CBSE EXAMINATION PAPER-2025

SCIENCE

(Solved)

Time allowed : 3 hours | Maximum Marks : 72

General Instructions :

Read the following instructions carefully and follow them :

i. This question paper contains **35 questions.** All questions are **compulsory.**

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

iii. **Section A** – questions number **1 to 15** are multiple choice questions Each question carries **1 marks.**

iv. **Section B** – questions number **16 to 23** are very short answer Each question carries **2 marks.**

v. **Section C** – questions number **24 to 30** are short answer Each question carries **3 marks.**

vi. **Section D** – questions number **31 to 31** are case based questions

vii. **Section E** – questions number **32 to 35** are long answer Each question carries **5 marks.**

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.

Electrolysis of water is a decomposition reaction. The mass ratio ($M_H : M_O$) of hydrogen and oxygen gases liberated at the electrodes during electrolysis of water is:

[1 Marks]

(A) 8 : 1

(B) 1 : 2

(C) 1 : 8

(D) 2 : 1

Explanation: The mass ratio of hydrogen to oxygen in water is always 1:8, meaning for every 1 gram of hydrogen, there are 8 grams of oxygen. During electrolysis, water decomposes into hydrogen and oxygen gases maintaining this mass ratio. Therefore, the correct mass ratio (M_H : M_O) of hydrogen to oxygen gases liberated is 1 : 8.

Question 2.

The products formed when Aluminium and Magnesium are burnt in the presence of air respectively are:

[1 Marks]

(A) Al_3O_4 and MgO

(B) Al_2O_3 and MgO

(C) Al_2O_3 and MgO_2

(D) Al_3O_4 and MgO_2

Explanation: When Magnesium burns in air, it reacts with oxygen to form Magnesium oxide (MgO), as confirmed by the provided context. Similarly, Aluminium burns in air to form Aluminium oxide (Al2O3). Therefore, the correct products are Aluminium oxide (Al2O3) and Magnesium oxide (MgO). The other options either have incorrect chemical formulas or incorrect products.

Question 3.

The following table shows the pH values of four solutions A, B, C and D on a pH scale:

The solutions A, B, C and D respectively are of a

[1 Marks]

(A) Weak acid, neutral, strong base, strong acid

(B) Weak acid, neutral, strong base, weak base

(C) Weak acid, neutral, weak base, strong base

(D) Strong acid, weak acid, neutral, strong base

Explanation: According to the pH scale, a pH value of 7 indicates a neutral solution, values less than 7 indicate acidic solutions (weak or strong acids depending on how low the pH is), and values greater than 7 indicate basic solutions (weak or strong bases depending on how high the pH is). Therefore, the solutions A, B, C, and D represent respectively a weak acid (pH slightly less than 7), neutral (pH 7), strong base (pH significantly greater than 7), and strong acid (pH significantly less than 7). This matches the option: Weak acid, neutral, strong base, strong acid.

Question 4.

Consider the following reactions:

(i) Dilute hydrochloric acid reacts with sodium hydroxide.

(ii) Magnesium oxide reacts with dilute hydrochloric acid.

(iii) Carbon dioxide reacts with sodium hydroxide.

It is found that in each case:

[1 Marks]

(A) Salt and water is formed.

(B) Neutral salts are formed.

(C) Hydrogen gas is formed.

(D) Acidic salts are formed.

Explanation: In all three reactions, an acid reacts with a base or an oxide/base to form salt and water. (i) Dilute hydrochloric acid and sodium hydroxide react to form salt (sodium chloride) and water. (ii) Magnesium oxide reacts with dilute hydrochloric acid to form magnesium chloride (a salt) and water. (iii) Carbon dioxide reacts with sodium hydroxide to form a salt (sodium carbonate or sodium bicarbonate) and water. Therefore, the correct answer is 'Salt and water is formed.'

Question 5.

The metals obtained from their molten chlorides by the process of electrolytic reduction are:

[1 Marks]

(A) Calcium and magnesium

(B) Sodium and iron

(C) Aluminium and silver

(D) Gold and silver

Explanation: The correct option is Calcium and magnesium. These metals, along with sodium, are highly reactive and cannot be extracted by traditional methods like reduction using carbon. They are obtained by electrolytic reduction of their molten chlorides. During this process, the metal ions gain electrons at the cathode to form the metal, while chlorine gas is released at the anode. Therefore, calcium and magnesium are extracted by electrolytic reduction of their molten chlorides.

Question 6. Secretion of less saliva in the mouth will affect the conversion of:

[1 Marks]

(A) Fats into fatty acids and glycerol

(B) Proteins into amino acids

(C) Starch into simple sugars

(D) Sugars into alcohol

Explanation: Saliva contains the enzyme salivary amylase which breaks down starch, a complex carbohydrate, into simple sugars. If less saliva is secreted, the amount of salivary amylase decreases, resulting in less conversion of starch into simple sugars. Therefore, secretion of less saliva will affect the conversion of starch into simple sugars.

Question 7. The plant hormone whose concentration stimulates the cells to grow longer on the side of the shoot which is away from light is:

[1 Marks]

(A) Cytokinins

(B) Gibberellins

(C) Auxins

(D) Adrenaline

Explanation: The correct answer is Auxins. According to the context, when light comes from one direction, auxin diffuses towards the shady side of the shoot and accumulates there. This higher concentration of auxin causes the cells on the shaded side to elongate more, making the shoot bend towards the light. Cytokinins promote cell division, gibberellins

promote stem growth but not specifically in response to light, and adrenaline is not a plant hormone.

Question 8.

The correct/true statement(s) for a bisexual flower is/are:

(i) They possess both stamen and pistil.

(ii) They possess either stamen or pistil.

(iii) They exhibit either self-pollination or cross-pollination.

(iv) They cannot produce fruits on their own.

[1 Marks]

(A) (i) and (iii)

(B) (i) only

(C) (iv) only

(D) (i) and (iv)

Explanation: The correct statements are (i) and (iii). A bisexual flower contains both stamens (male reproductive part) and pistils (female reproductive part), which makes statement (i) true. Such flowers can undergo self-pollination (pollen from the same flower fertilizes the ovule) or cross-pollination (pollen from another flower fertilizes the ovule), so statement (iii) is also true. Statement (ii) describes unisexual flowers which have either stamens or pistils, not both, so it is false for bisexual flowers. Statement (iv) is incorrect since bisexual flowers can produce fruits on their own due to having both reproductive parts.

Question 9. The breakdown of glucose has taken the following pathway: Glucose (a) → Pyruvate + Energy (b) → Lactic acid + Energy. The sites 'a' and 'b' respectively are:

[1 Marks]

(A) Mitochondria and Oxygen deficient muscle cells

(B) Cytoplasm and Yeast cells

(C) Cytoplasm and Oxygen rich muscle cells

(D) Cytoplasm and Oxygen deficient muscle cells

Explanation: The breakdown of glucose first occurs in the cytoplasm, where glucose is converted into pyruvate through glycolysis. When oxygen is absent or deficient, such as in

oxygen-deficient muscle cells, pyruvate is then converted into lactic acid to produce energy. Therefore, the site 'a' is the cytoplasm, and site 'b' refers to oxygen-deficient muscle cells where lactic acid is formed.

Question 10. An old person is suffering from an eye defect caused by weakening of ciliary muscles and diminishing flexibility of the eye lens. If the defect of vision is 'a' which can be corrected by lens 'b', then 'a' and 'b' respectively are:

[1 Marks]

(A) Hypermetropia and convex lens

(B) Myopia and concave lens

(C) Presbyopia and bifocal lens

(D) Myopia and bifocal lens

Explanation: The correct answer is 'Presbyopia and bifocal lens'. Presbyopia is the eye defect caused due to the gradual weakening of ciliary muscles and diminishing flexibility of the eye lens, common in old age. This makes it difficult to see nearby objects clearly. It is often corrected by bifocal lenses, which have two parts: the upper part with a concave lens for distant vision and the lower part with a convex lens for near vision. This matches the description given in the context.

Question 11.

The percentage of solar energy which is not converted into food energy by the leaves of green plants in a terrestrial ecosystem is about:

[1 Marks]

(A) 90%

(B) 10%

(C) 1%

(D) 99%

Explanation: Green plants capture only about 1% of the solar energy that falls on their leaves and convert it into food energy. This means that approximately 99% of the solar energy is not converted into food energy by the leaves. Therefore, the correct answer is 99%.

Question 12.

Assertion (A): Decomposition reactions are generally endothermic reactions.

Reason (R): Decomposition of organic matter into compost is an exothermic process.

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

Explanation: The assertion is true because most decomposition reactions require energy (heat, light, or electricity) to break down the compounds, making them endothermic. However, the decomposition of organic matter into compost is an example of an exothermic reaction where heat is released during the process. Therefore, both the assertion and reason are true, but the reason does not explain the assertion.

Question 13.

Assertion (A): A human child bears all the basic features of human beings.

Reason (R): It looks exactly like its parents, showing very little variations.

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

Explanation: The Assertion (A) is true because a human child does have all the basic features of human beings. However, the Reason (R) is false because a child does not look exactly like its parents; there are variations due to genetic inheritance. Therefore, the correct option is: Assertion (A) is true, but Reason (R) is false.

Question 14.

Assertion (A): No two magnetic field lines are found to cross each other.

Reason (R): The compass needle cannot point towards two directions at the point of intersection of two magnetic field lines.

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

(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 and Reason (R) is the correct explanation of Assertion (A). Magnetic field lines never cross each other because if they did, at the point of intersection, a compass needle placed there would point in two different directions simultaneously, which is not possible. Therefore, the compass needle's inability to point in two directions explains why magnetic field lines do not cross.

Question 15.

Assertion (A): The amount of ozone in the atmosphere began to drop sharply in the 1980s.

Reason (R): The oxygen atoms combine with molecular oxygen to form ozone.

[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 amount of ozone in the atmosphere began to drop sharply in the 1980s due to the effect of harmful chemicals like CFCs damaging the ozone layer. The Reason (R) describes the formation of ozone when oxygen atoms combine with molecular oxygen, which is a true process but does not explain why the ozone amount dropped sharply.

Section B

Question 16. Draw labelled diagrams to show different stages of budding in Hydra.

[2 Marks]

Answer: Budding in Hydra starts with a small bulge called a bud forming on the side of the parent Hydra. This bud grows gradually, developing tiny tentacles similar to those of the parent. Eventually, the bud fully develops into a miniature Hydra and detaches from the parent body, becoming an independent organism. The stages include the initial bud formation, bud growth with tentacle development, and final detachment.

Question 17. Besides minimising the loss of blood, why is it essential to plug any leak in a blood vessel? Name the component of blood which helps in this process and state how this component performs this function.

[2 Marks]

Answer: Plugging any leak in a blood vessel is essential not only to prevent blood loss but also to maintain blood pressure. Loss of pressure due to leakage can reduce the efficiency of the heart's pumping system, affecting blood circulation. The component of blood responsible for plugging these leaks is called platelets. Platelets circulate throughout the body and immediately gather at the site of injury. They help in clotting the blood by sticking together and forming a plug that seals the wound to stop bleeding and prevent further loss of blood and pressure.

Question 18. An object is placed at a distance of 60 cm from a concave lens of focal length 30 cm. Use lens formula to find the position of the image formed in this case.

[2 Marks]

Answer: Given: Object distance u = -60 cm (since the object is in front of the lens), Focal length f = -30 cm (concave lens has negative focal length). Using the lens formula, $1/f = 1/v - 1/u$. Substituting values: $1/(-30) = 1/v - 1/(-60)$. Simplifying, $1/v = 1/(-30) + 1/60 = (-2 + 1)/60 = -1/60$. Therefore, v = -60 cm. The negative sign means the image is formed on the same side as the object, at 60 cm from the lens. So, the image is virtual, upright, and reduced in size, located 60 cm in front of the lens.

Question 19. Define electric power. When do we say that the power consumed in an electric circuit is 1 watt?

[2 Marks]

Answer: Electric power is the rate at which electrical energy is consumed or converted into another form of energy in an electric circuit. The SI unit of electric power is watt (W). We say that the power consumed in an electric circuit is 1 watt when the energy consumption rate is one joule per second. Practically, this means a device consuming 1 ampere of current at a potential difference of 1 volt is using power equal to 1 watt.

Question 20. 'Excessive use of chemicals and pesticides in agriculture adversely effect the environment.' Justify this statement.

[2 Marks]

Answer: Excessive use of chemicals and pesticides in agriculture causes environmental problems. These chemicals are sprayed on plants or used to treat seeds and soil. When used excessively, they contaminate soil and water bodies as they get washed away by rain. This pollution harms many plant and animal species because these chemicals are often poisonous. Overusing fertilizers destroys soil fertility by killing valuable micro-organisms and reducing organic matter. It also leads to water pollution. Therefore, using too many chemicals in farming adversely affects the environment.

Question 21.

A student performs the following experiment in his school laboratory.

List two observations to justify that in this experiment a chemical change has taken place.

[2 Marks]

Answer: Two observations that justify that a chemical change has taken place in the experiment are: (1) There is a change in colour of the substance, indicating the formation of a new substance. (2) A gas is evolved during the experiment, which shows a chemical reaction is occurring. These observations confirm that a chemical change has occurred as physical changes do not involve such changes.

Question 22.

(i) The transport system in plants is relatively slower than in animals. Give reasons.

(ii) State the role of phloem in the transport of materials in plants.

[2 Marks]

Answer:

(i) The transport system in plants is slower than in animals because plants rely on passive transport mechanisms like diffusion and transpiration pull, which are naturally slower processes. Additionally, plants have rigid cell walls and large vacuoles that limit quick movement, and the transport occurs mainly through xylem and phloem which are less dynamic than animal circulatory systems.

(ii) Phloem is responsible for transporting food, especially sugars produced by photosynthesis in the leaves, to all parts of the plant. It consists of sieve tubes and companion cells that help move nutrients from the leaves to roots, stems, and growing parts, ensuring energy supply throughout the plant.

Question 23.

A wire of resistance R is cut into three equal parts. If these three parts are then joined in parallel, calculate the total resistance of the combination so formed.

[2 Marks]

Answer: When a wire of resistance R is cut into three equal parts, each part will have resistance equal to R/3 since resistance is directly proportional to length. Joining these three parts in parallel, the reciprocal of the total resistance (R_total) is the sum of the reciprocals of each of the three resistances: 1/R_total = 1/(R/3) + 1/(R/3) + 1/(R/3). Simplifying, 1/R_total = 3/(R/3) = 9/R. Therefore, R_total = R/9. Hence, the total resistance when the three parts are joined in parallel is one-ninth of the original resistance R.

Section C

Question 24.

(a) "Displacement reactions also play a key role in extracting metals in the middle of the reactivity series." Justify this statement with two examples.

(b) Why can metals high up in the reactivity series not be obtained by reduction of their oxides by carbon ?

[3 Marks]

Answer: (a) Displacement reactions are important in extracting metals, especially those in the middle of the reactivity series. In these reactions, a more reactive metal displaces a less reactive metal from its compound. For example, when aluminium powder is heated with manganese dioxide, aluminium displaces manganese, producing pure manganese metal and aluminium oxide. Another example is zinc displacing copper from copper sulfate solution. Such reactions help in obtaining pure metals from their compounds.

(b) Metals that are high up in the reactivity series, such as sodium, calcium, and aluminium, cannot be obtained by reduction of their oxides using carbon because these metals form very stable oxides and carbon is not reactive enough to reduce them. Instead, more reactive metals like aluminium are used as reducing agents to extract metals lower in the series. High-reactivity metals require other extraction methods like electrolysis to be obtained in pure form.

Question 25. With the help of an activity, explain the conditions under which iron articles get rusted.

[3 Marks]

Answer: To understand the conditions under which iron rusts, we can perform a simple activity. Take three test tubes labeled A, B, and C, and place clean iron nails in each of

them. In test tube A, pour water; in test tube B, pour water and add some oil to prevent air from reaching the water; in test tube C, leave it dry without water. Observe these test tubes over a few days. The nail in test tube A will start rusting because it is exposed to both water and air, which are necessary for rusting. The nail in test tube B will not rust because the oil layer prevents air from reaching the water, so rusting does not occur. The nail in test tube C will also not rust as there is no moisture present, even though air is present. From this activity, we learn that iron rusts only when both air and water are present. Rusting is a chemical reaction where iron reacts with oxygen and moisture to form hydrated iron oxide, which weakens the iron. Therefore, air (oxygen) and water (moisture) are essential conditions for rust to form on iron articles.

Question 26.

Plants have neither a nervous system nor muscles, even then they respond to stimuli. For example, the leaves of chhui-mui (touch-me-not) plant when touched begin to fold up and droop.

(a) How is the information communicated in "touch-me-not" plants ?

(b) What enables the plant cells to bring out the observable response ?

(c) Differentiate the movement mentioned above from the movement of tendrils in a pea plant.

[3 Marks]

Answer: (a) In touch-me-not plants, when the leaves are touched, the information about the stimulus is communicated from cell to cell by electrical and chemical signals. Even though plants do not have nervous tissue, these signals travel through the cells to reach the parts of the leaf that respond.

(b) The plant cells respond because they can quickly lose water from specialized cells at the base of the leaflets called pulvini cells. The loss of water changes the turgor pressure inside these cells, causing the leaves to fold and droop.

(c) The movement of the touch-me-not plant is a rapid response caused by changes in cell turgor pressure without growth, and it happens quickly after the stimulus. In contrast, the movement of tendrils in a pea plant is a slow movement that involves growth and bending towards support (a directional growth response called tropism), which helps the plant climb.

Question 27.

(a) What are chromosomes ?

(b) Explain in brief how stability of DNA content of a species is ensured in sexually reproducing organisms ?

[3 Marks]

Answer:

(a) What are chromosomes?
Chromosomes are thread-like structures located inside the nucleus of cells. They are made of DNA and proteins. Chromosomes carry genetic information in the form of genes, which determine the hereditary traits passed from parents to offspring. Each chromosome consists of two identical sister chromatids joined together after replication.

(b) How is the stability of DNA content ensured in sexually reproducing organisms?
In sexually reproducing organisms, stability of DNA content is maintained through the process of meiosis. Male and female gametes (sperm and egg) are produced with half the number of chromosomes (haploid). When these gametes fuse during fertilization, they restore the full number of chromosomes (diploid) in the new organism. This ensures that each generation has the same chromosome number and maintains genetic stability across generations.

Question 28.

Draw ray diagrams to show the nature, position and relative size of the image formed by a convex mirror when the object is placed

(i) at infinity and

(ii) between infinity and pole P of the mirror.

[3 Marks]

Answer:

(i) When the object is at infinity, the rays coming from the object are parallel to the principal axis. After reflection from the convex mirror, these rays diverge as if they are coming from the focus (F) behind the mirror. The image formed is virtual, highly diminished, erect, and located at the focus of the mirror behind the pole.

(ii) When the object is placed between infinity and the pole (P) of the convex mirror, the rays diverge after reflection. By tracing the reflected rays backwards, they appear to come from a point behind the mirror. The image formed is virtual, erect, diminished compared to the object, and located between the focus (F) and the pole (P) behind the mirror.

Thus, in both cases, the image formed by a convex mirror is virtual, erect, and smaller than the object, with its position changing depending on the location of the object.

Question 29.

(a) Write the relationship between resistivity and resistance of a cylindrical conductor of length l and area of cross-section A. Hence derive the SI unit of resistivity.

(b) Why are alloys used in electrical heating devices ?

[3 Marks]

Answer:

(a) The resistance R of a cylindrical conductor depends on its length l, area of cross-section A, and the material's resistivity ρ. The relationship is given by $R = \rho (l / A)$. This means resistance is directly proportional to length and resistivity, and inversely proportional to the area of cross-section. Here, resistivity ρ is a property of the material which quantifies how strongly it opposes the flow of electric current.

From the formula $R = \rho (l/A)$, we can express resistivity as $\rho = R (A/l)$.

Since resistance R is measured in ohms (Ω), length l in meters (m), and area A in square meters (m^2), the SI unit of resistivity is ohm-meter (Ω·m).

(b) Alloys are used in electrical heating devices because they generally have higher resistivity than pure metals. This higher resistivity allows them to generate heat more efficiently when current passes through. Additionally, alloys do not oxidize or burn easily at high temperatures, making them durable and safe materials for devices like electric irons and toasters.

Question 30.

(i) Name two metals which react violently with cold water. List any three observations which a student notes when these metal are dropped in a beaker containing water.

(ii) Write a test to identify the gas evolved (if any) during the reaction of these metals with water.

[3 Marks]

Answer:

(i) Two metals which react violently with cold water are sodium and potassium.

When sodium or potassium is dropped into a beaker containing cold water, a student may observe the following:

- Fizzing or bubbling due to the release of gas.
- The metal piece may start to move or float on the water surface.
- In the case of potassium, it often catches fire with a lilac-colored flame.

(ii) The gas evolved during the reaction of these metals with water is hydrogen. To test for hydrogen gas, bring a burning splinter near the mouth of the test tube containing the collected gas. If the gas is hydrogen, it will burn with a characteristic pop sound.

Section D

Question 31.

In our homes, we receive the supply of electric power through a main supply also called mains, either supported through overhead electric poles or by underground cables. In our country the potential difference between the two wires (live wire and neutral wire) of this supply is 220 V.

(1)

Write the colours of the insulation covers of the line wires through which supply comes to our homes.

[1 Marks]

Answer: The supply of electric power to our homes comes through two line wires. The wire through which current flows to our home is called the live wire, and its insulation cover is red in colour. The other wire, called the neutral wire, has a black coloured insulation cover. These two wires together carry the supply voltage of 220 volts to our homes.

> Key Points: Live wire has red insulation-Neutral wire has black insulation-Supply voltage between live and neutral is 220 volts

(2)

What should be the current rating of the electric circuit (220 V) so that an electric iron of 1 kW power rating can be operated ?

[1 Marks]

Answer: The power rating of the electric iron is 1 kW, which means it consumes 1000 watts of electric power. The voltage supplied is 220 V. To find the current rating required, we use the formula: Current (I) = Power (P) / Voltage (V). Substituting the values, I = 1000 watts / 220 volts = 4.54 amperes. Therefore, the electric circuit should have a current rating of about 5 amperes to safely operate the electric iron.

Key Points: Power rating of iron = 1000 W - Voltage supply = 220 V - Use formula Current = Power / Voltage - Calculate current, I = 1000 / 220 = 4.54 A - Current rating needed is approximately 5 A for safe operation

(3)

List two precautions to be taken to avoid electrical accidents. State how these precautions prevent possible damage to the circuit/appliance.

[2 Marks]

Answer: Two precautions to avoid electrical accidents are: 1) Use of fuses in the circuit. A fuse is connected in series with the live wire and it melts to break the circuit if the current exceeds a safe limit. This prevents damage to the wires and connected appliances by stopping excess current flow. 2) Proper insulation of wires. Live wires should always be properly insulated and should not be exposed. This prevents accidental contact with live wires, thus avoiding electric shocks and short circuits, protecting both people and electrical devices.

Key Points: Use of fuse - Fuse melts and breaks the circuit when current is too high - prevents damage to appliances-Proper insulation of wires - prevents accidental contact with live wire - avoids electric shocks and short circuits

(4)

What is the function of the earth wire ? State the advantage of the earth wire in domestic electric appliances such as electric iron.

[2 Marks]

Answer: The earth wire is a safety wire that protects people from electric shocks. Its function is to carry any leakage or fault current safely to the ground. In case of any fault in an appliance like an electric iron, the earth wire provides a path for the electric current to flow directly to the earth, preventing the metal body of the appliance from becoming live. This helps in avoiding electric shocks to the user. Thus, the advantage of the earth wire in domestic appliances like electric irons is that it ensures user safety by protecting against electric shocks when there is a fault.

Key Points: Earth wire is a safety wire-Earth wire carries fault current safely to the ground-It prevents electric shocks by making the appliance body safe-Helps in protecting users in case of electrical faults in appliances like electric iron

Section E

Question 32.

(i) Write the functions of the following parts of the human female reproductive system:

(I) Ovary,

(II) Fallopian tube,

(III) Uterus.

(ii) State briefly two contraceptive methods used by human males.

[5 Marks]

Answer:

(i) Functions of parts of the female reproductive system:

(I) Ovary: The ovaries are two small, oval-shaped organs located on each side of the uterus. Their main functions are to produce female sex hormones like estrogen and progesterone, which regulate the menstrual cycle and help develop female secondary sexual characteristics. The ovaries also produce and release eggs (ova) through a process called ovulation.

(II) Fallopian tube: Also called the oviduct, the fallopian tubes are narrow tubes that connect the ovaries to the uterus. Their primary function is to transport the released egg from the ovary to the uterus. Fertilization, where sperm meets the egg, usually takes place inside the fallopian tubes.

(III) Uterus: The uterus is a hollow, pear-shaped organ where a fertilized egg implants and develops into a fetus. Each month, its inner lining thickens in preparation to support a fertilized egg. If fertilization does not occur, this lining sheds during menstruation.

(ii) Two contraceptive methods used by human males:

1. Use of condoms: Condoms are a barrier method worn over the penis during sexual intercourse to prevent sperm from entering the female reproductive tract, thereby avoiding pregnancy.

2. Sterilization (vasectomy): This is a surgical procedure where the vas deferens (sperm-carrying tubes) are cut or sealed to prevent sperm from mixing with semen, resulting in permanent contraception.

Question 33.

(i) The power of a lens 'X' is – 2·5 D. Name the lens and determine its focal length in cm. For which eye defect of vision will an optician prescribe this type of lens as a corrective lens ?

(ii) "The value of magnification 'm' for a lens is – 2." Using new Cartesian Sign Convention and considering that an object is placed at a distance of 20 cm from the optical centre of this lens, state :

(I) the nature of the image formed;

(II) size of the image compared to the size of the object;

(III) position of the image, and

(IV) sign of the height of the image.

(iii) The numerical values of the focal lengths of two lenses A and B are 10 cm and 20 cm respectively. Which one of the two will show higher degree of convergence/divergence ? Give reason to justify your answer.

[5 Marks]

Answer:

(i) The power of the lens X is −2.5 D. Since the power is negative, the lens is a concave lens. The focal length f of the lens is related to its power P by the formula: f = 100 / P (in cm). Substituting P = −2.5, we get f = 100 / (−2.5) = −40 cm. The negative focal length confirms it is a concave lens. This type of lens is prescribed by an optician to correct myopia (nearsightedness), which occurs either due to the eye lens having too short a focal length or the eyeball being too long. The concave lens diverges the rays before they enter the eye, enabling the image to form on the retina.

(ii) Given magnification m = −2 and object distance u = −20 cm (object distances are negative as per new Cartesian sign convention).

- (I) Nature of the image: Since magnification is negative, the image formed is real and inverted.
- (II) Size of the image: Magnification of −2 means the image is twice the size of the object.
- (III) Position of the image: Magnification m = v/u, so v = m × u = −2 × (−20 cm) = +40 cm. The positive image distance indicates the image is formed on the opposite side of the lens, confirming it is real.

- (IV) Sign of the height of the image: Since magnification is negative, the height of the image is negative, indicating the image is inverted relative to the object.

(iii) Lens A has focal length $f_A = 10$ cm and lens B has focal length $f_B = 20$ cm. The degree of convergence or divergence of a lens is inversely proportional to its focal length. The lens with a smaller focal length will have a higher degree of convergence (if convex) or divergence (if concave). Therefore, lens A with 10 cm focal length has a higher degree of convergence/divergence than lens B with 20 cm focal length because 10 cm is smaller than 20 cm, so lens A bends the light rays more strongly than lens B.

Question 34.

(i) Differentiate between self-pollination and cross-pollination.

(ii) Identify A, B and C in the diagram given below and write one function of each.

[5 Marks]

Answer: (i) Difference between Self-pollination and Cross-pollination:

Self-pollination occurs when pollen from the anther of a flower lands on the stigma of the same flower or another flower on the same plant. This means the pollen and stigma belong to the same plant. It helps in reproduction but results in less genetic variation.

Cross-pollination is the transfer of pollen grains from the anther of one flower to the stigma of a flower on a different plant of the same species. This process increases genetic diversity and helps plants adapt to changing environments.

In brief:
- Self-pollination: Pollen → stigma (same flower or same plant).
- Cross-pollination: Pollen → stigma (different flower on a different plant).

(ii) Identification and Functions of A, B, and C in the diagram:

Assuming the diagram shows parts of a flower involved in pollination:

A: **Anther**
Function: Produces and releases pollen grains, which contain the male reproductive cells.

B: **Stigma**
Function: It is the sticky part on top of the pistil where pollen grains land and germinate.

C: **Pollen grains**

Function: They carry the male reproductive cells (sperm cells) necessary for fertilization of the ovule.

These parts play vital roles in the process of pollination and fertilization in flowering plants.

Question 35.

(i) Draw a ray diagram to show the refraction of a ray of light through a rectangular glass slab when it falls obliquely from air into glass.

(ii) State Snell's law of refraction of light.

(iii) Differentiate between the virtual images formed by a convex lens and a concave lens on the basis of :

(I) object distance, and

(II) magnification.

[5 Marks]

Answer: (i) Ray Diagram for Refraction through a Rectangular Glass Slab:
When a ray of light traveling from air falls obliquely on the surface of a rectangular glass slab, it bends towards the normal because glass is denser than air. After passing through the slab, the ray bends away from the normal as it enters air again. The ray inside the slab is parallel to the incident ray but laterally shifted.

(ii) Snell's Law of Refraction:
Snell's law states that the ratio of the sine of the angle of incidence (i) to the sine of the angle of refraction (r) is constant for the two given media. Mathematically, it is expressed as:
$\sin(i) / \sin(r) = \text{constant} = \text{refractive index}$

(iii) Difference between Virtual Images formed by Convex and Concave Lens:
(I) Object Distance:
- **Convex Lens:** Virtual image is formed when the object is placed between the optical centre and the principal focus (object distance less than focal length).
- **Concave Lens:** Virtual image is formed for any object position since it always forms virtual images.

(II) Magnification:
- **Convex Lens:** The virtual image formed is magnified (larger than the object).
- **Concave Lens:** The virtual image formed is diminished (smaller than the object).