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

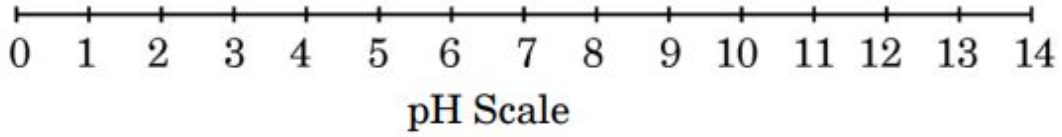
viii. There is no overall choice given in the question paper. However, an internal choice has been provided in few questions.

ix. Use of calculator is NOT allowed.

Section A

Question 1.

Acid-base indicators can be used to distinguish between an acid and a base. Universal indicator, a mixture of several indicators, shows different colours at different concentrations of acids and bases, thereby indicating their pH on the pH scale of 0 – 14. The pH of a solution is measured by pH paper, which is a paper impregnated with a universal indicator.



pH Scale

(1) When the pH of a solution is decreased from 4 to 2, what effect does it produce on its hydronium ion concentration? State the colour change shown by the pH paper.

[2 Marks]

Answer: When the pH of a solution decreases from 4 to 2, the hydronium ion concentration increases significantly. In mathematical terms, each unit decrease in pH corresponds to a tenfold increase in hydronium ion concentration. Therefore, moving from pH 4 to pH 2 results in an increase by a factor of 100 in hydronium ions. Regarding the colour change on pH paper, a solution with a pH of 2 typically shows a vibrant red colour, indicating a strong acidic solution.

Key Points: Decrease in pH indicates increase in hydronium ion concentration-Each pH unit decrease corresponds to tenfold increase in concentration-PH of 2 shows vibrant red on pH paper

(2) Solution P is a strong acid while solution Q is a strong base. On the pH scale, where would you place the solutions P and Q?

[1 Marks]

Answer: In the pH scale, which ranges from 0 to 14, strong acids have a pH value closer to 0, while strong bases have a pH value closer to 14. Therefore, Solution P, being a strong acid, would be placed towards the lower end of the pH scale, likely around pH 0 to 3. Conversely, Solution Q, as a strong base, would have a higher pH value, typically ranging from pH 11 to 14. Thus, we can conclude that Solution P is positioned at the acidic end of the pH scale, and Solution Q is at the basic end, indicating their strong nature as acids and bases respectively.

Key Points: pH scale ranges from 0 to 14- strong acids have low pH (0-3)- strong bases have high pH (11-14)

(3)

A solution has a pH of 7. Name a compound you would use to

(i) increase its pH, and

(ii) decrease its pH.

[1 Marks]

Answer: To increase the pH of a solution with a pH of 7, I would use sodium hydroxide (NaOH), which is a strong base. This compound will raise the concentration of hydroxide ions (OH-) in the solution, leading to an increase in pH. Conversely, to decrease the pH of the same solution, I would use hydrochloric acid (HCl), which is a strong acid. This acid will increase the concentration of hydrogen ions (H+) in the solution, resulting in a lower pH value.

> **Key Points: Sodium hydroxide (NaOH) for increasing pH - Hydrochloric acid (HCl) for decreasing pH - pH 7 is neutral**

(4)

A person is feeling pain and irritation in the stomach due to indigestion. What could be the pH of the fluid in the stomach ? Write the common name of the medicines people use for remedy. Give the chemical name of ‘‘milk of magnesia’’ often used for this purpose.

[2 Marks]

Answer:

The pH of the fluid in the stomach is typically around 1.5 to 3.5, indicating a highly acidic environment due to the presence of gastric acid, primarily hydrochloric acid (HCl). For indigestion, common remedies include antacids such as Tums, Rolaids, and milk of magnesia. The chemical name for milk of magnesia is magnesium hydroxide ($Mg(OH)_2$).

> **Key Points: 1. Stomach fluid pH is 1.5 to 3.5 2. Common remedies include antacids 3. Chemical name of milk of magnesia is magnesium hydroxide**

Question 2. When a girl is born, the ovaries already contain thousands of immature eggs. On reaching puberty, some of these start maturing. One matured egg is released every month by one of the ovaries. The two oviducts unite into an elastic bag-like structure known as the uterus.

(1) How does the uterus prepare itself to receive and nurture the growing embryo? Explain.

[1 Marks]

Answer: The uterus prepares itself for the arrival of a growing embryo through a series of physiological changes that occur monthly during the menstrual cycle. After puberty, with the release of a matured egg from the ovary, the uterine lining begins to thicken in a process called endometrial proliferation. This thickening is predominantly due to the increase in hormones, primarily estrogen and progesterone. The prepared uterine lining becomes nutritious and enriched with blood vessels to provide the necessary environment for implantation. If the egg is fertilized by sperm and successfully implants in the uterine wall, the changes support the embryo's growth, allowing it to receive nutrients and oxygen essential for development. If fertilization does not occur, the thickened lining is shed during menstruation.

Key Points: 1. Release of matured egg from the ovary. 2. Thickening of uterine lining (endometrium) due to hormones. 3. Preparation of a nutritious environment for embryo implantation and growth.

(2) Write the site of fertilization in human female.

[1 Marks]

Answer: In the human female reproductive system, fertilization typically occurs in the oviducts, also known as fallopian tubes. After ovulation, a matured egg is released from the ovary and travels through the oviduct, where it can meet the sperm that has entered through the vagina. If a sperm penetrates the egg, fertilization occurs inside the oviduct, which ultimately leads to the formation of a zygote that will later implant in the uterus for further development.

Key Points: Oviducts are the site of fertilization - Matured egg is released from the ovary - Sperm enters through the vagina - Fertilization occurs when sperm meets the egg in the oviduct

(3) What happens when the egg is not fertilized?

[2 Marks]

Answer: When the egg is not fertilized, it undergoes a process called menstruation. After being released from the ovary, if the egg does not meet a sperm for fertilization, it does not implant in the uterus. As a result, the thickened lining of the uterus, which was prepared to receive a fertilized egg, sheds, leading to menstrual bleeding. This cycle typically occurs every 28 to 30 days and marks the beginning of a new menstrual cycle. The immature eggs in the ovaries remain until they begin to mature in subsequent cycles.

> **Key Points: egg release- menstruation- thickened uterine lining sheds**

(4)

How does the developing embryo get nutrition from the mother’s blood ? Explain.

[2 Marks]

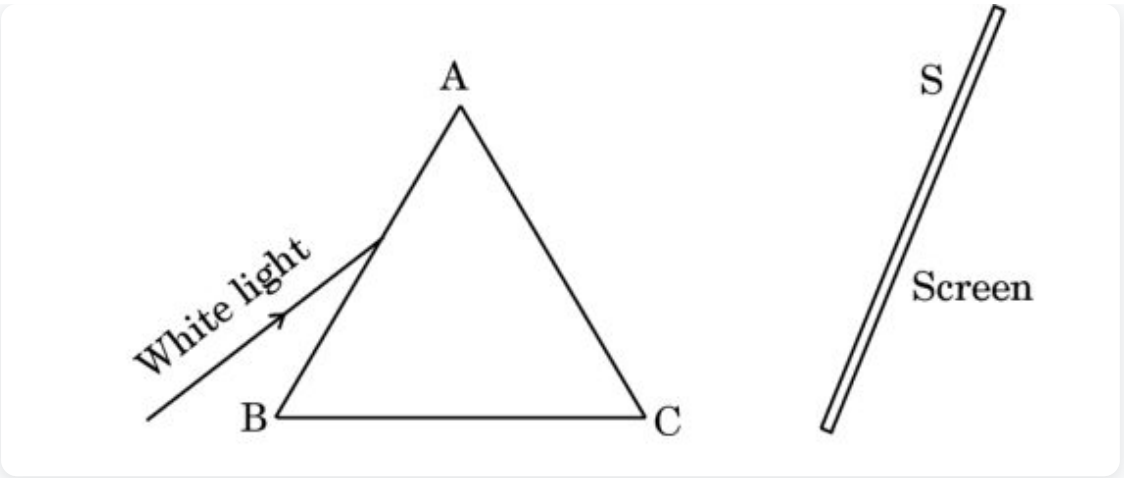
Answer: The developing embryo receives nutrition from the mother’s blood through a specialized structure called the placenta. The placenta forms after implantation of the embryo in the uterine lining. It facilitates the exchange of nutrients, oxygen, and waste between the mother and the embryo. The mother's blood vessels supply essential nutrients and oxygen to the placenta, which then transports these vital substances to the embryo. Additionally, the placenta also assists in the removal of waste products from the embryo’s blood back into the mother's bloodstream. This efficient exchange system is crucial for the proper growth and development of the embryo.

> **Key Points: placenta formation-nutrient exchange-mother's blood vessels**

Question 3.

A person allowed a narrow beam of white light from the sun to enter a dark room through a small aperture and placed a glass prism in its path in such a manner that the beam falls on the face AB of the prism as shown in the figure.

A screen S is placed on the other side of the prism, facing AC. On turning the prism slowly, a beautiful band of colours is obtained on the screen. It is the spectrum of sunlight.



(1) State the reason for getting a band of seven colours in the above case.

[1 Marks]

Answer: The band of seven colours is obtained because white sunlight is made up of seven different colours. When white light passes through the glass prism, it bends or refracts. Different colours bend by different amounts due to their different wavelengths. This causes white light to separate into its seven constituent colours, forming a spectrum on the screen.

Key Points: White light consists of seven colours-Different colours have different wavelengths-Different amounts of bending (refraction) occurs-Due to dispersion, white light splits into seven colours-spectrum is formed on the screen

(2) Name the phenomenon due to which a prism splits the incident white light into a band of colours.

[1 Marks]

Answer: The phenomenon is called dispersion.

Key Points: Prism splits white light-White light is made of many colours-Different colours bend differently-This splitting of light into colours is called dispersion

(3) Explain with the help of a labelled ray diagram, an experimental arrangement to show the recombination of the spectrum of white light.

[2 Marks]

Answer: Take two identical glass prisms and arrange them such that the spectrum formed by the first prism is allowed to pass through the second prism kept inverted (in the opposite orientation). First, allow a narrow beam of white sunlight to pass through the first prism, which disperses it into seven colours forming a spectrum on a screen. Then, place the second prism in the path of this spectrum but in the inverted position. When the spectrum passes through the second prism, the colours recombine to form white light again on the screen. This shows that the spectrum can be recombined to get the original white light. (Labelled ray diagram should show sunlight entering the first prism, spectrum formation, second prism in inverted position, and white light recombining on the screen.)

Key Points: Use of two identical prisms - First prism disperses white light into spectrum - Second prism inverted to recombine spectrum - Spectrum converts back into white light - Labelled ray diagram showing light path through both prisms

(4)

Draw a labelled ray diagram to show the formation of a rainbow.

[2 Marks]

Answer: A labelled ray diagram shows a triangular glass prism with a narrow beam of white sunlight entering one face of the prism (face AB). The white light refracts on entering the prism and disperses into seven colours inside the prism due to different refractive indices of the colours. The emerging rays exit from the opposite face (face AC) and fall on a screen where a spectrum is formed, displaying the seven colours of the rainbow in order: violet, indigo, blue, green, yellow, orange, and red.

Key Points: Labelled prism with faces AB and AC-White light entering the prism- Refraction and dispersion of light inside the prism- Emergence of seven colours forming a spectrum-Screen placed to observe the spectrum

Section B

Question 4.

The correct balanced chemical equation showing exothermic reaction in which natural gas burns in air is:

[1 Marks]

(A) $CH_4 + O_2 \rightarrow CO_2 + 2H_2O$

(B) $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$ + Energy

(C) $CH_4 + 2O_2 \rightarrow 2CO_2 + 2H_2O$ + Energy

(D) $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$

Explanation: The correct answer is '$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$ + Energy'. This equation accurately represents the combustion of natural gas (methane, CH_4) with oxygen (O_2) to produce carbon dioxide (CO_2) and water (H_2O), while also indicating that energy is released during the process, which is characteristic of exothermic reactions.

Question 5.

The warning sign shown in the given figure must invariably be displayed/pasted on the containers which contain hydroxide of:

[1 Marks]



(A) Sodium

(B) Calcium

(C) Magnesium

(D) Aluminium

Explanation:

The sign is used to **warn against corrosive chemicals** that can destroy living tissues or materials upon contact. **Sodium hydroxide (NaOH)** is:

- **Highly corrosive** in nature
- Can cause **severe chemical burns** to skin and eyes
- Reacts vigorously with water and organic tissues

Therefore, **containers with sodium hydroxide must display this warning symbol**.

Question 6. The body of human beings works within the pH range of:

[1 Marks]

(A) 6.1 to 6.8

(B) 6.5 to 7.3

(C) 7.5 to 8.1

(D) 7.0 to 7.8

Explanation: The correct option is 7.0 to 7.8 because the provided context states that our body functions within this pH range. Living organisms require a specific pH level to survive, and the context emphasizes that this range is crucial for human health.

Question 7. Aluminium powder is used in thermit welding because:

[1 Marks]

(A) Its reaction with iron is highly exothermic.

(B) When it is heated with iron (III) oxide, molten iron is obtained.

(C) Its melting point is low as compared to iron and a molten alloy of iron and aluminium is formed on heating which is used to join railway tracks.

(D) When it is heated with iron (III) oxide, molten aluminium oxide is obtained to join railway tracks.

Explanation: The correct option is 'When it is heated with iron (III) oxide, molten iron is obtained.' This is correct because the thermit reaction involves the reduction of iron (III) oxide (Fe_2O_3) by aluminium (Al), which produces molten iron (Fe) and aluminium oxide (Al_2O_3), along with a significant amount of heat, allowing the metal to be in a molten state for effective welding.

Question 8.

Two metals zinc and tin are dissolved separately in definite proportions in molten copper (the primary metal) to obtain two different alloys respectively known as:

[1 Marks]

(A) Brass and Solder

(B) Bronze and Brass

(C) Solder and Bronze

(D) Brass and Bronze

Explanation:

The correct answer is 'Brass and Bronze.' Brass is an alloy of copper and zinc (Cu and Zn), while bronze is an alloy of copper and tin (Cu and Sn). This is consistent with the context that explains the compositions of these alloys.

Question 9.

The opening and closing of stomata is regulated by:

[1 Marks]

(A) Temperature in guard cells

(B) CO_2 concentration in stomata

(C) O_2 concentration in stomata

(D) Amount of water in guard cells

Explanation:

The correct answer is 'Amount of water in guard cells'. The context explains that the guard cells swell when water flows into them, causing the stomatal pore to open, and shrink when water leaves, resulting in the closure of the pore. This indicates that the water level in guard cells directly regulates the opening and closing of stomata.

Question 10. One-cell thick blood vessels are known as:

[1 Marks]

(A) Alveoli

(B) Capillaries

(C) Veins

(D) Arteries

Explanation: The correct answer is 'Capillaries' because, according to the context, the smallest blood vessels are described as having walls that are one-cell thick. These capillaries are responsible for the exchange of materials between the blood and surrounding cells.

Question 11.

Observe the given figures A and B. When chhui-mui (sensitive) plant is touched, its leaves fold. This is due to :

[1 Marks]



Figure A



Figure B

(A) Electromagnetic effect

(B) Hormonal effect

(C) Thermal effect

(D) Change in amount of water in cells

Explanation: When the sensitive plant is touched, electrical signals trigger certain cells at the base of each leaf to lose water quickly. This loss of water causes these cells to shrink, leading to the folding of the leaves. Therefore, the movement is due to a change in the amount of water in the cells.

Question 12. Bryophyllum produces new plant through:

[1 Marks]

(A) Apical buds formed on the tip of the plant

(B) Vegetative buds produced in the notches of the leaf

(C) Fruits formed on the branches of the plant

(D) Flowers produced in the notches of the branches

Explanation: Bryophyllum produces new plants through vegetative buds that are formed in the notches along the leaf margins. When these buds fall on moist soil, they can develop into new plants, as stated in the relevant context.

Question 13. The number of chromosomes in a cell division is halved. This kind of cell division is observed in:

[1 Marks]

(A) Only testis

(B) Only ovary

(C) Ovary and testis both

(D) All cells of the body

Explanation: The correct option is 'Ovary and testis both' because meiosis is the type of cell division that reduces the chromosome number by half, producing gametes (sperm and eggs) in both the male (testis) and female (ovary) reproductive organs. This process is essential for sexual reproduction and ensures that when fertilization occurs, the resulting offspring have the correct number of chromosomes.

Question 14.

If the absolute refractive indices of two media X and Y are 6⁄5 and 4⁄3 respectively, then the refractive index of Y with respect to X will be:

[1 Marks]

(A) 10/9

(B) 9/8

(C) 8/9

(D) 9/10

Explanation: The refractive index of medium Y with respect to medium X can be calculated using the formula: n(Y relative to X) = n(Y) / n(X). Here, n(Y) = 4/3 and n(X) = 6/5. Thus, n(Y relative to X) = (4/3) / (6/5) = (4/3) * (5/6) = 20/18 = 10/9. Therefore, the correct answer is 10/9.

Question 15. An object is placed at a distance of 30 cm from the pole of a concave mirror. If its real and inverted image is formed at 60 cm in front of the mirror, the focal length of the mirror is:

[1 Marks]

(A) -15 cm

(B) -20 cm

(C) +15 cm

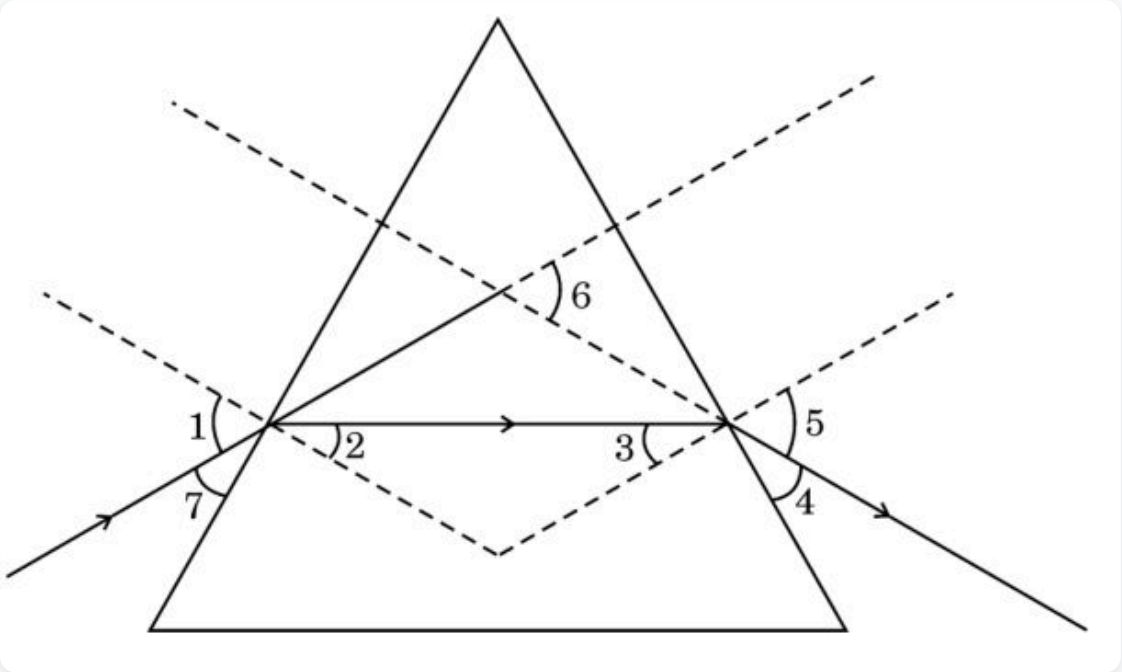
(D) +20 cm

Explanation: To find the focal length of the concave mirror, we use the mirror formula: 1/v + 1/u = 1/f, where v = -60 cm (image distance, negative for real images) and u = -30 cm (object distance, negative as per sign convention). Substituting the values gives 1/(-60) + 1/(-30) = 1/f, simplifying leads to f = -20 cm. Thus, the focal length of the mirror is -20 cm.

Question 16.

In the given figure the angle of incidence and the angle of deviation respectively are:

[1 Marks]



(A) 1 and 6

(B) 7 and 4

(C) 7 and 6

(D) 1 and 5

Explanation: The correct answer is 1 and 6. This is because the angle of incidence (∠i) is traditionally measured with respect to the normal from the refracting surface, matching to 1, while the angle of deviation (∠D) corresponds to the deviation of the ray as it passes through the prism, which is represented by the value 6.

Question 17. An electric bulb is connected to a power supply of 220 V. If the current drawn by the bulb from the supply is 500 mA, the power of the bulb is:

[1 Marks]

(A) 110 W

(B) 11 W

(C) 1100 W

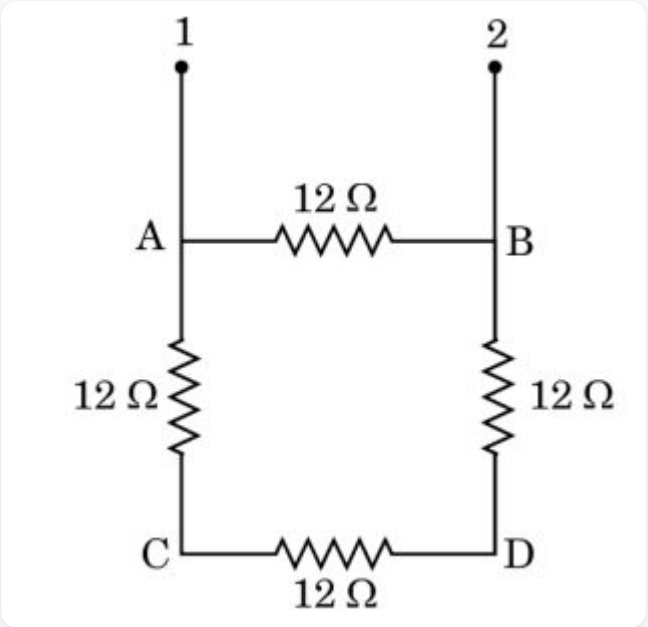
(D) 220 W

Explanation: The correct answer is 110 W. Using the formula P = VI, where V = 220 V and I = 0.5 A (500 mA), we calculate the power as P = 220 V × 0.5 A = 110 W.

Question 18.

Four identical resistors of 12 Ω each are connected in series to form a square ABCD as shown in the figure. The resistance of the network between the two points 1 and 2 is:

[1 Marks]



(A) 36 Ω

(B) 9 Ω

(C) 6 Ω

(D) 48 Ω

Explanation:

Identify the paths from A to B

There are **two possible paths** from point **A to B**:

1. **Direct path AB**:
    - This path has **one resistor** of **12 Ω**.
2. **Longer path A → C → D → B**:

- This path goes around the other side of the square.
- It contains **three resistors in series**:
  - AC = 12 Ω
  - CD = 12 Ω
  - DB = 12 Ω
- Total resistance of this path = 12 + 12 + 12 = **36 Ω**

These two paths are in parallel

Since current can flow through **either** path (AB **or** AC → CD → DB), they are in **parallel**.

So the equivalent resistance between points A and B is the **parallel combination** of **12 Ω** and **36 Ω**.

Use the parallel resistance formula:

1/Req = 1/R1 + 1/R2

1/Req = 1/12 + 1/36

1/Req = 3/36 + 1/36

1/Req = 4/36

1/Req = 1/9

Req = 9 ohm

Final Answer: 9 Ω

Question 19.

Identify from the following a group containing all non-biodegradable substances:

[1 Marks]

(A) Leather, Silk, Wool

(B) DDT, Polyester, Glass

(C) Cotton, Wood, Nylon

(D) Leather, Glass, Plastic

Explanation:

The correct option is ' DDT, Polyester, Glass' because these materials are known for their persistence in the environment and do not readily decompose. The context mentions non-biodegradable substances, which are generally materials that last a long time in the environment without breaking down, adversely affecting ecosystems.

Question 20.

Assertion (A): The metals high up in the reactivity series cannot be obtained from their compounds by heating with carbon.

Reason (R): Displacement reactions can also be used to obtain metal.

[1 Marks]

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

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

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

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

Explanation:

Assertion (A):

The metals high up in the reactivity series cannot be obtained from their compounds by heating with carbon.
True

- Highly reactive metals like **sodium, potassium, calcium, aluminium**, etc., form **very stable compounds**.
- **Heating with carbon** is not effective to reduce their oxides, because **carbon is not reactive enough** to displace them.
- These metals are extracted using **electrolytic methods**.

Reason (R):

Displacement reactions can also be used to obtain metal. **True**, but not in the context of **highly reactive metals**.

- Displacement reactions (like using a more reactive metal to displace a less reactive one) are used in some cases.

- But **this is not the reason** why carbon can't reduce highly reactive metals.

Question 21.

Assertion (A): A mango seed will germinate to form a mango tree.

Reason (R): Heredity determines the process by which traits and characteristics are reliably inherited from parents to offspring.

[1 Marks]

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

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

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

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

Explanation:

Assertion (A):

A mango seed will germinate to form a mango tree.
True

- A seed contains the **genetic material (DNA)** of its parent plant.
- A **mango seed** has the instructions to grow only into a **mango tree**, not any other plant.

Reason (R):

Heredity determines the process by which traits and characteristics are reliably inherited from parents to offspring.
True

- **Heredity** is the biological process where **genes are passed** from parent to offspring.
- This explains why a **mango seed** develops the same traits as the parent mango tree.

Question 22.

Assertion (A): Nichrome is an alloy which is commonly used in electrical heating devices such as electric irons, toasters, etc.

Reason (R): The resistivity of nichrome is high and its resistance decreases with increase in temperature.

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

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

Explanation: Assertion (A) is true because nichrome is indeed widely used in electrical heating devices due to its high resistivity, which allows it to convert electrical energy into heat efficiently. However, Reason (R) is false because while nichrome has high resistivity, its resistance actually increases with an increase in temperature, contrary to what is stated. Thus, the correct response is that Assertion (A) is true, but Reason (R) is false.

Question 23.

Assertion (A): Animals will not get energy if they eat (consume) coal as food.

Reason (R): Specific enzymes are needed for the breakdown of a particular food.

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

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

Explanation: Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A). Animals cannot derive energy from coal because specific enzymes required for breaking down organic food substances are absent, which supports the fact that coal cannot be digested and absorbed for energy.

Section C

Question 24.

(a) In common practice silver is recovered from silver nitrate solution by the use of copper metal. Name the type of reaction that takes place in this process and give the chemical equation of the reaction involved.

(b) Name the method used for refining silver.

[2 Marks]

Answer:

The reaction taking place is a displacement reaction, where copper displaces silver from silver nitrate solution. The chemical equation for this reaction is: $2AgNO_3 + Cu \rightarrow 2Ag + Cu(NO_3)_2$. Copper reacts with silver nitrate to yield silver and copper(II) nitrate. The method used for refining silver is electrolytic refining, where impure silver acts as the anode and pure silver as the cathode.

Key Points:

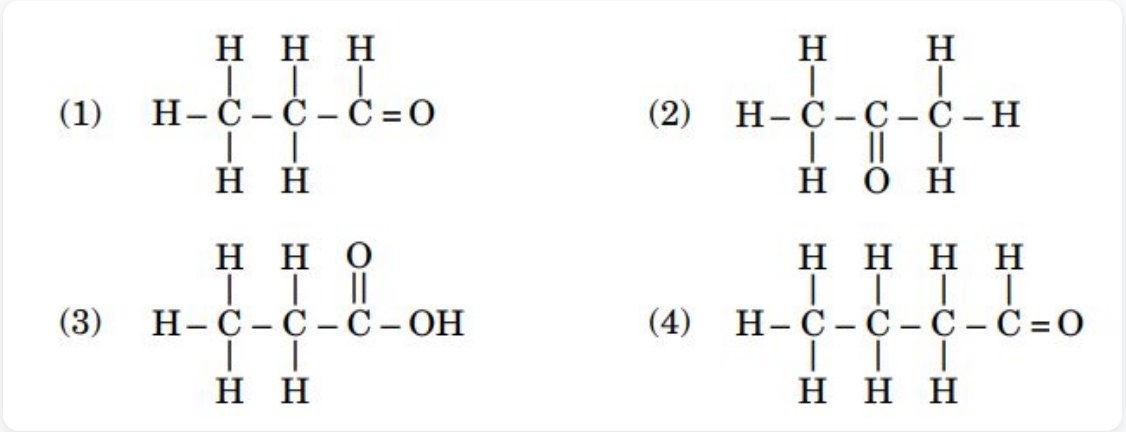
displacement reaction-copper displaces silver-chemical equation: $2AgNO_3 + Cu \rightarrow 2Ag + Cu(NO_3)_2$ electrolytic refining method for silver

Question 25.

(a) Select from the following the members of the same homologous series:

(b) What happens to (i) the melting point, and (ii) the solubility of compounds as the molecular mass of the compounds in a homologous series increases ?

[2 Marks]



Answer:

The members of the same homologous series include alkanes like CH_4 (methane), C_2H_6 (ethane), C_3H_8 (propane), and C_4H_{10} (butane). As the molecular mass increases in a homologous series, the melting point generally increases due to stronger intermolecular forces. Similarly, solubility tends to

decrease; compounds with higher molecular masses are less soluble in polar solvents due to lower polarity. Thus, both properties show a trend with increasing mass.

Key Points: members of homologous series include alkanes; melting point increases with molecular mass; solubility decreases with increasing molecular mass

Question 26. Name the parts of hind-brain of the human brain. Which part of the hind-brain controls involuntary actions such as blood pressure and salivation?

[2 Marks]

Answer: The hind-brain consists of three main parts: the medulla oblongata, pons, and cerebellum. The medulla oblongata is the part of the hind-brain that controls involuntary actions such as blood pressure, salivation, and vomiting. It plays a crucial role in regulating essential autonomic functions necessary for survival.

Key Points: hind-brain consists of medulla oblongata, pons, cerebellum - medulla controls involuntary actions - functions include blood pressure, salivation, vomiting

Question 27.

Write one function each of the following, in a seed:

(i) Seed coat

(ii) Cotyledon

(iii) Radicle

(iv) Plumule

[2 Marks]

Answer: The seed coat serves as a protective outer layer that safeguards the embryo from physical damage and pathogens. The cotyledon acts as the initial source of nutrients for the young plant during germination. The radicle, which is the embryonic root, is responsible for anchoring the plant and absorbing water and nutrients from the soil. Lastly, the plumule is the embryonic shoot that eventually develops into the stem and leaves of the plant.

Key Points: Seed coat protects the embryo - Cotyledon provides nutrients - Radicle anchors plant and absorbs water - Plumule develops into stem and leaves

Question 28.

Out of the two lenses, one concave and the other convex, state which one will diverge a parallel beam of light falling on it. Draw a ray diagram to show the principal focus of the lens.

[2 Marks]

Answer: The concave lens diverges a parallel beam of light that falls on it. When parallel rays pass through a concave lens, they appear to diverge from a point on the same side of the lens, known as the principal focus. The rays do not actually converge; instead, they spread apart after refraction. A ray diagram would illustrate parallel rays entering the lens and diverging from the principal focus on the same side.

> **Key Points: concave lens diverges light; rays appear to diverge; principal focus on the same side; ray diagram representation**

Question 29. An electric kettle is rated 750 W; 220 V. Can this kettle be used in a circuit which has a fuse of current rating 3 A? Give reason for your answer.

[2 Marks]

Answer: To determine if the electric kettle can be used in a 3 A circuit, we first calculate the current it draws. Using the formula P = VI, we find I = P/V, which gives I = 750 W / 220 V = 3.41 A. Since 3.41 A exceeds the 3 A fuse rating, using the kettle could lead to fuse blowout. Thus, the kettle cannot be safely used in this circuit.

> **Key Points: Power rating is 750 W; voltage is 220 V; current calculation (3.41 A); exceed fuse rating (3 A); risk of fuse blowout; unsafe usage.**

Question 30.

Write the main steps to culture yeast in the laboratory.

[2 Marks]

Answer: To culture yeast, first dissolve about 10 grams of sugar in 100 mL of water. Then, take 20 mL of this sugar solution in a test tube and add a pinch of yeast granules. Seal the test tube with a cotton plug to allow gas exchange and keep it in a warm place. After 1 to 2 hours, take a small drop of the yeast culture from the test tube, place it on a slide, and cover it with a coverslip for observation under a microscope.

> **Key Points: dissolve sugar in water - add yeast to sugar solution - plug test tube and maintain warmth - observe yeast culture under microscope**

Question 31.

A ray of light after refraction from a convex lens emerges parallel to its principal axis.

(i) Draw a labelled ray diagram to show it.

(ii) In this case, the incident ray before refraction from the lens passes through a point on its principal axis. Name the point.

[2 Marks]

Answer:

(i) A ray of light passing through the principal focus of a convex lens is refracted by the lens such that it emerges parallel to the principal axis. The ray diagram shows the incident ray coming from the left, passing through the focal point (F) of the convex lens before striking the lens, and then refracting to travel parallel to the principal axis on the other side.

(ii) The point through which the incident ray passes before entering the convex lens is called the **principal focus** of the lens.

Key Points: Ray passing through principal focus of convex lens refracts parallel to principal axis-Principal focus lies on the principal axis-Labelled ray diagram shows incident ray through focus and refracted ray parallel to principal axis-The point on principal axis is called principal focus

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Section D

Question 32.

(i) Define the term decomposition reaction. Write one chemical equation each for decomposition reaction where energy is supplied in the form of heat, light or electricity.

(ii) Decomposition of vegetable matter into compost is considered an exothermic reaction. Why ?

[3 Marks]

Answer:

A decomposition reaction is a chemical reaction where a single compound breaks down into two or more simpler substances. An example of such a reaction, where heat is supplied, is the thermal decomposition of calcium carbonate: $CaCO_3$ (s) → CaO (s) + CO_2 (g) upon heating. In terms of light energy, the decomposition of silver chloride2AgCl (s) → 2Ag (s) + Cl_2 (g) occurs when exposed to sunlight. The decomposition of vegetable matter into compost is exothermic because it releases energy in the form of heat as microbial activity breaks down the organic matter.

Key Points:

Definition of decomposition reaction|Example with heat: $CaCO_3$ (s) → CaO (s) + CO_2 (g)Example with light:2AgCl (s) → 2Ag (s) + Cl_2 (g) Exothermic nature of decomposition of vegetable matter|Release of energy during microbial breakdown

Question 33.

Write the electron-dot structures of (i) sodium, and (ii) oxygen. Using these structures, show the formation of sodium oxide. Mark the anion and cation present in this compound.

(At. No. – Sodium = 11 and Oxygen = 8)

[3 Marks]

Answer: Sodium (Na) has an atomic number of 11, so it has 1 electron in its outermost shell. The electron-dot structure for sodium is represented as Na•. Oxygen (O), with an atomic number of 8, has 6 electrons in its outer shell, shown as ••O••. When sodium reacts with oxygen, sodium donates its one electron to oxygen, forming Na^+ (the cation) and O^{2-} (the anion). The resulting compound is sodium oxide (Na_2O), where two sodium ions combine with one oxide ion to achieve stability.

Key Points: Electron-dot structure of sodium shows 1 valence electron; Electron-dot structure of oxygen shows 6 valence electrons; Sodium loses 1 electron to form Na^+; Oxygen gains 2 electrons to form O^{2-}; Formation of sodium oxide involves 2 Na^+ ions for each O^{2-} ion.

Question 34.

(a) Define hormone.

(b) “Hormones should be secreted in precise quantities. We have a feedback mechanism through which this is done.” With the help of an example justify the statement.

[3 Marks]

Answer: A hormone is a chemical messenger produced by glands in the endocrine system, which travels through the bloodstream to target distant organs for regulation of various physiological processes. Hormones must be secreted in precise quantities for optimal functioning; this is managed by feedback mechanisms. For instance, when blood sugar levels rise, pancreatic cells detect this increase and secrete insulin, helping to lower blood sugar levels. As blood sugar falls, insulin secretion decreases, demonstrating the negative feedback loop that maintains homeostasis.

Key Points: Definition of hormone, role in regulation, importance of precise quantities,

feedback mechanisms, example of insulin and blood sugar regulation.

Question 35.

The lowest part of the ear called earlobe, is closely attached to the side of the head in some of us (Figure 'X'), and not in others, called free earlobe (Figure 'Y'). Attached and free earlobes are two variants found in human populations. The gene for free earlobe is dominant over attached earlobes.

(a) A man with attached earlobes marries a woman having free earlobes. 50% of their children have free earlobes and 50% have attached earlobes. Explain the inheritance of this trait and write the trait combinations of the progeny.

(b) Write the gene combinations of the father and the mother in the above case.

[3 Marks]



Figure 'X'



Figure 'Y'

Answer: In this scenario, the man with attached earlobes has the genotype 'aa' (homozygous recessive) while the woman with free earlobes has the genotype 'Aa' (heterozygous). The gene for free earlobes (A) is dominant over attached earlobes (a). When they have children, there are two possible allele combinations from the parents: 'Aa' (free earlobes) and 'aa' (attached earlobes). Since there is a 50% chance for each, the offspring will have a 50% ratio of free to attached earlobes.

Key Points: Genotype of father (aa)-Genotype of mother (Aa)-Dominance of free earlobes trait-Probability of trait combinations (50%-50%)

Question 36. A convex lens forms an 8.0 cm long image of a 2.0 cm long object which is kept at a distance of 6.0 cm from the optical center of the lens. If the object and image are on the same side of the lens, find (i) the nature of the image, (ii) the position of the image, and (iii) the focal length of the lens.

[3 Marks]

Answer: The nature of the image formed by the convex lens in this case is virtual and erect since the object distance is less than the focal length of the lens. For a convex lens, if the object is within the focal length, the image will form on the same side as the object. The position of the image can be calculated using the lens formula $1/f = 1/v - 1/u$. Given $u = -6$ cm, we find that $v = -12$ cm. Therefore,

the image is virtual and located at 12 cm from the lens. To find the focal length, we use 1/f = 1/v + 1/u, which yields f = 4 cm.

Key Points: nature of image is virtual and erect; image position is at -12 cm; focal length calculated as 4 cm

Question 37. Three resistors of 2 Ω, 3 Ω, and 6 Ω are connected in (i) series, and (ii) parallel. Draw the arrangements of the resistors and find the equivalent resistance of each arrangement.

[3 Marks]

Answer:

To find the equivalent resistance of resistors connected in series and parallel, we first arrange the resistors accordingly. In series, the total resistance, $R_{series} = R_1 + R_2 + R_3 = 2\Omega + 3\Omega + 6\Omega = 11\Omega$. In parallel, we use the formula $1/R_{parallel} = 1/R_1 + 1/R_2 + 1/R_3 = 1/2 + 1/3 + 1/6$. Finding a common denominator (6), we get $1/R_{parallel} = 3/6 + 2/6 + 1/6 = 6/6$, making $R_{parallel} = 1\Omega$. Thus, R_{series} is 11Ω and $R_{parallel}$ is 1Ω.

Key Points: Equivalent resistance in series is the sum; Equivalent resistance in parallel uses the reciprocal formula; Arrangements can be visualized as series in a straight line and parallel in a branch.

Question 38. Write the essential function performed by ozone at the higher levels of the atmosphere. How is it formed in the upper atmosphere? Write the name of the group of chemicals mainly responsible for the depletion of the ozone layer.

[3 Marks]

Answer: The essential function of ozone in the upper atmosphere is to protect the Earth from harmful ultraviolet (UV) radiation emitted by the Sun. This UV radiation can cause serious health issues such as skin cancer and cataracts, as well as harming various organisms and ecosystems. Ozone is formed in the upper atmosphere through a process where UV light splits oxygen molecules (O2) into individual oxygen atoms (O). These free oxygen atoms then react with other oxygen molecules to form ozone (O3). The main group of chemicals responsible for the depletion of the ozone layer are chlorofluorocarbons (CFCs), which are used in industrial applications such as refrigeration, aerosol sprays, and foam production. CFCs break down ozone molecules and significantly reduce the ozone concentration in the atmosphere.

Key Points: Function of ozone is to protect Earth from UV radiation - Ozone formation involves the reaction of UV light with oxygen - CFCs are the main chemicals responsible for ozone depletion

Question 39.

Why are decomposition reactions called the opposite of combination reactions ? Write one chemical equation each for these two types of reactions mentioning the name of the reactant(s) and the product(s) involved in the reactions.

[3 Marks]

Answer:

Decomposition reactions are considered the opposite of combination reactions because they involve the breakdown of a single compound into two or more simpler products, while combination reactions involve the formation of a single compound from two or more reactants. For example, in a combination reaction, when hydrogen gas (H_2) reacts with oxygen gas (O_2), they form water (H_2O):$2H_2(g)+O_2(g) \rightarrow 2H_2O(l)$. Conversely, during the thermal decomposition of calcium carbonate ($CaCO_3$), it breaks down into calcium oxide (CaO) and carbon dioxide (CO_2): $CaCO_3(s) \rightarrow CaO(s) + CO_2(g)$. These reactions illustrate the fundamental difference in how reactants combine or decompose.

Key Points:

Decomposition reactions break down compounds; Combination reactions form compounds; Example of combination: $H_2 + O_2 \rightarrow H_2O$; Example of decomposition: $CaCO_3 \rightarrow CaO + CO_2$

Section E

Question 40.

(i) A compound ‘X’ having two carbon atoms in its molecule turns blue litmus red and 5 – 8% solution of ‘X’ in water is widely used as a preservative. Identify the compound ‘X’ and write its structure.(1.5)

(ii) Compare its pH nature with a mineral acid. (.5)

(iii) ‘X’ on reacting with alcohols produces sweet smelling compounds, used in making perfumes. Name the reaction and write its chemical equation. (1.5)

(iv) When sodium carbonate is added to ‘X’, a colourless gas is produced which turns lime water milky. Write the chemical equation for the reaction giving the name of the salt produced. (1.5)

[5 Marks]

Answer: The compound ‘X’ is acetic acid (CH_3COOH), which contains two carbon atoms and is known to turn blue litmus red, indicating its acidic nature. Acetic acid has a pH around 2.4, which is similar to that of many mineral acids, which typically range from 1 to 3. The reaction between acetic

acid and alcohols is known as esterification, where acetic acid reacts with alcohol to form esters. For example, $CH_3COOH + R\text{-}OH \rightarrow CH_3COOR + H_2O$. When sodium carbonate reacts with acetic acid, it produces carbon dioxide (CO_2) gas, which turns lime water milky, forming calcium carbonate ($CaCO_3$), and water. The chemical equation is: $2\ CH_3COOH + Na_2CO_3 \rightarrow 2\ CH_3COONa + CO_2 + H_2O$.

Key Points: Acetic acid, CH_3COOH, two carbon atoms, blue litmus red; pH 2.4, similar to mineral acids; esterification reaction; produces sweet-smelling esters; reactant equation; reaction with sodium carbonate; produces CO_2; milky lime water; chemical equation, calcium carbonate.

Question 41.

(i) Differentiate between saturated and unsaturated hydrocarbons by giving one example each, with a structural formula.

(ii) Write the method of converting an unsaturated hydrocarbon into a saturated hydrocarbon. Name the industry where this reaction is commonly used.

(iii) Write the name and structure of a hydrocarbon having double bond and four carbon atoms in its one molecule.

[5 Marks]

Answer:

Saturated hydrocarbons are compounds consisting only of carbon and hydrogen atoms, with all carbon-carbon bonds being single. They are typically less reactive due to the lack of multiple bonds. An example is ethane (C_2H_6), represented as $CH_3–CH_3$. Unsaturated hydrocarbons, on the other hand, contain at least one double or triple bond, making them more reactive. Ethene (C_2H_4) is an example, depicted as $CH_2=CH_2$. To convert unsaturated hydrocarbons into saturated ones, a common method is hydrogenation, where hydrogen is added across the double bond. This process is widely used in the food industry to convert liquid vegetable oils into solid fats. Lastly, butene (C_4H_8) has a double bond and the structure $CH_2=CH\text{-}CH_2\text{-}CH_3$.

Key Points:

Saturated hydrocarbons contain single bonds; example: ethane (C_2H_6); structural formula:$CH_3–CH_3$. Unsaturated hydrocarbons have double/triple bonds; example: ethene (C_2H_4); structural formula: $CH_2=CH_2$. Conversion method: Hydrogenation; industry: food industry. Hydrocarbon with double bond and four carbons: butene (C_4H_8); structure: $CH_2=CH–CH_2–CH_3$.

Question 42.

(i) “The length of the small intestine in various animals depends on the food they eat.” Justify the statement.

(ii) Discuss the role of the pancreas and bile juice in the digestion of food in human beings.

(iii) How is the small intestine designed to absorb digested food ?

[5 Marks]

Answer: The length of the small intestine in animals varies, adapting to their diet. Herbivores, like cows, consume fibrous plant material. Their longer small intestines allow for extended digestion and fermentation of cellulose, which is challenging to break down. In contrast, carnivores, such as tigers, eat meat that is easier to digest, resulting in shorter small intestines due to less required transit time. \nThe pancreas plays a crucial role in digestion by secreting enzymes like lipase for fats and trypsin for proteins, while bile, produced by the liver and stored in the gallbladder, aids in the emulsification of fats. \nFinally, the small intestine's design includes villi and microvilli that increase the surface area, enhancing nutrient absorption. This specialized structure ensures effective uptake of amino acids, sugars, and fatty acids, which are vital for the body’s metabolism.

Key Points: 1. Length variation in small intestine based on diet. 2. Herbivores have long intestines for cellulose digestion. 3. Carnivores have shorter intestines for easier digestion. 4. Pancreas secretes digestive enzymes (e.g., lipase, trypsin). 5. Bile helps emulsify fats. 6. Small intestine's villi and microvilli increase surface area for absorption.

Question 43.

(i) State the role of rings of cartilage present in the throat.

(ii) Discuss the role of the ribs and diaphragm when air is taken in during the breathing cycle.

(iii) Why do we get muscle cramps during heavy exercise ? Explain.

[5 Marks]

Answer: The rings of cartilage in the throat, also known as tracheal rings, play a crucial role in maintaining the structure of the airway. They prevent the trachea from collapsing, thereby ensuring that air can freely flow to and from the lungs. During inhalation, the ribs and diaphragm work together to facilitate breathing; when the diaphragm contracts, it moves downward, and the ribs elevate, expanding the chest cavity. This creates a negative pressure that draws air into the lungs. Muscle cramps during heavy exercise occur due to an imbalance of electrolytes and dehydration, resulting in involuntary muscle contractions. High-intensity activity depletes energy stores and leads to the accumulation of lactic acid, which can trigger cramps. Proper hydration and stretching are key to preventing such cramps.

Key Points: Rings of cartilage prevent airway collapse; Ribs and diaphragm facilitate inhalation; Diaphragm contraction lowers pressure; Ribs elevate to expand chest cavity; Muscle cramps result from dehydration and electrolyte imbalance; Lactic acid accumulation during heavy exercise causes cramps; Importance of hydration and stretching.

Question 44.

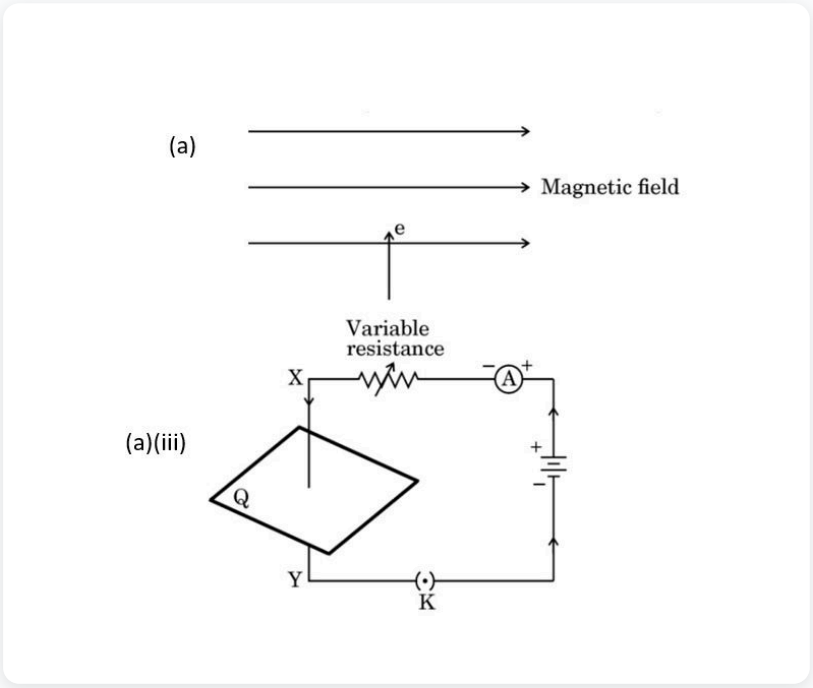
The given figure shows the current passing through the straight conductor XY.

(i) Copy the diagram and draw the magnetic field lines when current flows from conductor X to Y.

(ii) Name and state the rule used in determining the direction of the magnetic field lines in the situation given above.

(iii) State Fleming's left hand rule. Using this rule, determine the direction of force applied on an electron entering a uniform magnetic field as shown in the figure.

[5 Marks]



Answer: To determine the magnetic field lines around a straight conductor XY with current flowing from X to Y, we can use the right-hand thumb rule. If you hold the conductor with your right hand, pointing your thumb in the direction of the current (from X to Y), your fingers will curl around the conductor indicating the direction of the magnetic field lines. The rule used to find the direction of the magnetic field is known as the right-hand thumb rule. \nFleming's left-hand rule states that if you stretch your thumb, forefinger, and middle finger of the left hand at right angles to each other, the forefinger represents the direction of the magnetic field (B), the thumb indicates the direction of the force (F) acting on the conductor, and the middle finger shows the direction of the current (I). \nIn the

case of an electron entering a magnetic field at right angles, applying Fleming's left-hand rule indicates that the force on the electron is directed into the page.

Key Points: Magnetic field lines: direction given by right-hand thumb rule; Rule for direction: Right-hand thumb rule; Fleming's left-hand rule: thumb (force), forefinger (magnetic field), middle finger (current); Direction of force on an electron: into the page.

Question 45.

(i) Define the term solenoid. Draw the pattern of the magnetic field lines in and around a current carrying straight solenoid. Mark on the pattern the (i) direction of current, (ii) direction of field lines near the ends of the solenoid, and (iii) region where the magnetic field is uniform.

(ii) How would you make an electromagnet using a current carrying solenoid ?

[5 Marks]

Answer: A solenoid is a coil consisting of many circular turns of insulated copper wire, tightly wound in a cylindrical shape. When electric current is passed through it, it creates a magnetic field similar to that of a bar magnet, with one end acting as a north pole and the other as a south pole. The magnetic field lines inside the solenoid are parallel and equidistant, indicating a uniform magnetic field. To create an electromagnet, insert a soft iron rod inside the solenoid. When current flows, the rod becomes magnetized, turning it into a magnet, which can be switched on and off by controlling the electric current.

Key Points: Definition of a solenoid; Structure and function of a solenoid; Magnetic field pattern: uniform inside, direction of current; Creation of an electromagnet: inserting soft iron, current flow magnetizes the rod