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.

Many pure metals like copper, iron and gold are very soft and as such are considered unsuitable for certain uses. Metallic objects around us such as cooking utensils, statues, ornaments, guns etc. are actually not made up of pure metals. Instead of pure metals, alloys are used in the design of most of the useful objects. Making alloys enhances the basic properties of a metal which is the primary constituent (metal) of an alloy.

(1) Name an alloy used for welding two wires together in an electric circuit. Write its major constituents.

[1 Marks]

Answer: The alloy used for welding two wires together in an electric circuit is called solder. Its major constituents are lead (Pb) and tin (Sn). Solder has a low melting point, making it suitable for joining electrical components without damaging them.

Key Points: Solder is an alloy; major constituents are lead and tin; used for welding wires; low melting point.

(2) How does electrical conductivity and melting point of a metal change when it is converted to its alloy by mixing a small amount of an element in it?

[1 Marks]

Answer: When a pure metal is converted to its alloy by mixing it with a small amount of another element, both the electrical conductivity and the melting point are affected. Generally, alloys exhibit lower electrical conductivity compared to their pure metal constituents. This decrease is due to the presence of additional elements that disrupt the uniform arrangement of metal atoms, hindering the flow of electrical current. Additionally, the melting point of an alloy is typically lower than that of the pure metal. This alteration occurs because the introduction of other elements results in changes to the bonding and structure of the metallic lattice, leading to a reduced energy requirement for melting. For instance, brass, which is an alloy of copper and zinc, demonstrates these changes in properties when compared to pure copper.

Key Points: Alloys have lower electrical conductivity compared to pure metals; Alloys have a lower melting point than pure metals; Mixing a pure metal with another element alters its physical properties.

(3)

What is stainless steel ? How is it prepared ? Write one important property which makes it more useful in making cooking utensils as compared to its primary metal.

[2 Marks]

Answer: Stainless steel is an alloy of iron that contains chromium and often nickel. It is prepared by mixing iron with about 10.5% chromium and sometimes additional elements like nickel. This combination enhances the strength and resistance to corrosion. One important property of stainless steel is its resistance to rusting; unlike pure iron, which rusts easily, stainless steel maintains its appearance and structural integrity even in moist environments, making it more suitable for cooking utensils.

Key Points: Definition of stainless steel - Alloy of iron with chromium; Preparation using iron, chromium, and possibly nickel; Important property - Rust resistance compared to pure iron

(4)

What are alloys ? How is 'Brass' (an alloy) prepared ?

[2 Marks]

Answer: Alloys are homogeneous mixtures of two or more metals, or a metal and a non-metal, which are created to enhance the properties of the primary metal. They are not easily separable by physical methods but display the characteristics of their components. Brass is a well-known alloy that is typically composed of approximately 70% copper and 30% zinc. To prepare brass, the primary metal, copper, is first melted. Once liquefied, zinc is added to the molten copper, allowing the two metals to mix thoroughly and produce an alloy with improved properties, such as increased strength and resistance to corrosion.

Key Points: Definition of alloys; Mixture of metals or metal and non-metal; Properties enhanced by alloying; Preparation method of brass; Composition of brass (70% copper, 30% zinc)

Question 2. The growth movements of plant parts in which the direction of the stimulus determines the direction of the response is known as tropic movements or tropism. Plants also have non-directional movements which may not be growth dependent.



(1)

Name the movement which causes ‘X’ and ‘Y to grow downwards and upwards respectively. (Refer above figure)

[1 Marks]

Answer: The movement that causes ‘X’ (the roots) to grow downwards is called geotropism, while the movement that causes ‘Y’ (the shoots) to grow upwards is called phototropism. Geotropism directs the root growth towards gravity, thereby enhancing stability and nutrient absorption, while phototropism allows the shoot to grow towards light, maximizing photosynthesis.

Key Points: geotropism - downward growth of roots; phototropism - upward growth of shoots; responses to gravity and light

(2)

Write the name of a hormone that plays a major role in (i) falling of leaves (ii) rapid cell division

[1 Marks]

Answer: The hormone that plays a major role in the falling of leaves is Abscisic Acid (ABA), which promotes leaf senescence and abscission. For rapid cell division, the hormone involved is Cytokinins, which stimulate cell division and growth in plants.

Key Points: Abscisic Acid promotes leaf abscission-Cytokinins stimulate cell division-Plant hormones regulate growth and responses

(3)

Leaves of the sensitive plant move very quickly in response to ‘touch’. How is this stimulus of touch communicated and explain how the movement takes place.

[2 Marks]

Answer: The sensitive plant, known scientifically as Mimosa pudica, exhibits rapid leaf movement in response to touch. This quick response is a result of a complex process involving specialized cells and water movement. When the leaves of the sensitive plant are touched, the stimulus is communicated through electrical signals that travel rapidly along nerve-like structures in the plant. The electrical impulse causes the cells at the base of the leaflets, known as pulvini, to lose water quickly, leading to a reduction in turgor pressure. As a result, the leaflets fold and droop downwards as well as the petiole bends. This mechanism is thought to serve as a defense response against herbivores by making the plant appear less palatable or difficult to eat. Thus, the movement in response to touch showcases how plants can use mechanical stimulation to initiate rapid locomotion, which is distinct from growth-dependent movements seen in tropism.

Key Points: Sensitive plant, Mimosa pudica, rapid movement, electrical signals, pulvini, turgor pressure, leaflets folding, defense mechanism

(4)

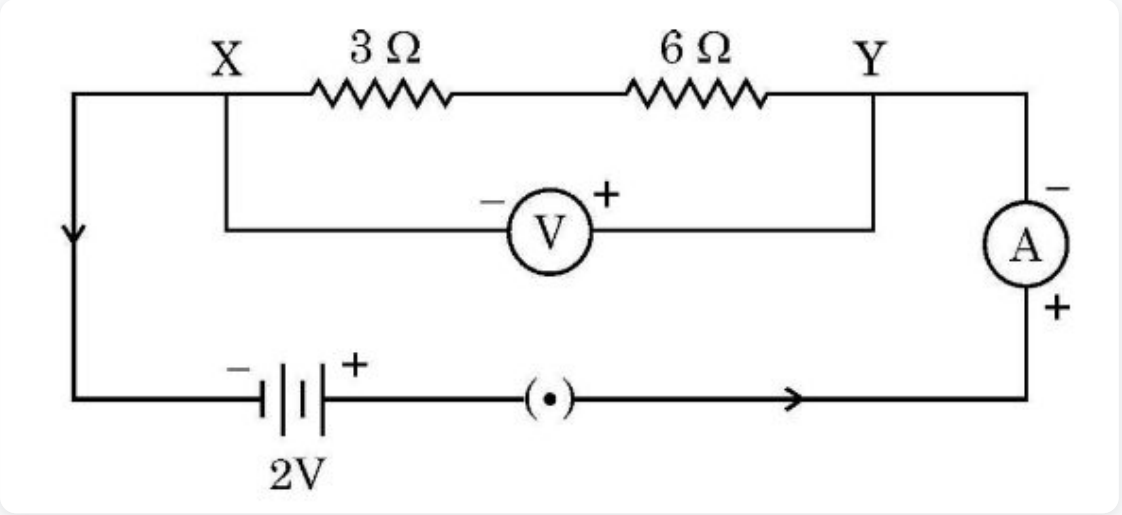
Name the plant hormone which is synthesized at the shoot tip. How does this hormone helps the plant to bend towards light ?

[2 Marks]

Answer: The plant hormone synthesized at the shoot tip is called auxin. Auxin plays a crucial role in phototropism, which is the growth of plant parts toward light. When light shines on a plant from one side, auxin is distributed unevenly, accumulating more on the shaded side of the shoot. This causes the cells on the shaded side to elongate more than those on the light-exposed side, resulting in the shoot bending towards the light source. This growth towards light enhances the plant's ability to photosynthesize effectively, thus supporting its growth and survival.

Key Points: Auxin is the hormone synthesized at the shoot tip - Auxin distribution is uneven in response to light - Uneven growth causes bending towards light - This helps the plant in photosynthesis

Question 3. Study the circuit shown in which two resistors X and Y of resistances 3Ω and 6Ω respectively are joined in series with a battery of 2V.



(1)

Draw a circuit diagram showing the above two resistors X and Y joined in parallel with same battery and same ammeter and voltmeter.

[1 Marks]

Answer: To draw the circuit diagram with resistors X (3Ω) and Y (6Ω) in parallel, we first place the battery symbol on the left side, indicating the positive terminal at the top. Next, we represent resistor X and resistor Y horizontally from the battery. Resistor X is connected from the top terminal of the battery to a junction point and then to the bottom terminal of the battery. Resistor Y is similarly connected in parallel between the same junction point and the bottom terminal of the battery. We add an ammeter in series with the battery to measure the total current flowing from the battery towards the junction point. Additionally, to measure the potential difference across both resistors, we place a voltmeter across the terminals of the battery and across the junction and the bottom terminal. This configuration ensures both resistors receive the same potential difference from the battery, facilitating the calculation of current through each resistor. The current through the ammeter will be the sum of the currents through each resistor due to the circuit being in parallel.

Key Points: Battery symbol; Resistor X (3Ω) and Y (6Ω) in parallel; Ammeter in series; Voltmeter across battery and junction; Current and voltage considerations

(2)

In which combination of resistors will the (i) potential difference across X and Y and (ii) current through X and Y, be the same ?

[1 Marks]

Answer: For the potential difference across resistors X and Y, and the current through them to be the same, they need to be connected in parallel. In a parallel combination, the potential difference across each resistor is the same and does not depend on their resistances. Therefore, the current flowing through each resistor will also be the same if they have the same resistance values. For example, if both resistors X (3Ω) and Y (3Ω) are connected in parallel, the voltage across each would be 2V (the battery voltage), ensuring that both the potential difference and the current through X and Y are equal.

Key Points: Parallel connection equal potential difference; same current through each in parallel; for equality, use resistors of equal resistance

(3)

Find the current drawn from the battery by the series combination of the two resistors (X and Y).

[2 Marks]

Answer:

To find the current drawn from the battery by the series combination of resistors X and Y, we first need to calculate the total resistance in the circuit. The total resistance (R_{total}) for resistors in series is the sum of their resistances: $R_{total} = R_x + R_y = 3\Omega + 6\Omega = 9\Omega$. Next, we apply Ohm's law to find the current (I) flowing through the circuit. Ohm's law states that $I = V/R$. Here, the potential difference (V) supplied by the battery is 2V. Hence, $I = 2V / 9\Omega = 0.222A$. Therefore, the current drawn from the battery by the series combination of the two resistors is approximately 0.222 A.

Key Points:

Total resistance (R_{total}) = $R_x + R_y$; Current (I) = V/R; Application of Ohm's law.

(4)

Determine the equivalent resistance of the parallel combination of the two resistors (X and Y).

[2 Marks]

Answer: To determine the equivalent resistance of resistors X and Y when combined in parallel, we first identify their resistances: R1 = 3Ω and R2 = 6Ω. The formula for equivalent resistance (R_eq) in parallel is given by: \n\n1/R_eq = 1/R1 + 1/R2 \n\nSubstituting the values: \n1/R_eq = 1/3 + 1/6 \n\nTo add these fractions, we find a common denominator, which is 6: \n1/R_eq = 2/6 + 1/6 = 3/6 \n\nThus, 1/R_eq = 3/6, which simplifies to 1/2. Therefore, \nR_eq = 2Ω. \nHence, the equivalent resistance of the parallel combination of the two resistors X and Y is 2Ω.

Key Points: Identify the resistances; use parallel resistance formula; calculate equivalent resistance

Section B

Question 4.

In the following experimental setup of electrolysis of water, if P and Q are the gases collected in the test tubes enclosing the electrodes R and 8S, then select the option/options in which the matching is correct :

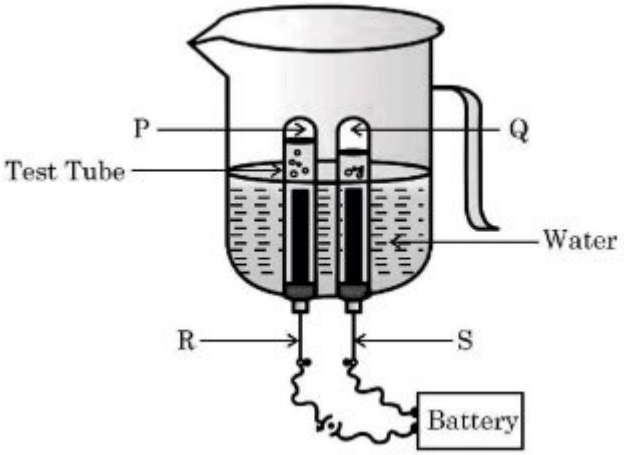
(i) P – Oxygen gas , R – Anode

(ii) P – Hydrogen gas , R – Cathode

(iii) Q – Hydrogen gas , S – Cathode

(iv) Q – Oxygen gas , S – Anode

[1 Marks]



(A) (i) and (ii)

(B) (ii) and (iv)

(C) (i) and (iii)

(D) (iii) and (iv)

Explanation:

In the electrolysis of water:

- **Water splits** into **hydrogen (H_2)** and **oxygen (O_2)** gases.
- **Hydrogen gas** is released at the **cathode (negative electrode)** — where **P = Hydrogen**.
- **Oxygen gas** is released at the **anode (positive electrode)** — where **Q = Oxygen**.

Thus, the correct match is:

- **P → Hydrogen**
- **Q → Oxygen**
  and
- **R → Cathode**, **S → Anode**

Therefore, **only statements (i) and (ii)** are correct.

Question 5.

You have three aqueous solutions A, B and C as given below:
A – Potassium nitrate
B – Ammonium chloride
C – Sodium carbonate

The ascending order of the pH of these solutions is:

[1 Marks]

(A) B < A < C

(B) B < C < A

(C) C < A < B

(D) A < B < C

Explanation: The correct option is B < A < C. Ammonium chloride (B) is a salt derived from a weak base (NH4OH) and strong acid (HCl), thus it has a lower pH. Potassium nitrate (A) is neutral and has a mid-range pH. Sodium carbonate (C), being a salt derived from a strong base (NaOH) and weak acid (H2CO3), has a higher pH, making it more alkaline. Therefore, the ascending order of pH is B < A < C.

Question 6.

Select from the following a statement which is not true about burning of magnesium ribbon in air :

[1 Marks]

(A) A white powder is formed on burning.

(B) Itis an example of a combination reaction.

(C) Itis an endothermic reaction.

(D) It burns with a dazzling white flame.

Explanation: The statement 'It is an endothermic reaction.' is not true because burning magnesium in air is an exothermic reaction. It releases heat and light, and the burning magnesium produces a dazzling white flame, forming magnesium oxide. The other statements accurately describe the reaction.

Question 7.

A Hydrocarbon which does not belong to the same homologous series of carbon compounds is

[1 Marks]

(A) C_4H_{10}

(B) C_6H_{14}

(C) $C_{10}H_{22}$

(D) C_7H_{14}

Explanation:

The given options represent hydrocarbons with different molecular formulas. C10H22, C4H10, and C6H14 all fit the general formula of alkanes (C_nH_{2n+2}), indicating they belong to the alkane homologous series. However, C_7H_{14} fits the formula C_nH_{2n}, which corresponds to alkenes, a different homologous series containing one double bond and having different chemical properties. Hence, C_7H_{14} does not belong to the same homologous series as the other options.

Question 8.

The colour of the solution observed after about 1 hour of placing iron nails in copper sulphate solution is

[1 Marks]

(A) Blue

(B) Yellow

(C) Pale green

(D) Reddish brown

Explanation: The correct answer is Pale green. This is because the blue copper sulphate solution changes to pale green due to the formation of iron sulphate, which is a new substance. The reaction involves iron displacing copper in the solution, leading to the observed colour change.

Question 9.

Juice of tamarind turns blue litmus to red. It is because of the presence of a chemical compound called

[1 Marks]

(A) Tartaric acid

(B) Acetic acid

(C) Oxalic acid

(D) Methanoic acid

Explanation: The correct option is 'Tartaric acid' because tamarind juice contains tartaric acid, which is an acidic compound that can change the color of blue litmus paper to red, indicating its acidic nature.

Question 10.

The water of crystallization is present in

(i) Bleaching Powder (ii) Plaster of Paris (iii) Washing Soda (iv) Baking Soda

[1 Marks]

(A) (ii) and (iii)

(B) (ii) and (iv)

(C) (i) and (iv)

(D) (i) and (iii)

Explanation: Water of crystallization refers to water molecules that are chemically bound within a crystal structure of a compound. According to the context, Plaster of Paris (CaSO4·½H2O) and Washing Soda (Na2CO3·10H2O) both contain water of crystallization. Bleaching Powder and Baking Soda do not have water of crystallization in their chemical formula. Therefore, the correct option is (ii) and (iii).

Question 11.

A tall pea plant with round seeds (TTRR) is crossed with a short pea plant with wrinkled seeds (ttrr). The F_1 generation will be:

[1 Marks]

(A) 100% tall with round seeds

(B) 50% tall with wrinkled seeds

(C) 25% tall with round seeds

(D) 75% tall with wrinkled seeds

Explanation: The F_1 generation will be 100% tall with round seeds because tallness and round seeds are dominant traits. Therefore, all offspring from the cross (TTRR x ttrr) will exhibit the dominant phenotypes.

Question 12.

A pair of endocrine glands located in the human brain is

[1 Marks]

(A) Parathyroid and Pituitary

(B) Pineal and Thymus

(C) Hypothalamus and Thymus

(D) Hypothalamus and Pineal

Explanation: The correct answer is 'Hypothalamus and Pineal' because the hypothalamus is a crucial endocrine gland that links the nervous system to the endocrine system and is located in the brain. The pineal gland, also located in the brain, regulates sleep-wake cycles through the secretion of melatonin. The context provided mentions the pituitary gland but does not include it as a pair with another gland that is also located in the brain.

Question 13.

Select the option having correct matching of the organism given in Column I with the mode of reproduction in Column II:

[1 Marks]

	Column I		Column II
P	Leishmania	1.	Regeneration
Q	Spirogyra	2.	Multiple Fission
R	Planaria	3.	Binary Fission
S	Plasmodium	4.	Fragmentation
		5.	Budding

(A) P-3, Q-4, R-5, S-2

(B) P-3, Q-4, R-1, S-2

(C) P-4, Q-2, R-1, S-3

(D) P-4, Q-3, R-2, S-1

Explanation:

The correct option is P-3, Q-4, R-5, S-2 because Column I refers to specific organisms and their respective modes of reproduction; P matches with its defined method, similarly for Q, R, and S. This aligns with the context provided about the modes of reproduction, which distinguishes between sexual and asexual reproduction in animals.

Question 14.

The basic filtration unit of the excretory system in human beings is :

[1 Marks]

(A) Nephron

(B) Urethra

(C) Neuron

(D) Urinary bladder

Explanation: The correct answer is Nephron. The nephron is the basic functional and structural unit of the kidney, responsible for the filtration of blood and the formation of urine, as indicated in the context where it describes the role of kidneys in excretion.

Question 15.

In human alimentary canal, the digestive juice secreted by the gastric glands are

[1 Marks]

(A) Hydrochloric acid, Pepsin, Mucus

(B) Bile, Trypsin, Pepsin

(C) Salivary amylase, Pepsin, Bile

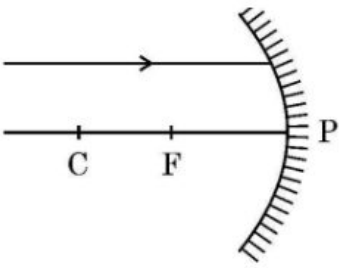
(D) Lipase, Bile, Mucus

Explanation: The correct answer is 'Hydrochloric acid, Pepsin, Mucus' as these are the substances secreted by the gastric glands in the stomach. Hydrochloric acid creates an acidic environment that facilitates enzyme action, particularly that of pepsin, which digests proteins. Mucus protects the stomach lining from the corrosive effects of the acid.

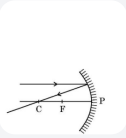
Question 16.

Identify from the following the ray diagram which shows the correct path of the reflected ray for the ray incident on a concave mirror as shown :

[1 Marks]



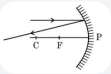
(A)



(B)



(C)



(D)



Explanation: For a concave mirror, rays that are parallel to the principal axis reflect and pass through the focal point F. This is a special property of concave mirrors. The law of reflection states that the angle of incidence equals the angle of reflection, and in the case of concave mirrors, parallel incident rays converge at the focal point after reflection. Therefore, the correct diagram will show the reflected ray passing through F.

Question 17.

The part of human eye which controls the amount of light entering into it.

[1 Marks]

(A) Iris

(B) Ciliary muscles

(C) Cornea

(D) Pupil

Explanation: The correct answer is 'Iris' because the iris is the dark muscular structure behind the cornea that contains the pupil. The iris controls the size of the pupil, which in turn regulates the amount of light entering the eye.

Question 18.

Consider the following food chain:
Grass → Grasshopper → Frog → Snake → Eagle

If the amount of energy available at third trophic level is 50 kJ, the available energy at the producer level was:

[1 Marks]

(A) 500 kJ

(B) 5 kJ

(C) 5000 kJ

(D) 0.5 kJ

Explanation: The energy available at each trophic level is generally about 10% of the energy from the level below it. Therefore, if the third trophic level has 50 kJ, the second trophic level (which is the primary consumer) would have approximately 500 kJ (10 times 50 kJ). This means the energy at the producer level (first trophic level) would be about 5000 kJ (10 times 500 kJ). Thus, the correct answer is 5000 kJ.

Question 19.

The incorrect statement about ozone is

[1 Marks]

(A) It is formed by combining oxygen molecule with free oxygen atom.

(B) It is used as a refrigerant and in fire-extinguishers.

(C) It is a deadly poisonous gas.

(D) It shields the surface of the earth from UV radiation from sun.

Explanation:

(A) *It is a deadly poisonous gas.*

- **True.** At ground level, ozone is harmful and can cause **respiratory problems**.

(B) *It shields the surface of the earth from UV radiation from the sun.*

- **True.** The **ozone layer** in the stratosphere **absorbs harmful ultraviolet (UV) rays**, protecting life on Earth.

(C) *It is used as a refrigerant and in fire-extinguishers.*

- **False.**
  - **Ozone is not used** as a refrigerant or fire-extinguisher gas.
  - **CFCs (chlorofluorocarbons)** were used as refrigerants and fire suppressants — **they damage ozone**.

(D) *It is formed by combining oxygen molecule with a free oxygen atom.*

- **True.**

  $O2+O \rightarrow O3$

Question 20.

Assertion (A) : Carbon and its compounds are our major sources of fuels.

Reason (R) : Most of the carbon compounds on burning release a large amount of heat and light.

[1 Marks]

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

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

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

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

Explanation: Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A). The context indicates that carbon and its compounds are indeed major fuels, and they release significant heat and light upon combustion, confirming that the reason explains why carbon compounds serve as fuel.

Question 21.

Assertion (A) : Xylem tissue moves water and minerals obtained from the soil by the roots.

Reason (R) : Xylem tissue is found only in the roots of a plant.

[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 the Assertion (A).

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

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

Explanation:

Assertion (A):

Xylem tissue moves water and minerals obtained from the soil by the roots.
True

- This is the **main function** of xylem tissue in plants.
- Xylem transports **water and dissolved minerals** from the **roots to all parts** of the plant.

Reason (R):

Xylem tissue is found only in the root of a plant.
False

- Xylem is **not limited to roots**.
- It is found throughout the plant — **roots, stems, and leaves** — forming a continuous system of water transport.

Question 22.

Assertion (A): In the common domestic circuits the earth wire is connected to a metallic plate buried deep inside the earth.

Reason (R) : Earth wire ensures that any leakage of current to the metallic body of the appliance keeps its potential to that of the earth, so the user may not get a severe electric shock.

[1 Marks]

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

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

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

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

Explanation: Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A). The earth wire is indeed connected to a metal plate buried deep in the earth, which serves as a safety measure to ensure that if there's any leakage of current, it directs it safely to the ground, reducing the risk of electric shock to users.

Question 23.

Assertion (A) : Food web is a network of several food chains operating in an ecosystem.

Reason (R) : Food web decreases the stability of an ecosystem.

[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 the Assertion (A).

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

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

Explanation: Assertion (A) is true, but Reason (R) is false. The food web indeed comprises multiple interconnected food chains, which enhances the stability of an ecosystem, as it allows for greater resilience to changes or disturbances compared to isolated food chains.

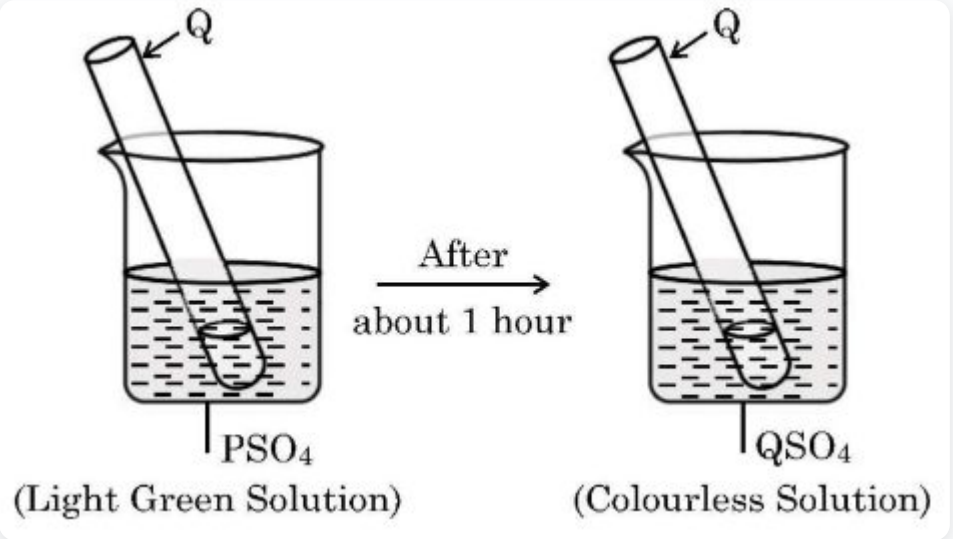
Section C

Question 24.

A light green coloured solution of sulphate salt of metal ‘P’ is taken in a beaker, a rod of another metal “Q’ is put in this solution as shown the following figures :

Identify the metals ‘P’ and ‘Q’ and write its chemical equation for the reaction that occurs. State the conclusion of this reaction in terms of reactivity series of metals.

[2 Marks]



Answer: In the given scenario, metal 'P' is iron (Fe), and metal 'Q' is copper (Cu). The reaction that occurs when a copper rod is placed in iron(II) sulphate solution is: Cu + FeSO4 → Fe + CuSO4. The conclusion from this reaction is that iron is more reactive than copper, as it displaces copper from its salt solution, thereby confirming the position of metals in the reactivity series.

Key Points: Identifying metal P as iron and metal Q as copper; writing the reaction equation; explaining the displacement reaction; noting iron's higher reactivity compared to copper.

Question 25.

(a) How is brain protected in our body ?

(b) A doctor finds in one of his patients that he is not maintaining a proper posture and balance of his body. State the region of brain and also the part of brain which is responsible for it.

[2 Marks]

Answer: The brain is protected by being enclosed in a hard bony structure known as the skull, which acts as a shield against physical damage. Additionally, it is surrounded by fluid that absorbs shocks. If a patient struggles with posture and balance, it indicates an issue with the cerebellum, which is part of the hindbrain. The cerebellum is crucial for coordinating voluntary movements and helps maintain stability.

Key Points: brain protected by skull-shock-absorbing fluid-cerebellum coordinates movements-balance and posture

Question 26.

“Proteins control the expression of various characters.” Explain this statement by taking an example of “tallness” as a characteristic in plants.

[2 Marks]

Answer: Proteins play a crucial role in determining traits in plants. For example, in pea plants, tallness is influenced by the gene that codes for an enzyme involved in hormone production. When the gene is functional, it produces sufficient hormones for growth, leading to tall plants. Conversely, if the gene is mutated and results in a less effective enzyme, hormone production decreases, resulting in shorter plants. Thus, proteins govern plant characteristics like tallness.

Key Points: Proteins determine traits; tallness influenced by gene; functional gene produces hormones; enzyme effectiveness affects plant height

Question 27.

Explain the mechanism of inheritance used by sexually reproducing organisms to ensure the stability of DNA of the species.

[2 Marks]

Answer: Sexually reproducing organisms inherit DNA from both parents, combining genetic materials from germ cells. This restores the normal chromosome number, preserving DNA stability. Variations arise from this combination, which can lead to traits that may enhance survival. Mendelian principles illustrate how dominant and recessive traits function in these organisms, ensuring continuity and subtle changes over generations. This process not only maintains DNA integrity but also allows adaptation through gradual variations.

Key Points: germ cells combine-chromosome restoration-DNA stability-Mendelian principles-dominant and recessive traits-variations enhance survival

Question 28.

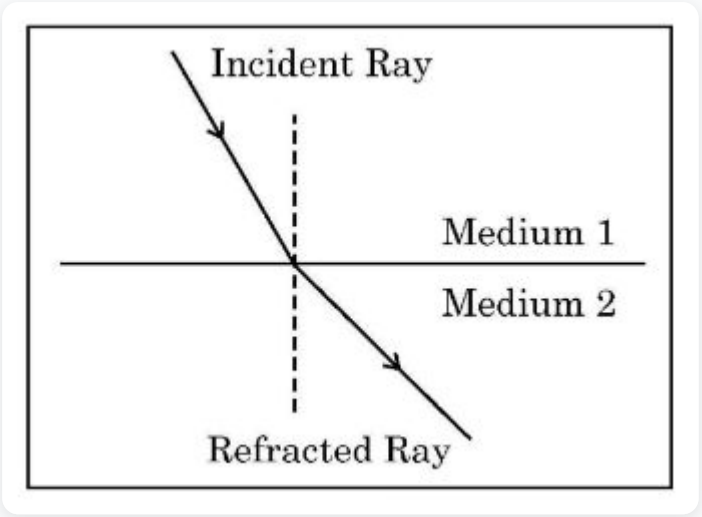
Study the figure in which the path of a ray of light going from Medium 1 to Medium 2 is shown.

(a) Out of the two Media — Medium 1 and Medium 2, in which is the speed of light more ?

(b) State reason of bending of the refracted ray away from the normal.

(c) Express refractive index of Medium 2 with respect to Medium 1 in terms of speed of light in two media.

[2 Marks]



Answer: (a) The speed of light is more in Medium 1 compared to Medium 2 because the light ray bends away from the normal while entering Medium 2.
(b) The refracted ray bends away from the normal because the speed of light increases as it moves from Medium 1 to Medium 2. This change in speed causes bending due to refraction.
(c) The refractive index of Medium 2 with respect to Medium 1 is given by $n = v_1 / v_2$, where v_1 is the speed of light in Medium 1 and v_2 is the speed of light in Medium 2.

Key Points: Speed of light in Medium 1 is more - Bending away from normal occurs when speed increases - Refractive index n = v1 / v2

Question 29.

Give Reasons:-

(i) The sky appears dark to passengers flying at very high altitude.

(ii) 'Danger' signal lights are red in colour.

[2 Marks]

Answer: Passengers flying at very high altitudes observe a dark sky because scattering of sunlight is minimal at those elevations. The atmosphere contains fewer particles, which reduces light scattering, allowing the deep blue-black of space to be seen. Danger signal lights are red because red light is less scattered in fog or smoke compared to other colors, allowing it to remain visible from greater distances. This characteristic makes red optimal for warning signals.

Key Points: Sky appears dark at high altitudes due to minimal scattering; fewer atmospheric particles; red light is less scattered than blue; red is visible over longer

distances; important for safety signals.

Question 30. What is a rainbow? “We see a rainbow in the sky only after the rainfall.” Why?

[2 Marks]

Answer: A rainbow is a natural spectrum that appears in the sky when sunlight is refracted and dispersed by tiny water droplets in the atmosphere, typically after rainfall. The sunlight, which is white light, is broken into seven colors as it enters, reflects internally, and exits the droplets. This phenomenon only occurs when the Sun is at a low angle, and the observer is positioned with their back to the Sun.

Key Points: Definition of a rainbow - Natural spectrum; Cause - Dispersion of sunlight by water droplets; Colors - Seven distinct colors; Occurrence - After rainfall; Position - Observer facing away from the Sun.

Question 31. We do not clean natural ponds or lakes whereas an aquarium or a swimming pool needs to be cleaned regularly. Why?

[2 Marks]

Answer: Natural ponds and lakes are self-sustaining ecosystems that have their own natural processes for waste decomposition, mainly through microorganisms and decomposers. In contrast, aquariums and swimming pools are artificial ecosystems that lack such natural recycling systems, leading to the accumulation of waste. Regular cleaning is essential in aquariums and pools to maintain water quality and ensure the health of the aquatic life within, as they cannot naturally balance themselves like ponds and lakes do.

Key Points: Self-sustaining ecosystems of natural ponds and lakes- Natural decomposition processes- Aquariums and pools need regular cleaning- Lack of natural recycling systems in artificial ecosystems- Importance of maintaining water quality for aquatic health

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Section D

Question 32.

Write balanced chemical equation for the reactions that occur when

(a) steam is passed over red hot iron.

(b) natural gas is burnt in air.

(c) glucose reacts with oxygen in the cells of our body and provides energy.

[3 Marks]

Answer:

(a) When steam is passed over red hot iron, iron reacts with steam to form iron oxide and hydrogen gas. The balanced chemical equation is:
$3Fe\ (s) + 4H_2O\ (g) \rightarrow Fe_3O_4\ (s) + 4H_2\ (g)$

(b) When natural gas, which mainly contains methane (CH_4), is burnt in air, it burns in presence of oxygen to give carbon dioxide and water along with heat and light. The balanced chemical equation is:
$CH_4(g) + 2O_2(g) \rightarrow CO_2(g) + 2H_2O(g)$

(c) Glucose reacts with oxygen in the cells during respiration to release energy. It produces carbon dioxide and water. The balanced chemical equation is:
$C_6H_{12}O_6(s) + 6O_2(g) \rightarrow 6CO_2(g) + 6H_2O(l) + \text{Energy (heat)}$
This process is called aerobic respiration and is essential for providing energy to living organisms.

> **Key Points: Balanced chemical equations-Steps to write equations for given reactions-Air contains oxygen used in combustion-Glucose oxidation releases energy in body-respiration is an exothermic process**

Question 33.

State the chemical property in each case on which the following uses of baking soda are based upon:

(i) as an anti-acid,

(ii) as a constituent in making baking powder,

(iii) in soda-acid fire extinguishers.

[3 Marks]

Answer: Baking soda, or sodium hydrogencarbonate, has several applications based on its chemical properties. (i) As an anti-acid, it is alkaline and effectively neutralizes excess stomach acid, offering relief from acidity. (ii) In baking powder, baking soda reacts with acids to produce carbon dioxide gas when heated or dissolved in water, causing dough to rise and become light. (iii) In soda-acid fire

extinguishers, it releases carbon dioxide when heated, which helps suffocate fires by displacing oxygen.

Key Points: Alkaline nature neutralizes stomach acid - Reacts with acids to produce CO2 - Releases CO2 to extinguish fires

Question 34.

Write chemical equations to show what happens when an acid reacts with

(i) metal,

(ii) base,

(iii) carbonate.

Write the name of the main product formed in each case.

[3 Marks]

Answer: (i) Acid + Metal:
When an acid reacts with a metal, it forms a salt and hydrogen gas.
Example: $2HCl + Zn \rightarrow ZnCl_2 + H_2$
The main product formed is a salt.

(ii) Acid + Base:
When an acid reacts with a base, it gives a salt and water. This is called neutralization.
Example: $HCl + NaOH \rightarrow NaCl + H_2O$
The main product formed is a salt.

(iii) Acid + Carbonate:
When an acid reacts with a carbonate, it produces a salt, carbon dioxide, and water.
Example: $2HCl + Na_2CO_3 \rightarrow 2NaCl + CO_2 + H_2O$
The main product formed is a salt.

Key Points: Acid reacts with metal to form salt and hydrogen gas - Acid reacts with base to form salt and water (neutralization) - Acid reacts with carbonate to form salt, carbon dioxide and water

Question 35. Name the blood vessel that brings (i) oxygenated blood, (ii) deoxygenated blood, to the human heart. Also, name the chamber of the heart which receives deoxygenated blood and state how deoxygenated blood from this chamber is sent to lungs for oxygenation.

[3 Marks]

Answer: The blood vessel that brings oxygenated blood to the human heart is the pulmonary vein, which transports oxygen-rich blood from the lungs to the left atrium. Conversely, the blood vessel that carries deoxygenated blood to the heart is the superior or inferior vena cava, which delivers oxygen-poor blood from the body to the right atrium. Deoxygenated blood enters the right atrium and is subsequently pumped into the right ventricle, which sends it to the lungs for oxygenation via the pulmonary arteries.

Key Points: Pulmonary vein brings oxygenated blood; Vena cava brings deoxygenated blood; Right atrium receives deoxygenated blood; Blood is pumped from right atrium to right ventricle; Right ventricle sends blood to lungs via pulmonary arteries for oxygenation

Question 36.

The gene combination of purple flowered pea plants is denoted as (WW) and that of white flowered pea plants as (ww). When these two plants are crossed, F_1 generation is obtained.

(a) List two observations made by Mendel in F_1 generation plants.

(b) Give the (i) percentage of white flowered plants and (ii) ratio of the gene combinations WW, Ww and ww in F_1 generation.

(c) Write one difference between dominant and recessive trait.

[3 Marks]

Answer: (a) The two observations made by Mendel in F_1 generation are: 1. All plants had purple flowers, showing purple color is dominant. 2. No white flowered plants appeared in F_1 generation.
(b) (i) Percentage of white flowered plants = 0% because all F_1 plants have at least one dominant W allele.
(ii) Ratio of gene combinations in F_1 plants is WW : Ww : ww = 0 : 100 : 0. All plants are heterozygous Ww.
(c) Dominant trait is the one that appears in the offspring when both dominant and recessive alleles are present, while recessive trait is masked in the presence of dominant allele and appears only when both alleles are recessive (ww).

Key Points: F1 plants all have purple flowers - No white flowers in F1 - F1 genotype is all heterozygous Ww - Dominant trait appears in F1 - Recessive trait hidden in F1

Question 37.

A student placed a candle flame at different distances from a convex lens and focused its image on a screen. He recorded his observation in tabular form as given below :

Analyse the observation table and on the basis of your analysis only, answer the following questions (without doing any calculations) :

(a) What is the focal length of the convex lens used ? Give reason to justify your answer.

(b) Which one of the sets of observations is not correct and why ?

(c) Draw ray diagram to show image formation for any correct set of observation.

[3 Marks]

S.No.	Distance of flame from the lens (cm)	Distance of the image from the lens
1	– 90	+ 18
2	– 60	+ 20
3	– 40	+ 24
4	– 30	+ 30
5	– 24	+ 40
6	– 20	+ 60
7	– 18	+ 90
8	– 12	+ 120

Answer: (a) The focal length of the convex lens is the distance at which the image formed is highly magnified or when the object is at the focal point F. In the observations, the focal length corresponds to the distance where the image is very large or cannot be formed on the screen clearly, indicating this distance as the focal length.
(b) Any set of observations where image characteristics contradict the properties of convex lens images is not correct. For example, if an image is described as virtual and formed on the screen, it is incorrect because virtual images cannot be projected on a screen. Also, if magnification or position does not follow the lens formula's logical pattern, that set is wrong.
(c) Ray diagram for object placed beyond 2F (twice the focal length):
- Draw the convex lens vertical line with focal points F on both sides.
- Place the candle flame beyond 2F.
- Draw one ray parallel to principal axis which after refraction passes through the focal point on other side.
- Draw second ray passing through the optical centre which goes straight without deviation.
- The rays converge at a point between F and 2F on the other side forming a real, inverted and smaller image on the screen.
This ray diagram corresponds to a correct observation set with object beyond 2F.

Key Points: Focal length identified from image position and size - Virtual images cannot be formed on screen indicating incorrect data - Correct ray diagram shows real, inverted image formed between F and 2F when object is beyond 2F

Question 38.

A person uses lenses of +2.0 D power in his spectacles for the correction of his vision.

(a) Name the defect of vision the person is suffering from.

(b) List two causes of this defect.

(c) Determine the focal length of the lenses used in the spectacles.

[3 Marks]

Answer: (a) The person is suffering from hypermetropia, also called farsightedness.
(b) Two causes of hypermetropia are: (i) The eyeball may be too small from front to back. (ii) The eye lens may have a focal length that is too long.
(c) The power P of a lens is related to its focal length f by the formula P = 100 / f where f is in cm. Given power P = +2.0 D, so focal length f = 100 / 2 = 50 cm = 0.50 m. Hence, the focal length of the lens used is +0.50 meter.

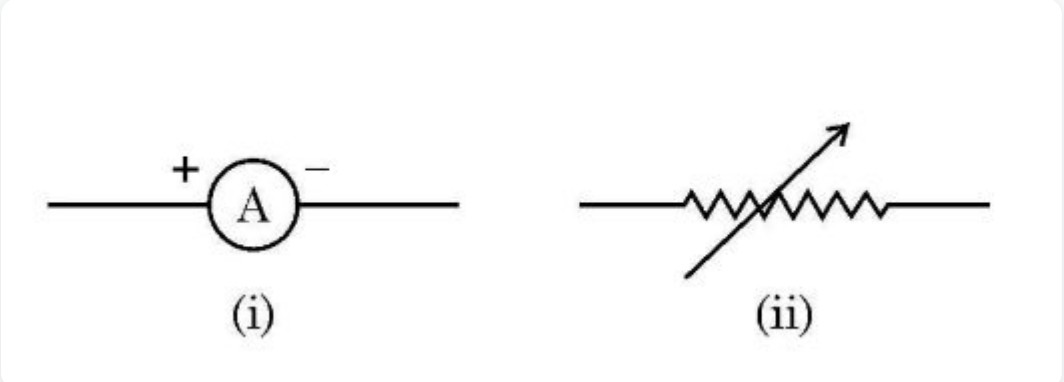
Key Points: Defect is hypermetropia - Causes are small eyeball and long focal length of the eye lens - Focal length calculated using f = 100 / P

Question 39.

(a) Explain the statement “Potential difference between two points is 1 volt”.

(b) What do the symbols given below represent in an electric circuit ? Write one function of each.

[3 Marks]



Answer:

(a) The statement “Potential difference between two points is 1 volt” means that 1 joule of work is done to move 1 coulomb of electric charge from one point to the other in the circuit. Essentially, this means the electric potential energy difference between these two points is equivalent to 1 volt. It indicates how much energy each unit charge gains or loses while moving between those points.

(b) In an electric circuit, different symbols represent various components:

Voltmeter (V): This instrument measures the voltage or potential difference between two points in the circuit. It helps us know how much electric potential energy per unit charge is available between those points.

Key (K): A key is a type of switch that can open or close the circuit. When closed, it allows current to flow; when opened, it stops the current, controlling the working of the circuit.

> **Key Points: Definition of 1 volt as 1 joule work done per coulomb charge- Explanation of electric potential difference- Function of voltmeter as measuring device for potential difference- Function of key as a switch controlling the circuit current flow**

Section E

Question 40.

Name an alcohol and a carboxylic acid having two carbon atoms in their structures. Draw their structures and state how this alcohol can be converted into a carboxylic acid. What happens when these two compounds react in the presence of an acid ? Write chemical equations for the reactions involved in the two cases mentioned above.

[5 Marks]

Answer: (a) Alcohol with two carbon atoms: Ethanol (CH_3CH_2OH)

Structure of Ethanol:
CH_3 - CH_2 - OH

Carboxylic acid with two carbon atoms: Ethanoic acid (Acetic acid) (CH_3COOH)

Structure of Ethanoic acid:
CH_3 - COOH

(b) Conversion of ethanol into ethanoic acid:
Ethanol can be oxidized to ethanoic acid using an oxidizing agent such as potassium dichromate ($K_2Cr_2O_7$) in acidic medium (dilute H_2SO_4). This is an oxidation reaction.

Chemical equation:
$CH_3CH_2OH + [O] \text{ --}(K_2Cr_2O_7/H_2SO_4)\text{--> } CH_3COOH + H_2O$

(c) Reaction between ethanol and ethanoic acid in presence of acid catalyst:
When ethanol reacts with ethanoic acid in presence of acid catalyst (usually concentrated H_2SO_4), an esterification reaction occurs forming an ester called ethyl ethanoate and water.
Chemical equation:
$CH_3COOH + CH_3CH_2OH \text{ --}(H_2SO_4)\text{--> } CH_3COOCH_2CH_3 + H_2O$

This reaction is reversible and acid catalyst helps in increasing the rate of reaction.

Summary:
- Ethanol is an alcohol with two carbon atoms.
- Ethanoic acid is a carboxylic acid with two carbon atoms.
- Ethanol can be oxidized to ethanoic acid.
- Ethanol and ethanoic acid react in presence of acid to form ester (ethyl ethanoate) and water.

> **Key Points: Ethanol and ethanoic acid contain two carbon atoms - Ethanol can be oxidized to ethanoic acid using K2Cr2O7/H2SO4 - Ethanol and ethanoic acid react in acidic medium to form ethyl ethanoate (ester) and water**

Question 41.

(a) Define Puberty. List any two changes seen in boys at the time of puberty.

(b) Why are testes in human males located outside the abdominal cavity in scrotum ?

(c) List any three techniques of contraception used by humans. Which one of these is not meant for males ?

[5 Marks]

Answer: (a) **Puberty** is the period during which a child's body develops into an adult body capable of reproduction. During puberty in boys, two changes seen are the growth of facial and pubic hair and the deepening of the voice due to the production of the hormone testosterone.
(b) The testes in human males are located outside the abdominal cavity in the scrotum because sperm formation requires a temperature slightly lower than the normal body temperature. The scrotum keeps the testes cooler, which helps in the production of healthy sperm.
(c) Three techniques of contraception used by humans are condoms, oral contraceptive pills, and copper-T (intrauterine device). Among these, oral contraceptive pills are not meant for males; they are used by females to prevent pregnancy.

Key Points: Definition of puberty - Changes in boys at puberty include hair growth and voice deepening - Testes are outside abdominal cavity to keep temperature lower for sperm formation - Contraception techniques include condoms, oral pills, copper-T - Oral pills are not for males

Question 42.

(a) Name the part performing following functions in human female reproductive system :

(i) production of eggs

(ii) site of fertilization

(iii) site of implantation

(iv) entry of the sperms

(b) What changes are observed in the uterus :

(i) subsequent to implantation of zygote and

(ii) if an egg does not get fertilized ?

[5 Marks]

Answer: (a) Parts performing the given functions in human female reproductive system:
(i) Production of eggs: The **ovary** is responsible for producing eggs or ova.
(ii) Site of fertilization: Fertilization occurs in the **fallopian tube (oviduct)** where the sperm meets the egg.
(iii) Site of implantation: The fertilized egg implants itself in the **lining of the uterus** called the endometrium.
(iv) Entry of sperms: Sperms enter the female reproductive system through the **vagina**.

(b) Changes observed in the uterus:
(i) Subsequent to implantation of zygote: The uterine lining thickens and becomes enriched with blood vessels to nourish the developing embryo. The uterus prepares to support pregnancy by becoming thick and spongy.
(ii) If an egg does not get fertilized: The thickened uterine lining breaks down and is shed from the body as menstrual blood. This process is called menstruation. The uterus returns to its normal state waiting for the next cycle.

Key Points: Ovary produces eggs - Fertilization occurs in fallopian tube - Implantation takes place in uterus lining - Sperms enter through vagina - Uterus thickens after implantation - Uterine lining sheds if no fertilization

Question 43.

What are soaps ? Write the structure of a soap molecule. Explain the cleansing action of a soap. Why are soaps not considered suitable for washing clothes in a region where water is hard ? How is this problem overcomed ?

[5 Marks]

Answer: (a) **Soaps :** Soaps are sodium or potassium salts of long chain fatty acids used as cleansing agents.

(b) **Structure of Soap Molecule :** A soap molecule has a long hydrocarbon chain which is hydrophobic (water repelling) and an ionic carboxylate group ($–COO^-Na^+$) which is hydrophilic (water loving).

(c) **Cleansing Action :** Soap molecules have two different ends: the hydrophobic tail dissolves in grease and oil, while the hydrophilic head remains in water. When soap is added to water containing dirt, the hydrophobic tails attach to the oil and grease, while the hydrophilic heads remain in water. This forms spherical structures called micelles where the dirt is trapped inside. These micelles are suspended in water and can be washed away, cleaning the clothes.

(d) **Soap in Hard Water :** Hard water contains Ca^{2+} and Mg^{2+} ions which react with soap to form insoluble compounds called scum. This scum reduces the cleaning ability of soaps and makes washing ineffective.

(e) **Solution :** This problem is overcome by using synthetic detergents instead of soaps. Detergents do not form scum in hard water and clean effectively.

> **Key Points: Soaps are sodium or potassium salts of fatty acids - Soap molecules have hydrophobic tail and hydrophilic head - Soap forms micelles to remove dirt - Hard water forms scum with soaps reducing cleaning - Detergents are used to solve the problem in hard water**

Question 44.

What are magnetic field lines ? How is the direction of magnetic field at a point determined ? Draw the pattern of magnetic field lines of the magnetic field produced by a current carrying circular loop. Mark on it the direction of (i) current and (ii) magnetic field lines.

Name the two factors on which the magnitude of the magnetic field due to a current carrying coil depends.

[5 Marks]

Answer: (a) What are magnetic field lines?

Magnetic field lines are imaginary lines used to represent the magnetic field around a magnet or a current carrying conductor. These lines show the direction of the magnetic force and help visualize the strength and shape of the magnetic field. The magnetic field is stronger where the lines are closer and weaker where they are farther apart.

(b) How is the direction of magnetic field at a point determined?
The direction of the magnetic field at any point is given by the tangent to the magnetic field line at that point. Around a current carrying conductor, the magnetic field direction can be found by using the right-hand thumb rule. If you curl the fingers of your right hand in the direction of the current, your thumb points the direction of the magnetic field.

(c) Pattern of magnetic field lines produced by a current carrying circular loop:
The magnetic field lines form concentric closed loops around the wire. Inside the circular loop, the field lines are almost straight and parallel, showing a uniform magnetic field. Outside the loop, the lines spread out and loop back to the other side. On the diagram, the direction of current is marked as arrows along the circular wire (usually anticlockwise or clockwise), and the direction of magnetic field lines is shown by arrows forming loops around and inside the coil.

(d) Two factors on which the magnitude of magnetic field due to a current carrying coil depends:
1. Magnitude of the current flowing through the coil.
2. Number of turns in the coil.
More current or more turns will increase the magnetic field produced by the coil.

> **Key Points: Magnetic field lines represent the magnetic field - Direction given by tangent at a point and right-hand thumb rule - Magnetic field pattern around circular coil shows loops with direction marked - Magnitude depends on current and number of turns**

Question 45.

Why can't two magnetic field lines cross each other ? Draw magnetic field lines showing the direction of the magnetic field due to a current carrying long straight solenoid. State the conclusion which can be drawn from the pattern of magnetic field lines inside the solenoid.

Name any two factors on which the magnitude of the magnetic field due to this solenoid depends.

[5 Marks]

Answer: (a) Two magnetic field lines cannot cross each other because if they did, at the point of crossing there would be two different directions of the magnetic field which is not possible. The magnetic field at any point has only one direction.
(b) The magnetic field lines due to a current carrying long straight solenoid are shown as closely spaced, nearly parallel lines inside the solenoid indicating a strong and uniform magnetic field. Outside the solenoid, the field lines spread out and loop from one end to the other, similar to the field of a bar magnet.
(c) The conclusion drawn from the pattern of magnetic field lines inside the solenoid is that the magnetic field inside the solenoid is strong and uniform. The solenoid behaves like a bar magnet with

a north and south pole.

(d) Two factors on which the magnitude of the magnetic field due to the solenoid depends are:

1. The number of turns of the coil (N) in the solenoid.

2. The current (I) passing through the solenoid.

Other factors include the length of the solenoid and the presence of a magnetic core.

Key Points: Magnetic field lines cannot cross as field direction is unique at any point - Magnetic field inside solenoid is strong and uniform - Magnitude depends on number of turns and current