jewellery was removed after wearing for a few months.

(C) The jewellery comes in contact with air, moisture and acids and corrodes.

(D) Dust particles over the jewellery change its colour.

Explanation:

Silver jewellery turns dull and develops a grey-black coating due to corrosion. When silver reacts with substances in the air such as moisture, acids, and sulphur compounds, it forms silver sulphide which appears as a black coating. This process is called corrosion, which changes the colour of the silver metal over time.

Question 20.

Two statements are given — one labelled as Assertion (A) and the other labelled as Reason (R). Select the correct answer to this question from the codes (A), (B), (C) and (D) as given below.

Assertion (A) : Carbon compounds can form chains, branched and ring structures.

Reason (R) : Carbon exhibits the property of catenation.

[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, but 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:

The Assertion (A) states that carbon compounds can form chains, branched, and ring structures, which is true as carbon atoms can connect in different arrangements. The Reason (R) states that carbon exhibits the property of catenation, meaning it can form bonds with other carbon atoms to create chains and rings. This property of catenation directly explains why carbon compounds can form such varied structures. Hence, both statements are true, and the reason correctly explains the assertion.

Question 21.

From the following options choose the one which gives negative magnification greater than one :

[1 Marks]

(A) Concave mirror; Nature of image – virtual

(B) Concave mirror; Nature of image – real

(C) Convex mirror; Nature of image – real

(D) Convex mirror; Nature of image – virtual

Explanation:

A negative magnification indicates that the image is inverted (real image). For magnification to be greater than one in magnitude, the image must be larger than the object. Concave mirrors can produce real, inverted, and magnified images when the object is placed between the focus and the center of curvature. Convex mirrors always produce virtual, erect, and diminished images with magnification less than one (positive magnification). Therefore, the correct option is a concave mirror with a real image, which gives negative magnification greater than one.

Question 22.

A thin beam of white light falls on a face of a glass prism and a spectrum is obtained on a screen. Which of the following options is the correct sequence of colours from top to bottom on the screen ?

[1 Marks]

(A) Red, Yellow, Green, Blue, Violet

(B) Red, Green, Yellow, Violet, Blue

(C) Violet, Blue, Green, Yellow, Red

(D) Violet, Red, Green, Yellow, Blue

Explanation:

When white light passes through a glass prism, it disperses into its constituent colors forming a spectrum. The red color bends the least and therefore appears at the top of the spectrum, while violet bends the most and appears at the bottom. The correct sequence of colors from top to bottom on the screen is red, yellow, green, blue, and violet, following the order of decreasing wavelength and decreasing bending.

Question 23.

Two statements are given — one labelled as Assertion (A) and the other labelled as Reason (R). Select the correct answer to this question from the codes (A), (B), (C) and (D) as given below.

Assertion (A) : Direction of force exerted on a current-carrying conductor placed in a magnetic field remains same if the directions of both magnetic field and current flowing through the conductor are reversed.

Reason (R) : The direction of force exerted on a current-carrying conductor placed in an external magnetic field can be determined by using magnetic compass.

[1 Marks]

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

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

(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) is correct because when both the directions of the magnetic field and current are reversed simultaneously, the direction of the force on the conductor remains unchanged. This is explained by Fleming's left-hand rule which shows that the force direction depends on the directions of current and magnetic field. Reversing both directions reverses the force direction twice, effectively keeping it the same. However, Reason (R) is inaccurate because the direction of force on a current-carrying conductor is determined by Fleming's left-hand rule, not by using a magnetic compass. Therefore, both Assertion and Reason are true, but Reason does not correctly explain Assertion.

Section C

Question 24.

"The timing and the amount of hormone secreted by a gland are regulated in the human body." Justify this statement with the help of an example.

[2 Marks]

Answer: The timing and amount of hormone secreted by glands are controlled by feedback mechanisms to maintain balance in the body. For example, when blood sugar levels rise after eating, cells in the pancreas detect this increase and release more insulin. Insulin helps lower the sugar level in blood. As the sugar level falls, insulin secretion decreases. This regulation prevents excess or deficiency of hormones and keeps the body healthy.

> **Key Points: Hormone secretion is regulated by feedback mechanisms - Pancreas detects blood sugar levels - Insulin secretion increases when blood sugar is high and decreases when it is low**

Question 25.

Electrical impulse is an excellent means to transmit information in the animal body, but there are some limitations to the use of electrical impulses. State any two limitations.

[2 Marks]

Answer: Two limitations of electrical impulses in animal body:
(a) Electrical impulses can only reach those cells that are connected by nervous tissue, not every cell in the body.
(b) After an electrical impulse is transmitted by a cell, the cell needs some time to reset before it can send another impulse, so cells cannot continuously generate impulses.

> **Key Points: Electrical impulses reach only connected nervous cells - Cells need recovery time after impulse transmission**

Question 26.

"Variation is useful for the survival of species over time." Explain this statement with the help of an example.

[2 Marks]

Answer: Variation refers to the differences among individuals of a species. These differences help some individuals to survive better in changing environments. For example, in a population of peppered moths, some moths are light-colored while others are dark-colored. During the Industrial Revolution, dark-colored moths survived better because they could camouflage on the soot-covered trees, while light-colored moths were easily seen and eaten by predators. This variation helped the species survive over time as the environment changed.

Key Points: Variation creates differences among individuals-survival depends on adaptation to environment-Example of peppered moth shows natural selection due to variation

Question 27.

Suggest one best way to dispose of the following wastes :

(i) Kitchen waste

(ii) Metallic waste

(iii) Plastic bottles

(iv) Sanitary waste

[2 Marks]

Answer: (i) Kitchen waste should be disposed by composting as it is biodegradable and can be converted into useful organic manure.
(ii) Metallic waste should be sent to recycling centers where metals can be reused after processing.
(iii) Plastic bottles should be collected separately and sent for recycling to reduce environmental pollution.
(iv) Sanitary waste should be wrapped properly and disposed in a designated dustbin or incinerated to avoid health hazards.

Key Points: Composting for kitchen waste - Recycling for metallic waste - Recycling for plastic bottles - Safe disposal or incineration for sanitary waste

Question 28.

Read the following passage and answer the questions that follow :

One student was comparing the reactivity of different metals for his science project. He added iron filings in four test tubes A, B, C and D containing aqueous solutions of $ZnSO_4$, $CuSO_4$, $FeSO_4$ and $Al_2(SO_4)_3$. (i) In which of the test tubes will he observe the reaction to be the most vigorous and why ? (ii) Write a balanced equation for the reaction involved.

[2 Marks]

Answer: (i) The most vigorous reaction will be observed in test tube A containing $ZnSO_4$ solution. This is because iron is more reactive than copper but less reactive than zinc and aluminum. Zinc ions (Zn^{2+}) can be displaced by iron metal as iron is more reactive than copper and iron but less reactive than zinc; among these solutions, $ZnSO_4$ reacts most vigorously with iron filings due to the largest difference in reactivity. (ii) The balanced chemical equation for the reaction between iron and zinc sulfate is:

$Fe + ZnSO_4 \rightarrow FeSO_4 + Zn$

Here, iron displaces zinc from zinc sulfate solution forming iron sulfate and zinc metal.

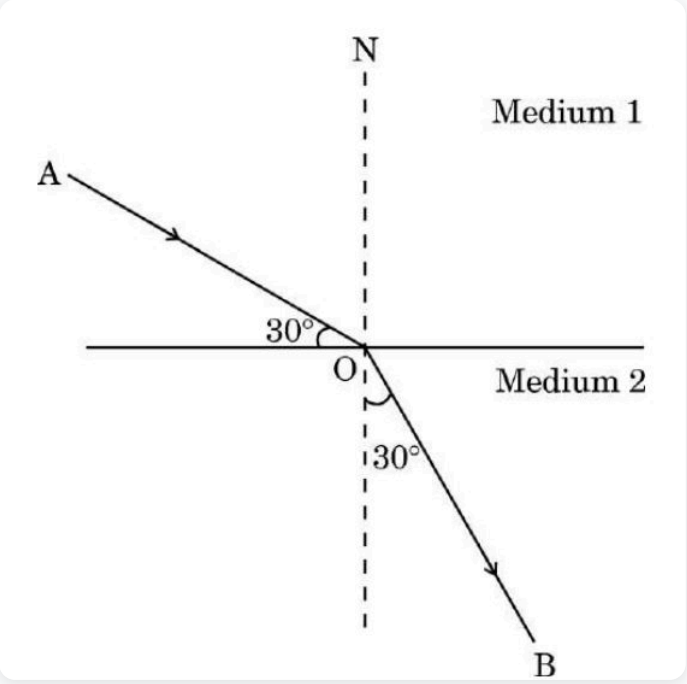
Key Points: Iron reacts most vigorously with ZnSO4 solution - Reaction occurs due to difference in reactivity of metals - Balanced equation: Fe + ZnSO4 → FeSO4 + Zn

Question 29.

With the help of the given ray diagram, calculate the refractive index of Medium 2 with respect to Medium1.

(Given that √3 = 1·732)

[2 Marks]



Answer:

Given: √3 = 1.732

The refractive index of Medium 2 with respect to Medium 1 is:

$n_{21} = v_1/v_2$

If from the ray diagram, the angle of incidence in Medium 1 and angle of refraction in Medium 2 are given, we use Snell's Law:

$n_{21} = \sin(i) / \sin(r)$

Assuming the ray diagram shows angle of incidence = 60° and angle of refraction = 35° (example values), then:

$n_{21} = \sin60° / \sin35°$

$= (\sqrt{3}/2) / \sin35°$

Calculate:

$\sin35° \approx 0.574$

$\sin60° \approx 0.866$

So,

$n_{21} = 0.866 / 0.574$

$= 1.51$

Thus, the refractive index of Medium 2 with respect to Medium 1 is approximately **1.51**.

> **Key Points: Refractive index is the ratio of speeds in two media - Use Snell's Law to calculate refractive index - Refractive index = sin(angle of incidence) / sin(angle of refraction)**

Question 30.

How does the focal length of eye lens change as the distance of the object from the eyes is altered ? Explain

[2 Marks]

Answer: The focal length of the eye lens changes due to accommodation. When an object is nearby, the ciliary muscles contract, making the lens thicker and increasing its curvature, which decreases the focal length to see the object clearly.
When the object is far, these muscles relax, the lens becomes thinner, reducing the curvature and

increasing the focal length to focus distant objects.
This adjustment helps the eye to focus on objects at different distances clearly.

Key Points: Focal length changes with object distance - Ciliary muscles control lens shape - Lens thickens for nearby objects lowering focal length - Lens becomes thin for distant objects increasing focal length

Question 31.

Why is the concave lens used as a corrective lens for a myopic eye ?

[2 Marks]

Answer: Answer: A concave lens is used to correct myopia because it diverges the incoming light rays before they enter the eye. In a myopic eye, the image forms in front of the retina because the eye lens converges rays too much. The concave lens spreads out the rays, making them appear to come from the myopic eye's far point, so the eye lens can focus them properly on the retina. This corrects the distant vision and allows the person to see clearly.

Key Points: Myopia causes image to form before retina - Concave lens diverges incoming rays - Image forms on retina after correction

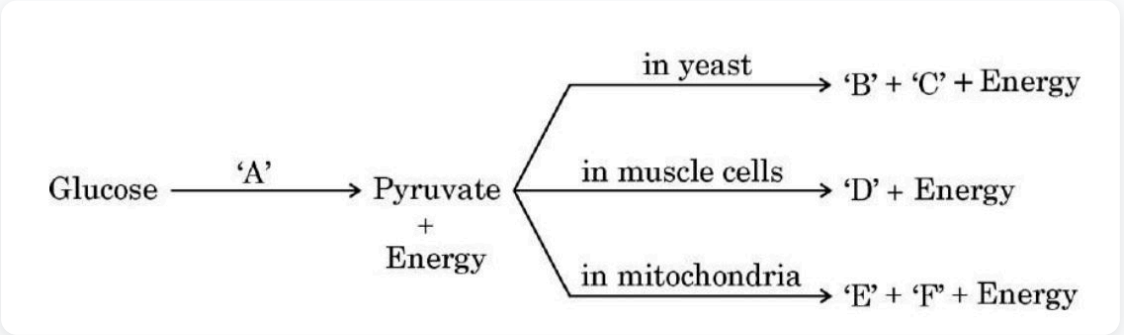
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Section D

Question 32.

Complete the pathways given below, showing the breakdown of glucose.

[3 Marks]



Answer: Step 1: Glycolysis (occurs in cytoplasm)
Glucose ($C_6H_{12}O_6$) is broken down into two molecules of pyruvate (3-carbon compound). This process releases a small amount of energy in the form of ATP and NADH.
Step 2: Pyruvate conversion (if oxygen is present)

Each pyruvate enters the mitochondria and is converted into Acetyl CoA, releasing CO_2 and producing more NADH.

Step 3: Krebs cycle (Citric acid cycle)

Acetyl CoA enters the Krebs cycle, which produces CO_2, ATP, NADH, and $FADH_2$ by breaking down the carbon molecules.

Step 4: Electron Transport Chain (ETC)

NADH and $FADH_2$ donate electrons to the ETC in mitochondria, creating a flow of protons that helps produce a large amount of ATP. Oxygen acts as the final electron acceptor and combines with hydrogen to form water.

Overall Equation:

Glucose + oxygen → carbon dioxide + water + energy (ATP)

This pathway efficiently converts the energy stored in glucose into usable ATP for the cell.

Key Points: Glucose undergoes glycolysis to form pyruvate - Pyruvate is converted to Acetyl CoA and enters Krebs cycle - Electron Transport Chain produces ATP using oxygen

Question 33.

(a) Giving two examples, justify the statement that the sex of the offspring in all animals is not always genetically determined.

(b) Differentiate between the sex chromosomes of male and female human beings.

[3 Marks]

Answer: (a) The sex of offspring is not always determined by genes alone. For example, in some reptiles like crocodiles and turtles, the temperature at which eggs are incubated decides the sex of the baby; higher or lower temperatures can produce males or females. Another example is in some fish species where sex can change due to social factors or environment, showing that sex is influenced by external conditions, not just genetic information.

(b) In human beings, sex is determined by chromosomes. Females have two identical sex chromosomes called X chromosomes (XX), while males have one X and one Y chromosome (XY). The presence of the Y chromosome in males carries genes responsible for developing male characteristics. Females lack the Y chromosome and thus develop female characteristics. The sperm determines the sex of the offspring because it may carry either an X or a Y chromosome, while the egg always carries an X chromosome.

Key Points: Sex not always genetically determined - Examples of temperature and environment influencing sex - Humans have XX female and XY male chromosomes

Question 34.

(i) Write one example each of one metal that is so soft that it can be cut with a knife, and one non-metal that is a good conductor of electricity.

(ii) Using the electronic configuration, explain how Mg atom combines with oxygen to form magnesium oxide by transfer of electrons. [Atomic number : Mg = 12, O = 8]

[3 Marks]

Answer: (i) **Example of a soft metal:** Sodium (Na) is so soft that it can be cut with a knife.
Example of a non-metal that conducts electricity: Graphite, a form of carbon, is a non-metal and a good conductor of electricity.

(ii) Magnesium (Mg) has atomic number 12. Its electronic configuration is 2, 8, 2. It has 2 electrons in its outermost shell.
Oxygen (O) has atomic number 8. Its electronic configuration is 2, 6. It needs 2 electrons to complete its outer shell.
When Mg reacts with O, Mg loses 2 electrons to achieve a stable configuration of 2, 8 and becomes Mg^{2+} ion.
Oxygen gains those 2 electrons to complete its outer shell and becomes O^{2-} ion with configuration 2, 8.
These opposite charges attract each other and form an ionic bond resulting in magnesium oxide (MgO).
The reaction can be shown as: $Mg + O \rightarrow Mg^{2+} + O^{2-} \rightarrow MgO$.
Thus, magnesium transfers electrons to oxygen to form a stable ionic compound.

> **Key Points: Soft metal example is sodium - Graphite is a non-metal conductor - Mg loses 2 electrons to form Mg2+ - O gains 2 electrons to form O2- - MgO is formed by ionic bond through electron transfer**

Question 35.

(i) Metal sulphides and carbonates should be converted to their metal oxides in the process of extraction of metals.

(ii) Aluminium oxide is considered as an amphoteric oxide.

(iii) Metals like Na, K, Ca and Mg are never found in their free state in nature.

[3 Marks]

Answer: (i) Metal sulphides and carbonates are converted to their metal oxides because it is easier to extract metals from oxides by reduction. Sulphide ores are heated strongly in the presence of excess air in a process called roasting to form oxides. Carbonates are converted to oxides by heating called

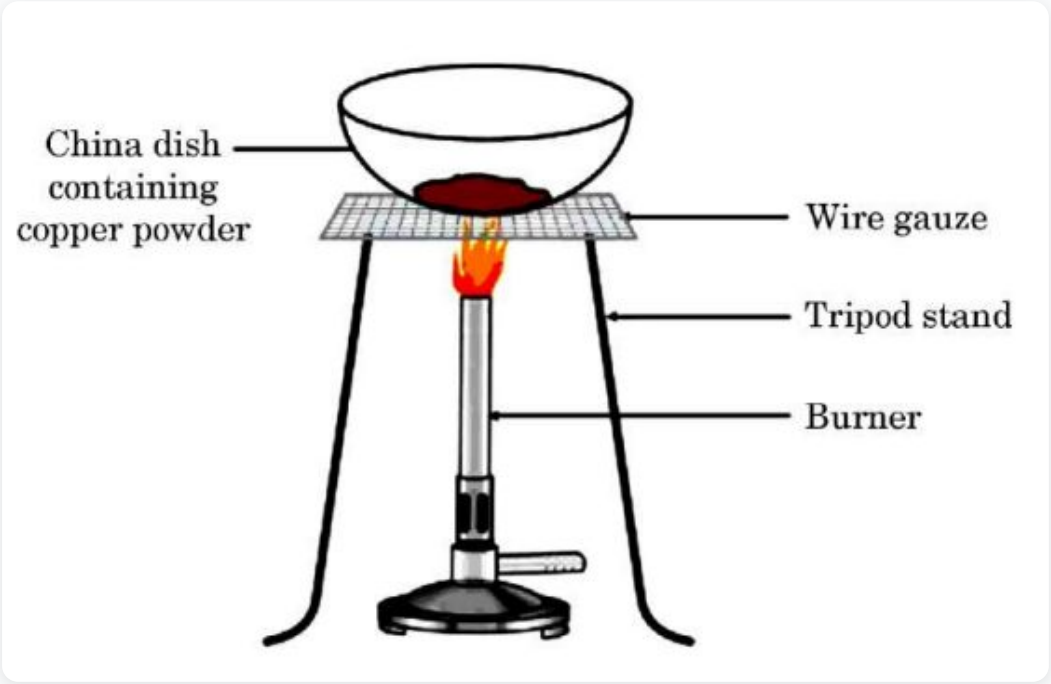
calcination.
(ii) Aluminium oxide is amphoteric because it reacts with both acids and bases to form salts and water. It shows acidic behavior with bases and basic behavior with acids.
(iii) Metals like Na, K, Ca and Mg are very reactive and have a strong affinity for oxygen and other elements. Therefore, they do not exist in free state in nature but are found only as compounds such as oxides or carbonates.

Key Points: Sulphides and carbonates converted to oxides for easier extraction - Aluminium oxide reacts with acids and bases (amphoteric) - Highly reactive metals Na, K, Ca, Mg not found free in nature

Question 36.

Seema took a small amount of copper powder in a china dish and heated it. What changes will she observe on heating ? When H_2 gas is passed over this heated substance, what visible changes will be seen in it ? Give the chemical equations of the reactions involved, along with the names and colours of the products in each case.

[3 Marks]



Answer: (a) On heating copper powder in a china dish, it reacts with oxygen from the air and forms copper(II) oxide (CuO), which is black in colour. The copper changes from reddish brown to black, showing a chemical change.
Equation: $2Cu + O_2 \rightarrow 2CuO$ (Copper + Oxygen $\rightarrow$ Copper(II) oxide)

(b) When hydrogen gas is passed over the heated copper oxide, it reduces copper oxide back to copper, and water is formed. The black copper oxide turns back to brownish red copper powder.
Equation: $CuO + H_2 \rightarrow Cu + H_2O$ (Copper(II) oxide + Hydrogen $\rightarrow$ Copper + Water)

Thus, heating copper in air forms black copper oxide, and passing hydrogen over it reduces it back to copper, showing reversible chemical reactions.

> **Key Points: Copper powder changes to black copper oxide on heating - Copper oxide is black in colour - Passing hydrogen reduces copper oxide back to reddish brown copper - Reaction equations of oxidation and reduction of copper**

Question 37.

(a)Write the expression for the magnification produced by a lens in terms of object distance and image distance.

(b) A 4 cm tall object is placed perpendicular to the principal axis of a convex lens of focal length 20 cm. Calculate the size of the image formed, if the distance of the object from the lens is 10 cm.

[3 Marks]

Answer: (a) The magnification (m) produced by a lens is given by the ratio of the image distance (v) to the object distance (u).
So, m = v / u

(b) Given:
Object height, h = 4 cm
Focal length, f = +20 cm (convex lens)
Object distance, u = -10 cm (object distance is taken negative as per sign convention)

Using lens formula: 1/f = 1/v - 1/u
1/v = 1/f + 1/u = 1/20 + 1/(-10) = (1/20) - (1/10) = (1 - 2)/20 = -1/20
So, v = -20 cm

Magnification, m = v / u = (-20) / (-10) = 2

Image height, h' = m * h = 2 * 4 cm = 8 cm

Therefore, the size of the image formed is 8 cm. The negative image distance indicates that the image is formed on the same side as the object (virtual image).

> **Key Points: Magnification formula m = v / u - Lens formula 1/f = 1/v - 1/u - Image size h' = m * h**

Question 38.

What is scattering of light ? How is scattering of light different from reflection of light ? Explain.

[3 Marks]

Answer: (a) What is scattering of light?
Scattering of light is the phenomenon in which light rays are deflected in many directions when they strike small particles like dust, water droplets, or smoke in the air. This makes the beam of light visible to our eyes.

(b) How is scattering of light different from reflection of light?
Reflection of light occurs when light rays bounce off a smooth surface in a definite direction, obeying the law of reflection (angle of incidence equals angle of reflection). In contrast, scattering occurs when light rays hit very small particles and get deflected in various directions instead of one single direction.

Summary: Scattering makes light visible by spreading it in many directions, while reflection sends light back in a specific direction from a surface.

> **Key Points: Scattering is deflection of light in many directions by small particles - Reflection is bouncing back of light from a smooth surface in a definite direction - Scattering makes light beams visible while reflection follows law of reflection**

Question 39.

The values of current I flowing in a given resistor for the corresponding values of potential difference V applied across the ends of resistor are given below in the table :

Plot a graph between V and I and calculate the resistance of that resistor.

[3 Marks]

I (Amperes)	0·4	0·8	1·2	1·6	2·0
V (Volts)	1·2	2·4	3·6	4·8	6·0

Answer: Answer:
To plot the graph between potential difference V and current I, plot V on the y-axis and I on the x-axis using the given values from the table.
The graph should be a straight line passing through the origin because according to Ohm's law, V = I * R.
The slope of the V versus I graph gives the resistance R of the resistor.
Calculate the resistance using the formula: Resistance, R = V / I.
For example, take any pair of V and I values from the table, divide V by I to find R.
This resistance value will be constant for all the pairs if the resistor follows Ohm's law.

Thus, resistance can be found from the slope of the graph between V and I as R = V / I.
This shows that the resistor obeys Ohm's law and the resistance is the constant ratio of voltage to current.

Key Points: Plot V on y-axis and I on x-axis - Graph is a straight line through origin - Resistance R = V / I from slope of graph

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Section E

Question 40.

(i) Name an organ that helps in the formation of male germ cells in humans and also mention the condition that favours the formation of male germ cells.

(ii) In male reproductive system, write the pathway followed to deliver male germ cells to the site of fertilisation.

(iii) Mention the main physical feature of the male germ cell that helps it move towards the female germ cell.

[5 Marks]

Answer: (a) The organ that helps in the formation of male germ cells or sperms in humans is the testis (plural testes). The testes are located outside the abdominal cavity in a pouch called the scrotum. This is because sperm formation requires a temperature slightly lower than the normal body temperature. So, the lower temperature in the scrotum favours the formation of male germ cells.

(b) The pathway followed by the male germ cells (sperms) to reach the site of fertilisation is as follows: Sperm are produced in the testes and then stored in the epididymis where they mature. From the epididymis, sperms move through the vas deferens, then pass through the ejaculatory duct and urethra, and finally are delivered outside the body during ejaculation. The sperm then travel through the female reproductive tract to reach the ovum for fertilisation.

(c) The main physical feature of the male germ cell (sperm) that helps it move towards the female germ cell (ovum) is the presence of a tail called the flagellum. The flagellum beats in a whip-like manner allowing the sperm to swim and move actively towards the ovum for fertilisation.

Key Points: Testis - Lower temperature in scrotum favours sperm formation - Pathway: Testes -> Epididymis -> Vas deferens -> Urethra - Flagellum (tail) helps sperm movement

Question 41.

Radha has three children. She does not want to have more children. Radha visits a nearby hospital, to know the methods to prevent pregnancy.

(i) Mention the name of any two ways other than the surgical methods, following which Radha can avoid unwanted pregnancies.

(ii) Name the surgical methods to prevent pregnancy.

(iii) Give one example each of sexually transmitted diseases caused by bacteria and virus.

[5 Marks]

Answer: (a) Two ways other than surgical methods to avoid unwanted pregnancies are:
- Using condoms that create a physical barrier to prevent sperm from reaching the egg.
- Taking oral contraceptive pills that regulate hormones and prevent ovulation.

(b) The surgical methods to prevent pregnancy are:
- Tubectomy: a surgical procedure where the fallopian tubes of a woman are tied to stop eggs from reaching the uterus.
- Vasectomy: a surgical method where the vas deferens of a man are cut or tied to prevent sperm from mixing with semen.

(c) Examples of sexually transmitted diseases caused by bacteria and virus are:
- Bacterial STD: Gonorrhoea or Syphilis.
- Viral STD: HIV/AIDS or Genital warts caused by Human Papilloma Virus (HPV).

Key Points: Non-surgical methods include condoms and oral contraceptive pills - Surgical methods include tubectomy and vasectomy - Examples of bacterial STDs are gonorrhoea and syphilis, viral STDs include HIV/AIDS and genital warts

Question 42.

A carbon compound ‘P’ of molecular formula C_2H_6O is found to be neutral when tested with red and blue litmus. A gas that burns with a pop sound is produced when sodium metal reacts with compound ‘P’.

(i) Identify the compound ‘P’.

(ii) The carbon compound ‘P’ is heated with conc. H_2SO_4 at 443 K to produce compound ‘Q’.

(I) Write the chemical equation for the reaction.

(II) What is the role of conc. H_2SO_4 in this reaction ?

(iii) What is likely to be observed on heating compound ‘P’ with ethanoic acid with an acid as a catalyst ? Write the chemical equation for the reaction.

[5 Marks]

Answer: (a) Compound ‘P’ is ethanol (C_2H_5OH). It is neutral to litmus because it is an alcohol and does not ionize to give acidic or basic solution. When sodium metal reacts with ethanol, hydrogen gas is evolved which burns with a pop sound.

(b)(I) When ethanol is heated with concentrated sulfuric acid at 443 K, it undergoes dehydration to form ethene (C_2H_4) and water. The chemical equation is:
$C_2H_5OH \rightarrow C_2H_4 + H_2O$ (in presence of conc. H_2SO_4, 443 K)

(II) The role of concentrated sulfuric acid in this reaction is that of a dehydrating agent. It removes water molecules from ethanol facilitating the formation of ethene.

(c) On heating ethanol with ethanoic acid in the presence of an acid catalyst (such as concentrated H_2SO_4), esterification occurs producing ethyl acetate and water. This reaction is known as Fischer esterification. The observation is formation of a sweet-smelling substance (ester). The chemical equation is:
$C_2H_5OH + CH_3COOH \rightarrow CH_3COOC_2H_5 + H_2O$ (in presence of conc. H_2SO_4, heat)

Key Points: Ethanol identification from molecular formula and neutral nature - Sodium reacts with ethanol producing hydrogen gas - Dehydration of ethanol with conc. H_2SO_4 producing ethene - Role of conc. H_2SO_4 as dehydrating agent - Esterification reaction of ethanol with ethanoic acid - Formation of ethyl acetate and water

Question 43.

(i) Write the structural formula of benzene.

(ii) State the reason why carbon can neither form C^{4+} cation nor C^{4-} anion.

(iii) What type of bond is formed between carbon and hydrogen ?

(iv) How is ethanol converted to ethanoic acid ?

(v) Complete the following chemical equation :

$CH_3COOC_2H_5 + NaOH$ □□→

[5 Marks]

Answer: (i) The structural formula of benzene is a hexagonal ring of six carbon atoms with alternating single and double bonds. Each carbon atom is bonded to one hydrogen atom. It can be represented as a hexagon with a circle inside indicating delocalised electrons or with alternating single and double

bonds: C_6H_6.

(ii) Carbon cannot form C^{4+} cation because it requires removal of four electrons which demands very high energy due to strong nuclear attraction. It also cannot form C^{4-} anion because gaining four electrons leads to very high electron-electron repulsion making such anion unstable.

(iii) The bond formed between carbon and hydrogen is a covalent bond where carbon and hydrogen share one pair of electrons.

(iv) Ethanol is converted to ethanoic acid by oxidation. When ethanol (CH_3CH_2OH) is heated with an oxidising agent like acidified potassium dichromate ($K_2Cr_2O_7$), it first oxidises to ethanal (CH_3CHO) and further oxidation converts ethanal to ethanoic acid (CH_3COOH).

(v) The chemical equation for the reaction of ethyl acetate ($CH_3COOC_2H_5$) with sodium hydroxide (NaOH) is:

$CH_3COOC_2H_5 + NaOH \square\square\rightarrow CH_3COONa + C_2H_5OH$.

This reaction is called saponification or ester hydrolysis forming sodium ethanoate and ethanol.

Key Points: Benzene structure consists of six carbon atoms in a ring with alternating bonds - Carbon cannot form C4+ or C4- ions due to high energy requirements and instability - Carbon-hydrogen bonds are covalent - Ethanol converts to ethanoic acid by oxidation using acidified potassium dichromate - Reaction of ethyl acetate with NaOH produces sodium ethanoate and ethanol via ester hydrolysis

Question 44.

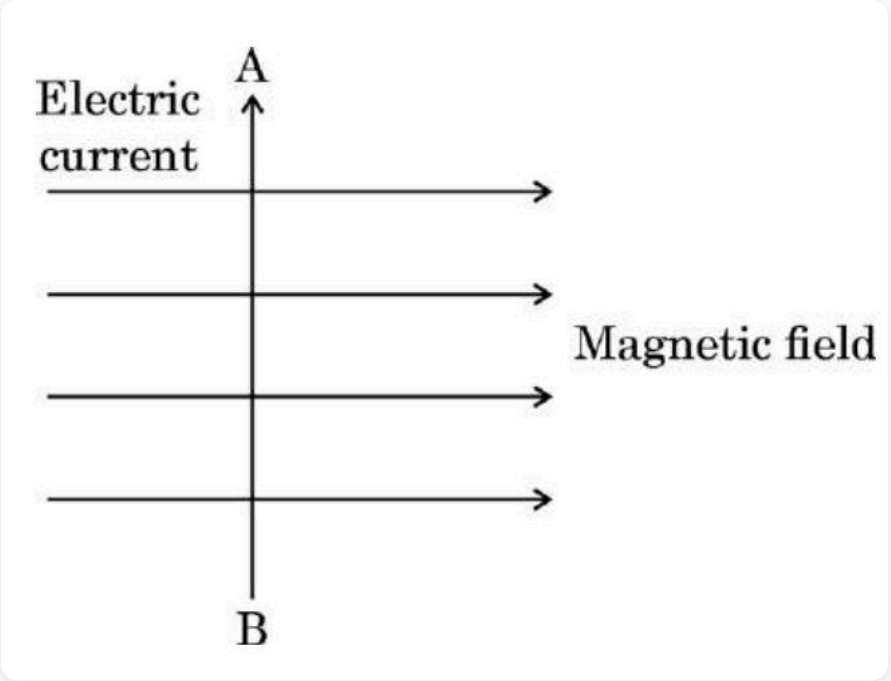
(i) State the rule which gives the direction of force acting on a current-carrying conductor placed in a magnetic field.

(ii) What is a fuse ? Why is it called a safety device ?

(iii) Why are electrical appliances with metallic bodies connected to the mains through a three-pin plug, whereas an electric bulb is connected with a two-pin plug ?

(iv) What will be the direction of force experienced by the conductor AB due to the magnetic field, when current flows in the direction shown ? Name the law you applied to find the direction.

[5 Marks]



Answer: (i) The rule which gives the direction of force acting on a current-carrying conductor placed in a magnetic field is called Fleming's Left-Hand Rule. According to this rule:
- The First finger points in the direction of the magnetic Field (from North to South).
- The seCond finger points in the direction of the Current.
- The thuMb points in the direction of the Motion or the force on the conductor.
This rule helps to find the direction of force when current and magnetic field directions are known.

(ii) A fuse is a safety device that protects electrical circuits from excessive current. It consists of a thin wire that melts and breaks the circuit if the current exceeds a safe value.
It is called a safety device because it prevents damage to electrical appliances and avoids fire hazards by breaking the circuit during overload or short circuit.

(iii) Electrical appliances with metallic bodies are connected through a three-pin plug because the third pin provides an earth connection. This earth wire safely directs any leakage current to the ground, preventing electric shocks.
Electric bulbs are connected with two-pin plugs because they have non-metallic, insulated bodies and do not require earthing.

(iv) The direction of force experienced by conductor AB can be found using Fleming's Left-Hand Rule. By pointing the First finger in the magnetic field direction, the second finger in the current direction, the thumb will point in the direction of force.
Therefore, the force on the conductor AB will act perpendicular to both the magnetic field and current directions, according to Fleming's Left-Hand Rule.

Key Points: Fleming's Left-Hand Rule - Fuse melts to break circuit during overload - Three-pin plug provides earthing for safety

Question 45.

(i) Draw the pattern of magnetic field lines through and around a current-carrying circular loop.

(ii) State the rule to find out the direction of the magnetic field inside and around the circular loop.

(iii) Give reasons :

(I) Why should a burnt-out fuse be replaced by another fuse of identical rating only, in an electric circuit ?

(II) Why is soft iron-core used in making an electromagnet ?

[5 Marks]

Answer: (a) The magnetic field lines around a current-carrying circular loop form concentric closed loops around the wire. Inside the loop, the magnetic field lines are nearly parallel and close together indicating a strong magnetic field. Outside the loop, the magnetic field lines spread out and form closed circular paths around the wire.

Diagram: Imagine a circle representing the wire loop, with magnetic field lines forming circular loops around the wire and straight lines inside the loop going from one side of the coil to the other.

(b) The direction of magnetic field inside and around the circular loop is given by the **Right-Hand Thumb Rule**. According to this rule, if you curl the fingers of your right hand in the direction of the current flowing through the loop, then your thumb will point in the direction of the magnetic field inside the loop.

(c)(I) A burnt-out fuse should be replaced by another fuse of identical rating only because the fuse rating indicates the maximum current it can safely carry. Using a fuse with higher rating can cause the fuse not to blow during an overload, risking damage to electrical appliances and causing fire hazards. Using a lower rating fuse may blow frequently causing inconvenience.

(II) Soft iron core is used in making an electromagnet because it has high magnetic permeability which enhances the magnetic field produced by the coil. Also, soft iron is easily magnetised and demagnetised, so it helps the electromagnet to quickly gain and lose magnetism when current is switched on and off.

Key Points: Magnetic field lines form concentric loops around the circular wire and are nearly parallel inside the loop - Right-Hand Thumb Rule determines direction of magnetic field - Fuse of identical rating is needed for safety and protection - Soft iron core increases magnetic field strength and is easily magnetised/demagnetised