CBSE EXAMINATION PAPER-2024

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. Carbon is a versatile element that forms the basis of all living organisms and many of the things we use. A large variety of compounds is formed because of its tetravalency. Compounds of carbon are formed with oxygen, hydrogen, nitrogen, sulphur, chlorine and many other elements.

(1) What are hydrocarbons?

[1 Marks]

Answer: Hydrocarbons are compounds made up of only carbon and hydrogen atoms.

Key Points: Hydrocarbons contain only carbon and hydrogen atoms - Carbon forms bonds with hydrogen in these compounds - Hydrocarbons are the simplest carbon compounds - They form the basis for many other carbon compounds

(2) List two properties by virtue of which carbon can form a large number of compounds.

[1 Marks]

Answer: Two important properties of carbon that allow it to form a large number of compounds are: 1) Catenation: Carbon can form strong bonds with other carbon atoms creating long chains, branched chains or rings. 2) Tetravalency: Carbon has four valence electrons which enable it to form covalent bonds with up to four other atoms including atoms of different elements, resulting in a variety of stable compounds.

Key Points: Catenation-Tetravalency-Strong covalent bonds and stability of compounds due to carbon's small size

(3) Write the formula of the functional group present in (1) aldehydes, and (2) ketones. Write a chemical equation for the reaction that occurs between ethanoic acid and ethanol in the presence of a catalyst.

[2 Marks]

Answer: 1) The functional group present in aldehydes is the aldehyde group with the formula -CHO. 2) The functional group present in ketones is the keto group with the formula -CO-. The reaction between ethanoic acid and ethanol in the presence of a catalyst (usually concentrated sulfuric acid) is called esterification. They react to form an ester, ethyl ethanoate, and water. The chemical equation is: Ethanoic acid + Ethanol → Ethyl ethanoate + Water CH3COOH + C2H5OH → CH3COOC2H5 + H2O

Key Points: Functional group in aldehydes is -CHO-The functional group in ketones is -CO- -Reaction between ethanoic acid and ethanol forms an ester called ethyl ethanoate- Catalyst is usually concentrated sulfuric acid- General esterification reaction involves acid + alcohol → ester + water

(4)

What are structural isomers? Write the structures of two

isomers of butane (C_4H_{10})

[2 Marks]

Answer: Structural isomers are compounds that have the same molecular formula but different arrangements of atoms. In other words, they differ in how the carbon atoms are connected to each other. For example, two isomers of butane (C4H10) are: 1. n-Butane: A straight chain of four carbon atoms connected one after another (C-C-C-C), with hydrogen atoms filling the remaining bonds. 2. Isobutane (or methylpropane): A branched chain where three carbon atoms form a chain and the fourth carbon is attached to the middle carbon atom, creating a branch. These two have the same molecular formula but different structures, resulting in different properties.

Key Points: Definition of structural isomers-Same molecular formula but different atomic arrangement-Example of n-butane (straight chain) and isobutane (branched chain)-Explain difference in carbon skeleton

Question 2. Pollination is an important process in sexual reproduction of plants. It is an essential process that facilitates fertilisation in plants. Pollinating agents can be wind, water, insects and birds.

Several changes take place in the flower after the fertilization has taken place.

(1) Name the part of the flower which attracts insects for pollination. What happens to this part after fertilisation?

[1 Marks]

Answer: The part of the flower that attracts insects for pollination is the petals. After fertilization occurs, the petals usually wither and may fall off as the plant focuses on developing the fertilized ovule into a seed.

Key Points: 1. Petals attract pollinators; 2. Petals may wither after fertilization; 3. Focus shifts to seed development

(2) Write the main difference between self-pollination and cross-pollination.

[1 Marks]

Answer: The main difference between self-pollination and cross-pollination is that self-pollination occurs when pollen is transferred from the anthers to the stigma of the same flower, while cross-pollination occurs when pollen is transferred from the anthers of one flower to the stigma of a different flower.

Key Points: Self-pollination occurs within the same flower; Cross-pollination occurs between different flowers; Agents of cross-pollination include wind, water, and animals.

(3) Define fertilisation. What is the fate of ovules and the ovary in a flower after fertilisation?

[2 Marks]

Answer: Fertilisation is the process where the sperm and ovum fuse, resulting in the formation of a zygote. After fertilisation, the ovules develop into seeds, and the ovary transforms into a fruit, protecting the developing seeds and aiding in their dispersal.

Key Points: Fertilisation is sperm-ovum fusion; Ovules become seeds; Ovary becomes fruit

(4)

In a germinating seed, which parts are known as future

shoot and future root ? Mention the function of cotyledon.

[2 Marks]

Answer: In a germinating seed, the part that develops into the future shoot is known as the 'plumule' and the part that develops into the future root is called the 'radicle.' The cotyledon serves the important function of storing food for the developing embryo, providing necessary nutrients until the seedling can produce its own food through photosynthesis.

Key Points: plumule-radicle-cotyledon function

Question 3.

A highly polished surface such as a mirror reflects most of the light falling on it. In our daily life we use two types of mirrors plane and spherical. The reflecting surface of a spherical mirrors may be curved inwards or outwards. In concave mirrors, reflection takes place from the inner surface, while in convex mirrors reflection takes place from the outer surface.

(1) A ray of light is incident on a concave mirror, parallel to its principal axis. If this ray after reflection from the mirror passes through the principal axis from a point at a distance of 10 cm from the pole of the mirror, find the radius of curvature of the mirror.

[1 Marks]

Answer: When a ray of light is incident parallel to the principal axis of a concave mirror, it passes through the focus after reflection. Given that the ray passes through a point 10 cm from the pole, this point is the focus (f) of the mirror. The radius of curvature (R) of a concave mirror is twice the focal length, so R = 2 × 10 cm = 20 cm. Therefore, the radius of curvature of the mirror is 20 cm.

Key Points: concave mirror-reflecting surface curved inward-ray parallel to principal axis passes through focus-focal length equals 10 cm-radius of curvature equals twice the focal length-radius of curvature is 20 cm

(2) Define the principal axis of a concave mirror.

[1 Marks]

Answer: The principal axis of a concave mirror is an imaginary straight line that passes through the center of the mirror and its pole, and is perpendicular to the surface of the mirror.

Key Points: Principal axis is an imaginary straight line-It passes through the center and pole of the mirror-It is perpendicular to the mirror's surface

(3) An object is placed at a distance of 10 cm from the pole of a convex mirror of focal length 15 cm. Find the position of the image.

[2 Marks]

Answer: Given data: Object distance, u = -10 cm (The object is always placed in front of the mirror, so u is negative) Focal length of convex mirror, f = +15 cm (For convex mirrors, focal length is positive) Using the mirror formula: 1/f = 1/v + 1/u => 1/v = 1/f - 1/u => 1/v = 1/15 - 1/(-10) => 1/v = 1/15 + 1/10 => 1/v = (2 + 3)/30 = 5/30 = 1/6 Therefore, v = 6 cm. So, the image is formed at a distance of 6 cm behind the mirror.

Key Points: Define focal length for convex mirror-Use sign conventions (u negative, f positive)-Apply mirror formula 1/f = 1/v + 1/u-Calculate image distance v-Interpret positive v as virtual image formed behind mirror

(4)

A mirror forms a virtual, erect and diminished image of an

object. Identify the type of this mirror. Draw a ray diagram

to show the image formation in this case.

[2 Marks]

Answer: The mirror that forms a virtual, erect and diminished image of an object is a convex mirror. In a convex mirror, the reflective surface curves outward, and it always forms a virtual, erect and diminished image irrespective of the position of the object. [Here, draw a ray diagram showing an object in front of a convex mirror, with parallel rays reflecting and appearing to come from the focal point behind the mirror, and the image formed behind the mirror, smaller and upright.]

Key Points: Type of mirror is convex mirror-Convex mirror has a reflective surface curved outwards-Always forms a virtual, erect and diminished image-Image formed behind the mirror-Ray diagram should show the reflection and image formation

Section B

Question 4.

To balance the following chemical equation, the values of the coefficients x, y, and z must be respectively:

[1 Marks]

$$x\ \mathrm{Zn(NO_3)_2} \xrightarrow{\Delta} y\ \mathrm{ZnO} + z\ \mathrm{NO_2} + \mathrm{O_2}$$

(A) 4, 4, 2

(B) 4, 2, 2

(C) 2, 4, 2

(D) 2, 2, 4

Explanation: In balancing chemical equations, the number of atoms of each element must be equal on both sides of the equation. Given the information that oxygen atoms are unbalanced initially (1 ≠

4), adjusting the coefficients to 2, 4, and 2 balances all elements, including oxygen, hydrogen, and zinc. This matches the balanced equation of Zn + 2 H2SO4 → ZnSO4 + 2 H2, where coefficients correspond to reactants and products to maintain equality of atoms.

Question 5.

Which of the following is a redox reaction, but not a combination reaction?

[1 Marks]

(A) $Fe_2O_3 + 3\ CO \rightarrow 2\ Fe + 3\ CO_2$

(B) $2\ Mg + O_2 \rightarrow 2\ MgO$

(C) $2\ H_2 + O_2 \rightarrow 2\ H_2O$

(D) $C + O_2 \rightarrow CO_2$

Explanation: A redox reaction involves both oxidation and reduction occurring simultaneously. A combination reaction is one where two or more reactants combine to form a single product. The first three options are combination reactions where elements or simple molecules combine to form one compound, and all are redox reactions. The fourth option, $Fe_2O_3 + 3\ CO \rightarrow 2\ Fe + 3\ CO_2$, is a redox reaction where iron(III) oxide is reduced to iron and carbon monoxide is oxidized to carbon dioxide, but it is not a combination reaction because multiple products are formed.

Question 6. The salt present in tooth enamel is:

[1 Marks]

(A) Calcium phosphate

(B) Sodium phosphate

(C) Aluminium phosphate

(D) Magnesium phosphate

Explanation: The correct answer is 'Calcium phosphate' because tooth enamel is primarily composed of hydroxyapatite, which is a crystalline structure of calcium phosphate. This mineral provides strength and hardness to teeth.

Question 7. An aqueous solution of sodium chloride is prepared in distilled water. The pH of this solution is:

[1 Marks]

(A) 7

(B) 8

(C) 3

(D) 6

Explanation: The correct answer is 7, as sodium chloride (NaCl) is a neutral salt formed from the strong acid hydrochloric acid (HCl) and the strong base sodium hydroxide (NaOH). When dissolved in distilled water, it does not affect the pH significantly, which remains around 7, indicating a neutral solution.

Question 8.

Select from the following the conditions responsible for the rapid spread of bread mould on a slice of bread:

(i) Formation of large number of spores

(ii) Presence of moisture and nutrients in bread

(iii) Low temperature

(iv) Presence of hyphae

[1 Marks]

(A) (iii) and (iv)

(B) (ii) and (iii)

(C) (ii) and (iv)

(D) (i) and (ii)

Explanation: The correct conditions responsible for the rapid spread of bread mould are (i) Formation of large number of spores and (ii) Presence of moisture and nutrients in bread. Bread mould spreads quickly because fungi produce a large number of spores which are tiny reproductive units that can grow into new fungi when conditions are favorable. Bread provides moisture and nutrients that help the fungus grow and spread. Low temperature is not favorable for growth, and although hyphae are part of the fungus structure, they do not directly cause the rapid spread like spores and moisture do.

Question 9. The process in which transport of soluble products of photosynthesis takes place in plants is known as:

[1 Marks]

(A) Transpiration

(B) Evaporation

(C) Translocation

(D) Conduction

Explanation: The correct answer is 'Translocation' because it refers to the process by which the soluble products of photosynthesis, such as sugars and amino acids, are transported from the leaves (where they are produced) to other parts of the plant, specifically through the vascular tissue known as phloem.

Question 10. Sense organ in which olfactory receptors are present is:

[1 Marks]

(A) Nose

(B) Skin

(C) Tongue

(D) Inner ear

Explanation: The correct answer is 'Nose' because olfactory receptors, which are responsible for the sense of smell, are present in the nasal cavity. This is supported by the context which states that 'olfactory receptors will detect smell,' indicating that they are located in the nose.

Question 11. The incorrect statement about placenta is:

[1 Marks]

(A) It is a disc embedded in the uterine wall.

(B) It has a very small surface area for glucose and oxygen to pass from mother to the embryo.

(C) The embryo gets nutrition from the mother.

(D) It is formed only during pregnancy.

Explanation: The correct answer is 'It has a very small surface area for glucose and oxygen to pass from mother to the embryo.' This statement is incorrect because the context clearly states that the placenta provides a large surface area for glucose and oxygen to pass from the mother to the embryo, enabling effective nutrient transfer.

Question 12.

The correct sequence of events when someone's hand touches a hot object unconsciously:

[1 Marks]

(A) Receptors in skin →Motor neuron → Relay neuron → Sensory neuron → Effector muscle in arm

(B) Receptors in skin → Sensory neuron → Relay neuron →Motor neuron → Effector muscle in arm

(C) Receptors in skin → Relay neuron → Sensory neuron → Motor neuron → Effector muscle in arm

(D) Receptors in skin → Sensory neuron → Effector muscle in arm → Motor neuron → Relay neuron

Explanation:

This statement is correct because when someone touches a hot object unconsciously, the response follows the **reflex arc pathway**. First, the **receptors in the skin** detect heat/pain. The signal is then carried by the **sensory neuron** to the spinal cord. Inside the spinal cord, the impulse is passed to a **relay neuron**, which quickly transfers it to a **motor neuron**. Finally, the **motor neuron** sends the signal to the **effector muscle in the arm**, causing it to contract and pull the hand away immediately.

Question 13. How will the image formed by a convex lens be affected, if the upper half of the lens is wrapped with a black paper?

[1 Marks]

(A) The size of the image formed will be one-half of the size of the image due to the complete lens.

(B) The image of the upper half of the object will not be formed.

(C) The brightness of the image will reduce.

(D) The lower half of the inverted image will not be formed.

Explanation: When the upper half of a convex lens is covered, the lens still forms the complete image because every part of the lens contributes to the formation of the whole image. However, since less light passes through the lens, the brightness of the image decreases. The size and the nature of the image remain unchanged.

Question 14.

The phenomena of light involved in the formation of rainbow are:

[1 Marks]

(A) Refraction, reflection and dispersion

(B) Refraction, dispersion, scattering and total internal reflection

(C) Refraction, dispersion and internal reflection

(D) Reflection, dispersion and internal reflection

Explanation: The correct option is 'Refraction, dispersion and internal reflection'. When sunlight enters a raindrop, it first bends due to refraction. Inside the raindrop, the light undergoes internal reflection off the water-air boundary. Finally, as the light exits the raindrop, it again refracts and disperses into its component colors, producing the rainbow. These three phenomena—refraction, dispersion, and internal reflection—together cause the formation of a rainbow.

Question 15. The colour of light for which the refractive index of glass is minimum, is:

[1 Marks]

(A) Yellow

(B) Red

(C) Green

(D) Violet

Explanation: The correct answer is Red. In the visible spectrum, red light has the longest wavelength and, as a result, it experiences the least bending when passing through materials like glass. This means that the refractive index for red light is lower compared to other colors such as violet, which has a shorter wavelength and a higher refractive index.

Question 16. The current-carrying device which produces a magnetic field similar to that of a bar magnet is:

[1 Marks]

(A) A straight conductor

(B) A circular loop

(C) A circular coil

(D) A solenoid

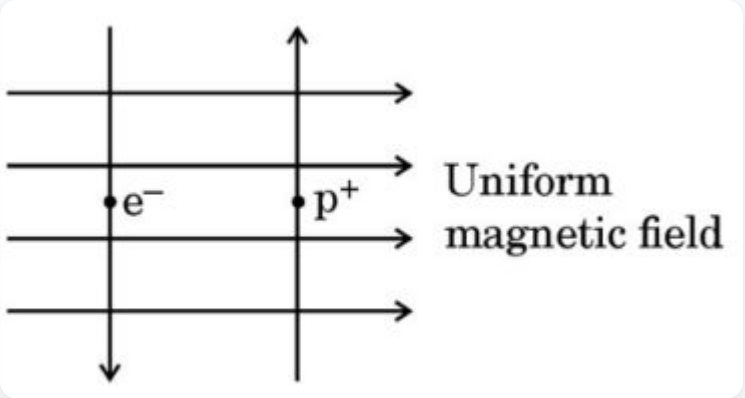
Explanation: The correct answer is 'A solenoid'. A solenoid is a coil of many circular turns of insulated wire, and when current passes through it, the magnetic field produced is similar to that of a bar magnet, with a distinct north and south pole. This is supported by the context provided, which specifically mentions the magnetic field pattern of a solenoid resembling that of a bar magnet.

Question 17.

A uniform magnetic field exists in the plane of paper as shown in the diagram. In this field, an electron

(e^-) and a positron (p^+) enter and shown. The electron and positron experience forces:

[1 Marks]



(A) both pointing into the plane of the paper.

(B) both pointing out of the plane of the paper.

(C) pointing into the plane of the paper and out of the plane of the paper respectively.

(D) pointing out of the plane of the paper and into the plane of the paper respectively.

Explanation:

The correct answer is 'pointing out of the plane of the paper and into the plane of the paper respectively.' This is because the electron, having a negative charge, will experience a force that is directed opposite to that of a positively charged particle (the positron) when they enter a magnetic field at right angles. According to Fleming's left-hand rule, the force direction for the electron will be into the page while for the positron it will be out of the page.

Question 18. Which one of the following is not a natural ecosystem?

[1 Marks]

(A) Pond ecosystem

(B) Grassland ecosystem

(C) Forest ecosystem

(D) Cropland ecosystem

Explanation: The correct answer is 'Cropland ecosystem' because according to the provided context, natural ecosystems include forests, ponds, and grasslands, while gardens and crop-fields are identified as humanmade (artificial) ecosystems.

Question 19.

Assertion (A): Some vegetable oils are healthy.

Reason (R): Vegetable oils generally have long unsaturated carbon chains.

[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, 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:

Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A). Some vegetable oils are considered healthy because they contain unsaturated fatty acids, which have long unsaturated carbon chains. Unlike animal fats that have saturated carbon chains and are considered harmful, unsaturated fats in vegetable oils help in maintaining good health.

Question 20.

Assertion (A): Sex of the children will be determined by what they inherit from their mother.

Reason (R): Women have XX sex chromosomes.

[1 Marks]

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

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

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

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

Explanation:

Assertion (A) is false because the sex of the children is determined by the father's chromosome; he can provide either an X (girl) or a Y (boy) chromosome. Reason (R) is true as women do have XX sex chromosomes, but it does not explain Assertion (A) correctly since it is the paternal contribution that determines the child's sex.

Question 21.

Assertion (A): Electrons move from lower potential to higher potential in a conductor.

Reason (R): A dry cell maintains electric potential difference across the ends of a conductor.

[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:

Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of Assertion (A). Electrons, which carry negative charge, actually move from points of lower electric potential to higher electric potential inside a conductor. A dry cell does maintain an electric potential difference (voltage) across the ends of a conductor, which drives the flow of electric current. However, the reason that electrons move from lower potential to higher potential is due to the electric field established by the potential difference, not simply because the dry cell maintains the potential difference. Therefore, while both statements are true, the reason does not directly explain the assertion.

Question 22.

Assertion (A): Ozone layer protects the surface of the Earth from harmful UV radiations.

Reason (R): Chlorofluorocarbons (CFCs) are responsible for depletion of ozone layer.

[1 Marks]

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

Explanation:

Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of Assertion (A).. The ozone layer absorbs harmful ultraviolet (UV) radiation from the sun, thus protecting life on Earth from its damaging effects. Chlorofluorocarbons (CFCs) are chemicals that cause depletion of the ozone layer, leading to increased exposure of UV radiation on Earth's surface.

Question 23. A metal 'X' is used in thermit process. When 'X' is heated with oxygen, it gives an oxide 'Y', which is amphoteric in nature. 'X' and 'Y' respectively are :

[1 Marks]

(A) Mn, MnO_2

(B) Mg, MgO

(C) Al, Al_2O_3

(D) Fe, Fe_2O_3

Explanation: In the thermit process, aluminium (Al) is the metal used. When aluminium reacts with oxygen, it forms aluminium oxide (Al_2O_3), which is amphoteric in nature. Amphoteric oxides can react with both acids and bases, as shown by the reactions of Al_2O_3 with HCl and NaOH. The thermit reaction involves aluminium reducing iron(III) oxide to iron, while aluminium itself is oxidised to aluminium oxide.

Section C

Question 24.

Copper powder is taken in a china dish and heated over a burner. Name the product formed and state its colour. Write the chemical equation for the reaction involved.

[2 Marks]

Answer: (a) Product formed: Copper oxide (CuO)
(b) Colour of the product: Black
(c) Chemical equation: $2Cu + O_2$ heat $2CuO$
Explanation: When copper powder is heated in presence of oxygen from the air, it reacts to form copper oxide which is black in colour. This is a chemical change where copper metal reacts with oxygen gas to form copper oxide.

> **Key Points: Copper powder heated in oxygen forms copper oxide - Copper oxide is black in colour - Chemical equation is 2Cu + O2 heat 2CuO**

Question 25. The melting and boiling points of carbon compounds are generally low and they are largely non-conductors of electricity. State two conclusions based on these two properties.

[2 Marks]

Answer: The low melting and boiling points of carbon compounds indicate that the forces of attraction between their molecules are weak. This means that these compounds do not require much energy to change their state from solid to liquid or liquid to gas. Additionally, since carbon compounds are largely non-conductors of electricity, it shows that they do not have free charged particles like ions or electrons to carry electric current. This is because their atoms are bonded covalently and electrons are shared, not transferred.

Key Points: 1. Low melting and boiling points mean weak intermolecular forces in carbon compounds. 2. Carbon compounds have covalent bonding with shared electrons. 3. They lack free charged particles and so do not conduct electricity.

Question 26. Sometimes while running, the athletes suffer from muscle cramps. Why? How is respiration in this case different from aerobic respiration?

[2 Marks]

Answer: Athletes suffer from muscle cramps during running because their muscles sometimes respire anaerobically due to insufficient oxygen supply. During intense exercise, muscles require more energy than what aerobic respiration can provide, and oxygen becomes scarce. Anaerobic respiration breaks down glucose partially to produce energy and lactic acid. The buildup of lactic acid causes muscle cramps. Unlike aerobic respiration, which fully breaks down glucose using oxygen to release more energy, anaerobic respiration happens without oxygen and produces less energy along with lactic acid.

Key Points: Muscle cramps happen due to lactic acid buildup - Anaerobic respiration occurs when oxygen supply is low - Anaerobic respiration produces energy without oxygen - Lactic acid accumulation causes cramps - Aerobic respiration requires oxygen and produces more energy - Anaerobic respiration breaks down glucose partially

Question 27. Write the other name given to lymph. State its two functions.

[2 Marks]

Answer: The other name given to lymph is tissue fluid. Two functions of lymph are: 1) It carries digested and absorbed fats from the intestine to the bloodstream. 2) It drains excess fluid from the spaces around the tissues back into the blood, helping to maintain fluid balance in the body.

Key Points: Other name for lymph is tissue fluid-Lymph carries absorbed fats from intestine to blood-Lymph drains excess fluid from tissue spaces to blood

Question 28. Some unicellular organisms such as Plasmodium and Leishmania differ in the manner in which they reproduce. Name and explain the reproductive process taking place in them.

[2 Marks]

Answer: Plasmodium reproduces through multiple fission, a process where the organism divides into many daughter cells simultaneously, especially during unfavorable conditions. Conversely, Leishmania reproduces via binary fission, where the cell divides into two daughter cells in a specific orientation, often guided by its whip-like structure. This distinct method allows each organism to adapt and thrive in their respective environments efficiently.

Key Points: Plasmodium-multiple fission-binary fission-Leishmania-whip-like structure-adaptation

Question 29.

The heat produced at a point due to concentration of sunlight by a convex lens burns a paper. (a)Explain why it happens. (b) Name the term given to the point at which the paper starts burning.

[2 Marks]

Answer: (a) When sunlight, which consists of parallel rays, passes through a convex lens, the lens converges these rays to a single point. This concentration of light energy at that point produces heat, which is sufficient to burn the paper. (b) The point at which the rays converge and the paper starts burning is called the 'focus' of the convex lens.

Key Points: Sunlight consists of parallel rays - Convex lens converges parallel rays - Rays meet at one point - Concentrated light produces heat - Heat burns paper - Point where rays meet is called focus

Question 30. An electric source can supply a charge of 500 coulomb. If the current drawn by a device is 25 mA, find the time in which the electric source will be discharged completely.

[2 Marks]

Answer: Given the total charge Q = 500 coulombs and current I = 25 mA = 0.025 A. We know that current I = charge Q divided by time t, so t = Q/I. Substituting the values, t = 500 / 0.025 = 20000 seconds. Thus, the electric source will be discharged completely in 20000 seconds or approximately 5 hours 33 minutes.

Key Points: Definition of current as charge per unit time-Conversion of current from milliampere to ampere-Use of the formula t = Q/I for calculating time-Charge given as 500 C-Current given as 25 mA-Calculation of time in seconds and conversion to hours and minutes

Question 31.

Write chemical equation for the chemical reaction which occurs when the aqueous solutions of barium chloride and sodium sulphate react together. Write the symbols of the ions present in the compound

precipitated in the reaction.

[2 Marks]

Answer: When aqueous solutions of barium chloride (BaCl2) and sodium sulphate (Na2SO4) are mixed, a double displacement reaction occurs. Barium ions (Ba2+) react with sulphate ions (SO4 2-) to form barium sulphate (BaSO4), which is an insoluble white solid precipitate. The balanced chemical equation is: BaCl2 (aq) + Na2SO4 (aq) → BaSO4 (s) + 2NaCl (aq). The precipitate formed contains barium ions (Ba2+) and sulphate ions (SO4 2-).

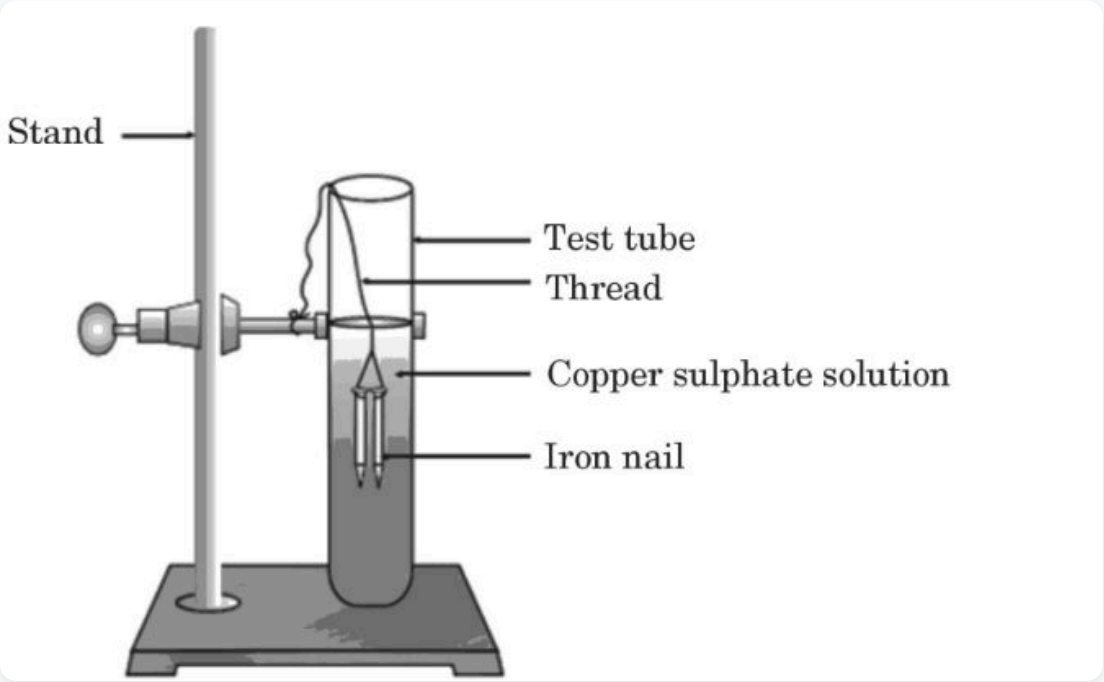
Key Points: Mixing of BaCl2 and Na2SO4 produces a double displacement reaction-Barium sulphate (BaSO4) is the white solid precipitate-Balanced equation: BaCl2 (aq) + Na2SO4 (aq) → BaSO4 (s) + 2NaCl (aq)-Ions in precipitate: Ba2+ and SO4 2-

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Section D

Question 32. Study the experimental set-up shown in the diagram and write the chemical equation for the chemical reaction involved. Name and define the type of reaction. List two other metals which can be used in place of iron to show the same type of reaction with copper sulphate solution.

[3 Marks]



Answer: (a) The chemical equation for the reaction is: Fe (s) + $CuSO_4$ (aq) --> $FeSO_4$ (aq) + Cu (s). Here, solid iron reacts with aqueous copper sulphate solution to form aqueous iron sulphate and solid copper.

(b) This reaction is called a displacement reaction. It occurs when a more reactive metal displaces a less reactive metal from its salt solution.

(c) Two other metals which can be used in place of iron to show the same type of reaction with copper

sulphate solution are zinc (Zn) and aluminium (Al). Both these metals are more reactive than copper and can displace copper from copper sulphate solution.

Key Points: Chemical equation-Displacement reaction-Other reactive metals zinc and aluminium

Question 33. Name the ore of mercury and state the form in which it is found in nature. Write the chemical equations along with the conditions required for the reactions involved in the extraction of mercury from its ore.

[3 Marks]

Answer: (a) The ore of mercury is cinnabar, which is mercury sulfide (HgS). It is found in nature as an insoluble red mineral.

(b) Mercury is extracted from cinnabar by roasting it in the presence of oxygen. The first reaction involves heating mercury sulfide in air to form mercury oxide and sulfur dioxide: $2HgS(s) + 3O_2(g) \ Heat\rightarrow 2HgO(s) + 2SO_2(g)$. This reaction requires heating in air to provide oxygen.

(c) The second reaction involves the thermal decomposition of mercury oxide to produce liquid mercury and oxygen gas: $2HgO(s) \ Heat\rightarrow 2Hg(l) + O_2(g)$. This reaction also requires heating.

Thus, mercury is obtained by heating cinnabar in air, which converts HgS first to HgO and then to metallic mercury.

Key Points: Ore of mercury is cinnabar (HgS) - Mercury found as mercury sulfide in nature - Extraction involves roasting HgS in air - First reaction: HgS + O_2 forms HgO and SO_2 - Second reaction: HgO decomposes on heating to Hg and O_2 - Both reactions require heating in presence of oxygen

Question 34. Taking the example of any two animal hormones along with their gland of secretion, explain how these hormones help (i) in growth and development and (ii) regulate metabolism, in the body.

[3 Marks]

Answer: Two important animal hormones are Growth Hormone (GH) and Insulin. GH is secreted by the anterior pituitary gland and plays a crucial role in growth and development. It stimulates tissue growth, increases cell size, and promotes the synthesis of proteins, ensuring the development of bones and muscles during childhood. On the other hand, Insulin is produced by the pancreas and regulates metabolism by controlling glucose levels in the blood. It facilitates the uptake of glucose by cells for energy production, thus maintaining metabolic balance and ensuring proper growth. Both hormones are vital, as GH supports bodily growth, while Insulin ensures efficient energy utilization, which is essential for sustaining growth and function.

Key Points: Growth Hormone (GH) aids in tissue growth, secreted by anterior pituitary; Insulin regulates blood glucose, secreted by pancreas; GH supports bone/muscle development; Insulin ensures energy production for metabolism.

Question 35.

Mendel crossed pure tall pea plants (TT) with pure short pea plants (tt) and obtained F_1 progeny. When the plants of F_1 progeny were self-pollinated, plants of F_2 progeny were obtained.

(a) What did the plants of F_1 progeny look like? Give their gene combination.

(b) Why could the gene for shortness not be expressed in plants of F_1 progeny?

(c) Write the ratio of the plants obtained in F_2 progeny and state the conclusion that can be drawn from this experiment.

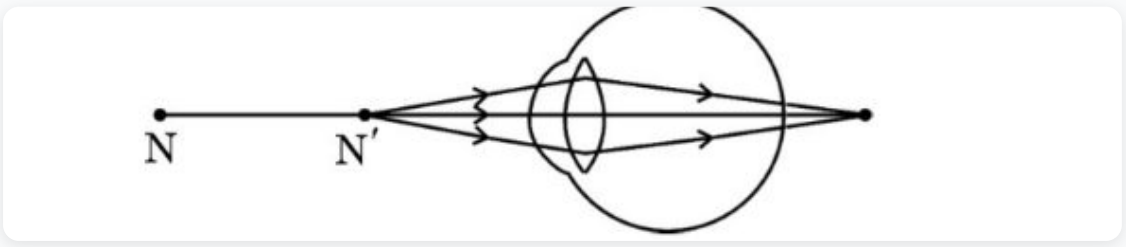
[3 Marks]

Answer: (a) All plants in the F_n progeny were tall in height. Their gene combination was heterozygous tall (Tt), having one dominant allele T for tallness and one recessive allele t for shortness.
(b) The gene for shortness could not be expressed in F_n progeny because the allele for tallness (T) is dominant over the allele for shortness (t). Hence, the presence of the dominant allele masks the effect of the recessive allele.
(c) In F_2 progeny, the plants appeared in the phenotypic ratio of 3 tall : 1 short. Their genotypes appeared in the ratio 1 TT : 2 Tt : 1 tt. This shows that traits are inherited as discrete units and dominant traits can mask recessive traits in heterozygotes. It also supports Mendel's law of segregation which states that allele pairs separate during gamete formation so that each gamete carries only one allele of each gene.

Key Points: F_n plants all tall Tt genotype - Dominant T allele masks recessive t allele in F_n - F_2 phenotypic ratio 3 tall : 1 short confirms Mendel's law of segregation

Question 36. Study the diagram given below and answer the questions that follow: (i) Name the defect of vision depicted in this diagram stating the part of the eye responsible for this condition. (ii) List two causes of this defect. (iii) Name the type of lens used to correct this defect and state its role in this case.

[3 Marks]



Answer: (i) The defect of vision shown in the diagram is Myopia or near-sightedness. It occurs because the image of a distant object is focused in front of the retina instead of on it. This happens when the eyeball is too long or the eye lens has excessive curvature.
(ii) Two causes of myopia are: (1) elongation of the eyeball, which makes the distance between the lens and retina longer than normal, (2) excessive curvature of the eye lens, which decreases its focal length.
(iii) Myopia is corrected by using a concave lens (diverging lens). The concave lens diverges the light rays before they enter the eye so that they focus properly on the retina, thus forming a clear image of distant objects.

Key Points: Myopia - Image formed in front of retina - Causes: elongated eyeball, excessive lens curvature - Corrected by concave lens - Concave lens diverges light rays to focus image on retina

Question 37.

(a) What happens when a bundle of wires of soft iron is placed inside the coil of a solenoid carrying a steady current? Name the device obtained. Why is it called so?

(b) Draw the magnetic field lines inside a current carrying solenoid. What does this pattern of magnetic field lines indicate ?

[3 Marks]

Answer: (a) When a bundle of soft iron wires is placed inside the coil of a solenoid carrying a steady current, the soft iron becomes magnetised and the magnetic field produced inside the coil becomes much stronger. The device obtained is called an electromagnet because it behaves like a magnet only when electric current flows through the solenoid. (b) The magnetic field lines inside a current carrying solenoid are nearly parallel and uniformly spaced, indicating a strong and uniform magnetic field inside the solenoid. Outside the solenoid, the field lines spread out and are weaker. This pattern shows that the solenoid produces a magnetic field similar to that of a bar magnet with distinct north and south poles.

Key Points: Soft iron inside solenoid becomes magnetised - Device called electromagnet as it acts like a magnet only when current flows - Magnetic field lines inside solenoid are uniform and parallel indicating uniform field

Question 38. Differentiate between food chain and food web. In a food chain consisting of deer, grass, and tiger, if the population of deer decreases, what will happen to the population of organisms belonging to the first and third trophic levels?

[3 Marks]

Answer: A food chain represents a linear sequence of energy transfer through trophic levels, while a food web encompasses interconnected food chains illustrating feeding relationships within an

ecosystem. In the context of a chain involving grass (producers), deer (primary consumers), and tigers (tertiary consumers), a decrease in the deer population would mean that the primary consumers (deer) have less food, likely leading to their potential decline. Consequently, the population of tigers, which rely on deer for sustenance, would also decrease due to less available prey, showing the interconnectedness of trophic levels within an ecosystem.

Key Points: Definition of food chain vs food web; linear vs interconnected structure; trophic levels; impact of deer population decrease on producers (grass) and tertiary consumers (tigers); interconnectedness in ecosystems

Question 39.

What is dispersion of white light ? State its cause. Draw a diagram to show dispersion of a beam of white light by a glass prism.

[3 Marks]

Answer: Dispersion of white light is the phenomenon in which white light splits into its constituent colors when it passes through a prism. This happens because white light is made up of many colors mixed together. When white light enters the glass prism from air, it slows down and bends due to refraction. Different colors have different wavelengths and therefore bend by different amounts inside the prism. This difference in bending causes the white light to spread out and form a spectrum of colors ranging from red to violet. The cause of dispersion is that various colors of light refract differently because of their different wavelengths. Below is a simple diagram showing the dispersion of white light by a glass prism.

Key Points: Definition of dispersion-White light is composite of many colors-White light refracts when entering prism-Different colors bend by different amounts-Different bending causes separation of colors-Cause: different wavelengths refract differently-Diagram shows incident white light, prism, and emerging spectrum of colors

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Section E

Question 40.

A few crystals of ferrous sulphate were taken in a dry boiling tube and heated. Tiny water droplets were observed in the tube after some time.

(i) From where did these water droplets appear? Explain.

(ii) What colour change will be observed during heating?

(iii) How many molecules of water are attached per molecule of $FeSO_4$ crystal? Write the molecular formula of crystalline forms of (I) Copper sulphate, and (II) Sodium carbonate.

(iv) State how is Plaster of Paris obtained from gypsum. Write two uses of Plaster of Paris.

[5 Marks]

Answer: (a) The tiny water droplets appeared due to the water of crystallization present in ferrous sulphate crystals. When ferrous sulphate crystals ($FeSO_4 . 7H_2O$) are heated, the water molecules chemically bound in the crystal structure are released as water vapor, which condenses on the cooler parts of the boiling tube forming tiny droplets of water.

(b) During heating, the colour of ferrous sulphate crystals changes from greenish-blue to white or pale yellow as it loses its water of crystallization and becomes anhydrous.

(c) There are 7 molecules of water attached per molecule of $FeSO_4$ crystal in ferrous sulphate heptahydrate ($FeSO_4 . 7H_2O$).

The molecular formula of crystalline forms are:

(I) Copper sulphate pentahydrate : $CuSO_4 . 5H_2O$

(II) Sodium carbonate decahydrate : $Na_2CO_3 . 10H_2O$

(d) Plaster of Paris (POP) is obtained by heating gypsum ($CaSO_4 . 2H_2O$) to about 150 deg Celsius. The heating removes water of crystallization partially, producing calcium sulfate hemihydrate ($CaSO_4 . 1/2\ H_2O$), which is Plaster of Paris.

Two uses of Plaster of Paris are:

1. It is used in making casts for broken bones in medicine.
2. It is used for making decorative objects and molds in art and architecture.

Key Points: Water of crystallization causes water droplets - Colour changes from greenish-blue to white on heating - 7 molecules of water in ferrous sulphate heptahydrate - CuSO4 . 5H2O for copper sulphate pentahydrate - Na2CO3 . 10H2O for sodium carbonate decahydrate - POP obtained by heating gypsum - Uses of POP in medical casts and decoration

Question 41. Design an experiment to demonstrate that carbon dioxide is essential for photosynthesis. Write the observation and conclusion of the experiment.

[5 Marks]

Answer: Experiment to prove that carbon dioxide is essential for photosynthesis:

(a) Take two potted plants of the same type and size. Cover one plant with a plastic bag containing some soda lime or potassium hydroxide which absorbs carbon dioxide, and keep the other plant uncovered as a control.

(b) Place both plants in sunlight for a few hours.

(c) After some time, test the leaves of both plants for the presence of starch by using iodine solution after boiling the leaves in alcohol and then in water.

Observation: The uncovered plant shows a blue-black color indicating the presence of starch, while

the plant covered with soda lime shows no blue-black color, indicating no starch formation.
Conclusion: Carbon dioxide is essential for photosynthesis because the plant deprived of CO_2 was unable to prepare food, as shown by the absence of starch in its leaves. Hence, photosynthesis requires carbon dioxide to occur.

Key Points: Use of soda lime to absorb CO2 - Comparison between test and control plants - Starch test to confirm photosynthesis

Question 42.

(i) The potential difference across the two ends of a circuit component is decreased to one-third of its initial value while its resistance remains constant. What change will be observed in the current flowing through it? Name and state the law which helps us to answer this question.

(ii) Draw a schematic diagram of a circuit consisting of a battery of four 1.5 V cells, a 5 Ω resistor, a 10 Ω resistor and a 15 Ω resistor connected in series. Now find (I) the electric current passing through the circuit, and (II) potential difference across the 10 Ω resistor when the plug key is closed.

[5 Marks]

Answer: (i) According to Ohm's law, the current I through a resistor is directly proportional to the potential difference V across it and inversely proportional to its resistance R, which remains constant here. Mathematically, I = V / R. If the potential difference is decreased to one-third, the current will also decrease to one-third of its initial value.
Ohm's Law: It states that the current flowing through a conductor between two points is directly proportional to the voltage across the two points and inversely proportional to the resistance, provided the temperature remains constant.
Mathematically, V = I R.

(ii) Schematic Diagram: Four 1.5 V cells are connected in series to make 6 V total (4 * 1.5 V). The three resistors of 5 Ω, 10 Ω, and 15 Ω are connected in series with the battery and a plug key.
Calculations:
(I) Total resistance R_{total} = 5 Ω + 10 Ω + 15 Ω = 30 Ω.
Total voltage V_{total} = 4 * 1.5 V = 6 V.
Using Ohm's law, current I = V_{total} / R_{total} = 6 V / 30 Ω = 0.2 A.
(II) Potential difference across 10 Ω resistor, V = I * R = 0.2 A * 10 Ω = 2 V.
Therefore, the electric current through the circuit is 0.2 A, and the potential difference across the 10 Ω resistor is 2 V when the plug key is closed.

Key Points: Ohm's law relates current and voltage - Current decreases to one-third when voltage decreases to one-third with constant resistance - Total resistance in series is

sum of individual resistances - Calculate current using I = V / R - Potential difference across resistor is I * R

Question 43.

An acid 'X' present in tamarind when mixed with 'Y', produces a mixture 'Z'. 'Z' on addition to a dough when heated makes cakes soft and spongy. 'Y' is prepared from common salt and helps in faster cooking.
(i) Write the common names of 'X', 'Y' and 'Z', and the chemical formula of 'Y'.
(ii) How is 'Y' prepared and how does it help in making cakes soft and spongy? Illustrate the reaction with suitable chemical equation.
(iii) Write the name and chemical formula of a mild base other than 'Y' used as an antacid.

[5 Marks]

Answer: (i) Acid 'X' present in tamarind is **Tartaric acid** with chemical formula $C_4H_6O_6$. 'Y' is **Sodium bicarbonate** with chemical formula $NaHCO_3$. 'Z' is **Baking powder**, which is a mixture of tartaric acid and sodium bicarbonate.
(ii) 'Y' (Sodium bicarbonate) is prepared from common salt (NaCl) by Solvay process or by treating sodium carbonate with carbon dioxide and water:
$Na_2CO_3 + CO_2 + H_2O \rightarrow 2\ NaHCO_3$
Baking powder ('Z') produces carbon dioxide gas when heated or in presence of water due to reaction between tartaric acid and sodium bicarbonate. The released CO_2 gas forms bubbles inside the dough making the cakes soft and spongy.
$C_4H_6O_6 + 2\ NaHCO_3 \rightarrow Na_2C_4H_4O_6 + 2\ CO_2 + 2\ H_2O$
(iii) A mild base other than sodium bicarbonate used as antacid is **Magnesium hydroxide** with chemical formula $Mg(OH)_2$.

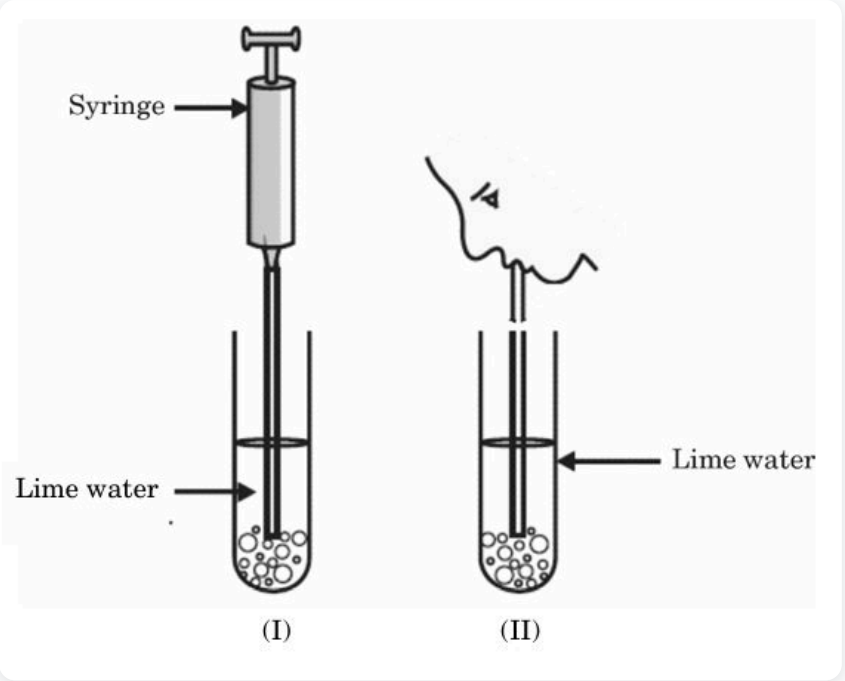
Key Points: Tartaric acid is acid 'X' - Sodium bicarbonate is base 'Y' and is used in baking powder 'Z' - Baking powder releases CO2 making cakes soft and spongy - Sodium bicarbonate prepared from common salt via CO2 and water - Magnesium hydroxide is mild base used as antacid

Question 44.

(i) In the experimental set-up shown above in diagram (I) atmospheric air is being passed into lime water with a syringe while in diagram (II) air is being exhaled into lime water. The time taken for the lime water to turn milky in both the test tubes is different. Give reason.

(ii) Draw the diagram of an open stomatal pore and label (I) Guard cells, and (II) Chloroplast on it. Mention two functions performed by stomata.

[5 Marks]



Answer: (i) The lime water turns milky due to the formation of calcium carbonate caused by the presence of carbon dioxide in the air passing through it. In diagram (I), atmospheric air contains less carbon dioxide (about 0.03-0.04%), so it takes longer time for the lime water to turn milky. In diagram (II), exhaled air has a higher concentration of carbon dioxide (around 4-5%), so the lime water turns milky much faster.

(ii) **Diagram of an open stomatal pore:**
[Imagine a drawing here showing two kidney-shaped guard cells forming a pore between them]
Labels:
(I) Guard cells - These are the two curved cells surrounding the pore.
(II) Chloroplast - Present inside the guard cells.

Functions of stomata:
1. They allow exchange of gases; letting carbon dioxide in for photosynthesis and oxygen out as a by-product.
2. They help in transpiration, the loss of water vapor which helps in cooling the plant and maintaining water movement.

Thus, stomata regulate gas exchange and water loss in plants.

Key Points: Lime water turns milky due to CO2 - Exhaled air has more CO2 than atmospheric air - Stomata allow gas exchange and transpiration - Guard cells control the opening of stomatal pore - Chloroplasts are present in guard cells

Question 45.

(i) When is the potential difference between two points said to be 1 volt ?

(ii) A copper wire has a diameter of 0·2 mm and resistivity of 1·6 $\times 10^{-8}$ Ωm. What will be the length of this wire to make its resistance 14Ω ? How much does the resistance change, if the diameter of the wire is doubled ?

[5 Marks]

Answer: (i) The potential difference between two points is said to be 1 volt when 1 joule of work is done to move a charge of 1 coulomb from one point to the other. In other words, 1 volt = 1 joule/1 coulomb.

(ii) Given data:

Diameter, d = 0.2 mm = $0.2 * 10^{-3}$ m = $2 * 10^{-4}$ m

Resistivity, ρ = $1.6 * 10^{-8}$ Ω m

Resistance, R = 14 Ω

First, find the cross-sectional area, A = π * $(d/2)^2$ = 3.1416 * $(1 * 10^{-4})^2$ = 3.1416 * 10^{-8} m^2

Using the formula for resistance, R = ρ * (L / A), we can find the length L:

L = R * A / ρ = 14 * 3.1416 * 10^{-8} / 1.6 * 10^{-8} = (14 * 3.1416 / 1.6) m = 27.49 m (approx).

If the diameter is doubled, the new diameter d' = 2 * 0.2 mm = 0.4 mm = $4 * 10^{-4}$ m.

New cross-sectional area A' = π * $(d'/2)^2$ = 3.1416 * $(2 * 10^{-4})^2$ = 3.1416 * 4 * 10^{-8} = 12.5664 * 10^{-8} m^2

Ratio of areas A' / A = 12.5664 * 10^{-8} / 3.1416 * 10^{-8} = 4.

Since resistance R is inversely proportional to area A (R ~ 1/A), resistance will become 1/4th.

New resistance R' = R / 4 = 14 / 4 = 3.5 Ω.

Thus, length of the wire should be approximately 27.5 m to have 14 Ω resistance and if diameter is doubled, resistance decreases to one fourth, i.e 3.5 Ω.

Key Points: Definition of 1 volt as work done per charge - Calculation of length using R = ρ L / A - Effect of diameter on resistance (resistance inversely proportional to square of diameter)