

Question 1:

To get an image of magnification -1 on a screen using a lens of focal length 20 cm, the object distance must be:

- (1) Less than 20 cm
- (2) 30 cm
- (3) 40 cm
- (4) 80 cm

Correct Answer: (3) 40 cm

Question 2:

When a pure-tall pea plant is crossed with a pure-dwarf pea plant, the percentage of tall pea plants in F_1 and F_2 generation pea plants will be respectively:

- (1) 100% ; 25%
- (2) 100% ; 50%
- (3) 100% ; 75%
- (4) 100% ; 100%

Correct Answer: (1) 100% ; 25%

Question 3:

Plants like rose and banana have lost the capacity to produce:

- (1) flowers
- (2) buds
- (3) seeds
- (4) fruits

Correct Answer: (3) seeds

Question 4:

In which one of the following situations a chemical reaction does not occur?

- (1) Milk is left open at room temperature during summer
- (2) Grapes get fermented
- (3) An iron nail is left exposed to the humid atmosphere
- (4) Melting of glaciers

Correct Answer: (4) Melting of glaciers

Question 5:

The property by which a solid material can be drawn into thin wires is called:

- (a) malleability
- (b) ductility
- (c) rigidity
- (d) resistivity

Correct Answer: (b) ductility

Question 6:

To prepare dry hydrogen chloride gas in a humid atmosphere, the gas produced is passed through a guard tube (drying tube) which contains:

- (a) Calcium chloride
- (b) Calcium oxide
- (c) Calcium hydroxide
- (d) Calcium carbonate

Correct Answer: (a) Calcium chloride

Question 7:

Select from the following a hydrocarbon having one C-C bond and one C=C bond:

- (a) Benzene
- (b) Cyclohexane
- (c) Butyne
- (d) Propylene

Correct Answer: (c) Butyne. Question 8:

Which one of the following has half the number of chromosomes and half the amount of DNA as compared to the non-reproductive body cells?

- (1) Male germ cell
- (2) Female germ cell
- (3) Zygote
- (4) Both, male and female germ cells

Correct Answer: (4) Both, male and female germ cells

Question 9:

The essential element taken up from the soil by the plants to synthesize proteins is:

- (1) Phosphorus
- (2) Nitrogen
- (3) Iron
- (4) Magnesium

Correct Answer: (2) Nitrogen

Question 10:

Select TRUE statements about lymph from the following:

- A. Lymph vessels carry lymph through the body and finally open into larger arteries.
- B. Lymph contains some amount of plasma, proteins, and blood cells.
- C. Lymph contains some amount of plasma, proteins, and red blood cells.
- D. Lymph vessels carry lymph through the body and finally open into larger veins.

The true statements are:

- (1) A and B
- (2) B and D
- (3) A and C
- (4) C and D

Correct Answer: (4) C and D

Question 11:

Which one of the following gets biomagnified at different levels in a food chain?

- (1) Carbon monoxide
- (2) CFC's
- (3) DDT

(4) Manure

Correct Answer: (3) DDT

Question 12:

In the food chains given below, select the most efficient food chain in terms of energy:

(1) Grass → Grasshopper → Frog → Snake

(2) Plants → Deer → Lion

(3) Plants → Man

(4) Phytoplankton → Zooplankton → Small Fish → Big Fish

Correct Answer: (4) Phytoplankton → Zooplankton → Small Fish → Big Fish

Question 13:

An optical device 'X' is placed obliquely in the path of a narrow parallel beam of light. If the emergent beam gets displaced laterally, the device 'X' is:

(1) Plane mirror

(2) Convex lens

(3) Glass slab

(4) Glass prism

Correct Answer: (3) Glass slab

Question 14:

A piece of wire of resistance 'R' is cut lengthwise into three identical parts. These parts are then connected in parallel. If the equivalent resistance of this combination is $R'R'$, then the value of $R/R'R/R'$ is:

(1) $1/9$

(2) $1/3$

(3) 3

(4) 9

Correct Answer: (4) 9

Question 15:

The minimum number of identical bulbs of rating 4V, 6W, that can work safely with desired brightness, when connected in series with a 240V mains supply is:

- (a) 20
- (b) 40
- (c) 60
- (d) 80

Correct Answer: (b) 40

Question 16:

An electric bulb is rated 220V, 11W. The resistance of its filament when it glows with a power supply of 220V is:

- (a) 4400 Ω
- (b) 440 Ω
- (c) 400 Ω
- (d) 20 Ω

Correct Answer:(a) 4400 Ω

Question 17:

Assertion (A): All exothermic reactions are accompanied with evolution of heat and light.

Reason (R): Combination reactions may or may not be exothermic.

In the light of the above statements, choose the most appropriate answer from the options given below:

- (1) Both Assertion (A) and Reason (R) are true, and Reason (R) is the correct explanation of Assertion (A).
- (2) Both Assertion (A) and Reason (R) are true, and Reason (R) is not the correct explanation of Assertion (A).
- (3) Assertion (A) is true, but Reason (R) is false.
- (4) Assertion (A) is false, but Reason (R) is true.

Correct Answer: (4) Assertion (A) is false, but Reason (R) is true.

Question 18:

Assertion (A): When ciliary muscles contract, the eye lens becomes thin.

Reason (R): Ciliary muscles control the power of the eye lens.

In the light of the above statements, choose the most appropriate answer from the options given below:

- (1) Both Assertion (A) and Reason (R) are true, and Reason (R) is the correct explanation of Assertion (A).
- (2) Both Assertion (A) and Reason (R) are true, and Reason (R) is not the correct explanation of Assertion (A).
- (3) Assertion (A) is true, but Reason (R) is false.
- (4) Assertion (A) is false, but Reason (R) is true.

Correct Answer: (3) Assertion (A) is true, but Reason (R) is false.

Question 19:

Assertion (A): Concentrated nitric acid is diluted by adding water slowly to acid with constant stirring.

Reason (R): Concentrated nitric acid is easily soluble in water.

In the light of the above statements, choose the most appropriate answer from the options given below:

- (1) Both Assertion (A) and Reason (R) are true, and Reason (R) is the correct explanation of Assertion (A).
- (2) Both Assertion (A) and Reason (R) are true, and Reason (R) is not the correct explanation of Assertion (A).
- (3) Assertion (A) is true, but Reason (R) is false.
- (4) Assertion (A) is false, but Reason (R) is true.

Correct Answer: (2) Both Assertion (A) and Reason (R) are true, and Reason (R) is not the correct explanation of Assertion (A).

Question 20:

Assertion (A): In reptiles, the temperature at which the fertilized eggs are kept decides the sex of the offspring.

Reason (R): Sex is not genetically determined in some animals.

In the light of the above statements, choose the most appropriate answer from the options given below:

- (1) Both Assertion (A) and Reason (R) are true, and Reason (R) is the correct explanation of Assertion (A).
- (2) Both Assertion (A) and Reason (R) are true, and Reason (R) is not the correct explanation of Assertion (A).
- (3) Assertion (A) is true, but Reason (R) is false.
- (4) Assertion (A) is false, but Reason (R) is true.

Correct Answer:(1) Both Assertion (A) and Reason (R) are true, and Reason (R) is the correct explanation of Assertion (A).

Question 21:

While burning a magnesium ribbon in air, list two safety measures which should be followed. Also state two observations of this activity.

Correct Answer:

Safety Measures:

Always use a pair of tongs to hold the magnesium ribbon to prevent direct contact with hands.

Burn magnesium in a fume hood or open space to avoid inhaling any fumes.

Observations:

Magnesium burns with a bright white flame and produces a white ash of magnesium oxide. The magnesium ribbon turns into a white powder (magnesium oxide) after combustion..

Question 22:

(a) Draw a ray diagram to show the refraction of a ray of light passing through an equilateral glass prism. Mark the angle through which the emergent ray bends from the direction of the incident ray and also name it.

Correct Answer:

The ray diagram is as follows:

To draw a ray diagram showing the refraction of a ray of light passing through an equilateral glass prism and to mark the angle through which the emergent ray bends from the direction of the incident ray, follow these steps:

1. Draw the Prism:

Sketch an equilateral triangle to represent the glass prism. Label the vertices as AA, BB, and CC.

2. Incident Ray:

Draw an incident ray approaching the prism at one of its faces (e.g., face ABAB). Label the point where the ray enters the prism as point PP.

3. Refraction at First Face:

At point PP, draw the refracted ray inside the prism. The ray bends towards the normal as it enters the denser glass medium from air.

4. Refraction at Second Face:

The refracted ray travels through the prism and reaches the second face (e.g., face ACAC). Label the point where the ray exits the prism as point QQ.

5. Emergent Ray:

At point QQ, draw the emergent ray leaving the prism. The ray bends away from the normal as it exits the denser glass medium into air.

6. Angle of Deviation:

Extend the incident ray and the emergent ray backwards (dotted lines) to show their original paths if there were no prism.

The angle between the extended incident ray and the emergent ray is called the angle of deviation, denoted as δ . Mark this angle clearly on your diagram.

7. Labeling:

Label the incident ray, refracted ray, emergent ray, and the angle of deviation δ .

The angle of deviation δ is the measure of how much the emergent ray has bent from the direction of the incident ray due to the refraction through the prism. This angle depends on the angle of incidence, the material of the prism, and the wavelength of the light.

By following these steps, you can create a detailed and accurate ray diagram illustrating the refraction of light through an equilateral glass prism and identify the angle of deviation.

Question 22:

(b) Name the type of lenses required by the persons for the correction of their defect of vision called presbyopia. Write the structure of the lenses commonly used for the correction of this defect, giving reason for such designs.

Correct Answer:

Type of Lenses:

For the correction of presbyopia, bifocal lenses or progressive lenses are used.

Structure and Reasoning:

Bifocal lenses consist of two parts: a lower part for near vision and an upper part for distance vision.

The lower part is typically a convex lens to aid in near vision, while the upper part is a concave lens to help with distance vision.

The reason for using bifocal lenses is to correct the vision for both distant and near objects without changing glasses.

Question 23:

In the human alimentary canal, the small intestine is designed to absorb the digested food. Justify this statement.

Correct Answer:

The small intestine is designed to absorb digested food due to the following reasons:

It has a large surface area due to villi and microvilli. This increases the surface area for nutrient absorption.

Villi contain a network of blood vessels that carry absorbed nutrients like glucose, amino

acids, and vitamins into the bloodstream.

The epithelial cells of the small intestine secrete enzymes, aiding in further digestion and absorption.

The small intestine is long enough to provide sufficient time for nutrients to be absorbed into the bloodstream.

Question 24:

Pure-tall (TT) pea plants are crossed with pure-dwarf (tt) pea plants. The pea plants obtained in F1 generation are then self-pollinated to produce F2 generation.

- (i) What do the plants of F1 generation look like? Justify your answer.
- (ii) What is the ratio of pure-tall plants to pure-dwarf plants in F2 generation?

Correct Answer:

(i) The plants in the F1 generation will all be heterozygous (Tt), as tall (T) is dominant over dwarf (t). Hence, all F1 generation plants will exhibit the tall phenotype.

(ii) In the F2 generation, the F1 plants (Tt) are self-pollinated. The resulting offspring will follow a 3:1 phenotypic ratio, with three tall plants for every one dwarf plant: Phenotypic ratio: 3 tall:1 dwarf

Thus, the ratio of pure-tall plants (TT) to pure-dwarf plants (tt) in F2 generation is 1:3.

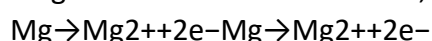
Question 25:

(a) Show the formation of magnesium chloride by electron transfer. Write the name of the cation and anion present in the compound formed. (Atomic Number of Mg = 12, Cl = 17)

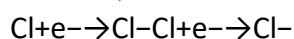
Correct Answer:

Magnesium (Mg) has an atomic number of 12. Its electronic configuration is 2, 8, 2.

Magnesium needs to lose two electrons to achieve a stable noble gas configuration. When magnesium loses two electrons, it forms a cation Mg^{2+} :



Chlorine (Cl) has an atomic number of 17, and its electronic configuration is 2, 8, 7. Chlorine needs one electron to achieve a stable noble gas configuration. When chlorine gains one electron, it forms an anion Cl^{-} :



Two chlorine atoms are required to balance the charge of one magnesium cation. The ionic equation is:



The cation formed is Mg^{2+} and the anion is Cl^{-} .

Question 25:

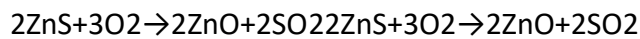
(b) How is zinc extracted from its ore? Name the processes involved in the extraction and write chemical equations for the reactions that occur during these processes.

Correct Answer:

Zinc is extracted from its ore, zinc blende (ZnS), through the following processes:

Concentration of Ore: Zinc blende is first concentrated by the process of froth flotation. In this method, the ore is crushed and mixed with water and frothing agents. The lighter impurities are separated from the heavier zinc ore.

Roasting: The concentrated zinc ore (ZnS) is heated in the presence of oxygen. This process is called roasting, and it converts zinc sulfide into zinc oxide, releasing sulfur dioxide:



Reduction of Zinc Oxide: The zinc oxide obtained from roasting is then reduced to zinc metal by heating it with carbon in a furnace:



This reduction process takes place at a high temperature, and zinc metal is extracted.

Question 26:

State the role of an electric fuse, used in series with an electrical appliance. Why should in an electric circuit a fuse with defined rating not be replaced by one with a larger rating?

Correct Answer:

The role of an electric fuse is to protect the electrical circuit and appliances from damage caused by excess current. A fuse is a safety device that is connected in series with the electrical appliance. It is made of a wire with a low melting point, and if the current exceeds a certain threshold, the wire melts, thus breaking the circuit and preventing damage to the appliance.

Why should a fuse with a defined rating not be replaced by one with a larger rating?

A fuse is designed to melt and break the circuit if the current exceeds a certain safe value for the appliance. If a fuse with a larger rating is used, it will not melt and break the circuit at the right time.

This can lead to overheating of the wires and components, potentially causing fires or damaging the appliance.

Using a larger-rated fuse will not protect the appliance as intended, as it will allow excessive current to flow without interrupting the circuit.

Question 27:

What are decomposers? Give two examples. State how they maintain a balance in an ecosystem.

Correct Answer:

Decomposers are organisms that break down dead and decaying organisms to obtain energy and recycle nutrients back into the ecosystem. They play an essential role in the ecosystem by decomposing organic matter and returning essential nutrients such as nitrogen, carbon, and phosphorus to the soil, making them available for plants to absorb and grow.

Examples:

Bacteria

Fungi

How they maintain balance:

Decomposers help maintain ecological balance by ensuring the recycling of nutrients and preventing the accumulation of dead organic matter in the ecosystem. This promotes the growth of plants and sustains the food chain.

Question 28:

Samples of four metals A, B, C, and D were added one by one to the following solutions. The results obtained were tabulated as follows:

Metal	Iron Sulphate	Copper Sulphate	Zinc Sulphate	Aluminium Sulphate
A	-	Displacement	No reaction	No reaction
B	Displacement	Displacement	Displacement	-
C	Displacement	?	-	No reaction
D	No reaction	No reaction	No reaction	No reaction

Use the table above to answer the following questions about metals A, B, C, and D:

- (i) Which is the least reactive metal?
- (ii) What would be observed if C is added to a solution of copper sulphate?
- (iii) Arrange the metals A, B, C, and D in the order of their decreasing reactivity.

Correct Answer:

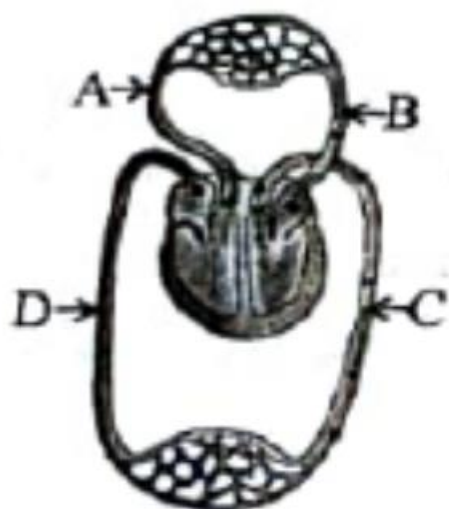
- (i) Least reactive metal: Metal D is the least reactive since it does not displace any metal from any solution (it shows no reaction).
- (ii) Observation when C is added to copper sulphate: C will not displace copper from copper sulphate as indicated by the table; thus, no visible change is expected.

(iii) Order of decreasing reactivity: $A > B > C > D$. This is based on the results of the displacement reactions, with A being the most reactive and D being the least reactive.

Question 29:

(i) Study the diagram and name the parts marked as A, B, C, and D.

(ii) Write the function of A and C.



Correct Answer:

Part A: The diagram represents a typical electric heater or an electrical appliance. In this context:

- A is the heating element.

Part B: The part labeled B is the insulating material. It protects the electrical components and ensures safety by preventing electrical leakage.

Part C: The part labeled C represents the wire wound around the heating element that conducts the current through the element.

Part D: The part labeled D is the metal casing or the outer surface that holds the internal parts and provides mechanical protection.

Functions:

Function of A (Heating element): It generates heat when an electric current passes through it. This heat is transferred to the surrounding environment or the object to be heated.

Function of C (Wire): It allows the passage of electric current to the heating element, enabling it to function by converting electrical energy into heat.

Question 30:

The electrical resistivity of three materials A, B, and C at 20°C is given below:

Material A: Resistivity $10^{17}\Omega\text{m}$

Material B: Resistivity $44 \times 10^{-6}\Omega\text{m}$

Material C: Resistivity $1.62 \times 10^{-8}\Omega\text{m}$

(i) Classify these materials as conductor, alloy, and insulator.

(ii) Give one example of each of these materials and state one use of each material in the design of an electrical appliance, say an electric stove or an electric iron.

Correct Answer:

(i) Classification:

Material A with resistivity $10^{17}\Omega\text{m}$ is an insulator, as its resistivity is extremely high, preventing the flow of electricity.

Material B with resistivity $44 \times 10^{-6}\Omega\text{m}$ is an alloy, which has moderate resistivity and is often used in electrical heating applications.

Material C with resistivity $1.62 \times 10^{-8}\Omega\text{m}$ is a conductor, as it has low resistivity, allowing electricity to flow easily.

(ii) Examples and Uses:

Material A (Insulator): Example - Rubber, Glass.

Use: Insulating materials like rubber are used for covering wires to prevent electric shock.

Material B (Alloy): Example - Nichrome (used in heating elements).

Use: Nichrome is used in electric stoves and heating elements due to its ability to withstand high temperatures.

Material C (Conductor): Example - Copper, Silver.

Use: Copper is used in electrical wires due to its excellent conductivity.

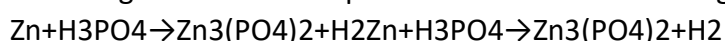
Question 31:

If we want to obtain a real and magnified image of an object by using a concave mirror of focal length 18 cm. Where should the object be placed? Use mirror formula to determine the object distance for an image of magnification -2 by this mirror to justify your answer.

Correct Answer:

Question 32:

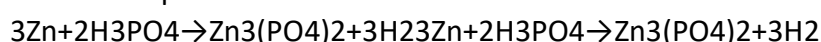
(a) Why do we balance a chemical equation? Name and state the law that suggests the balancing of a chemical equation. Balance the following chemical equation:



Correct Answer:

We balance chemical equations to ensure that the law of conservation of mass is satisfied. According to this law, matter cannot be created or destroyed in a chemical reaction. Therefore, the number of atoms of each element must be the same on both sides of the equation.

Balanced equation:



This balanced equation shows that 3 atoms of zinc react with 2 molecules of phosphoric acid to produce zinc phosphate and hydrogen gas.

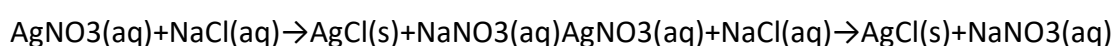
Question 32:

(b) Define a precipitation reaction. Give its example and also express the reaction that occurs in the form of a balanced chemical equation.

Correct Answer: A precipitation reaction occurs when two soluble salts in aqueous solution react to form an insoluble solid, called a precipitate.

Example:

When silver nitrate reacts with sodium chloride, a white precipitate of silver chloride is formed:



In this reaction, silver chloride (AgCl) is the precipitate.

Question 33:

State two limitations of electrical impulses in multicellular organisms. Why is chemical communication better than electrical impulses as a means of communication between cells in multicellular organisms?

Correct Answer:

Limitations of electrical impulses:

Electrical impulses can only travel along nerve fibers and do not cover large distances within the organism.

The speed of electrical impulses is slower than that of chemical signals in some cases, limiting their use for rapid communication over long distances.

Why chemical communication is better:

Chemical signals, such as hormones, can travel through the bloodstream and reach various parts of the body, providing a broader and more coordinated form of communication.

Chemical communication is slower but can last longer and be more sustained compared to electrical impulses, which are often short-lived.

Question 34. (A) (i):

What are structural isomers? Draw structural isomers of butane (C₄H₁₀). Give reason why propane has no structural isomers.

Correct Answer:

Structural Isomers: Structural isomers are compounds that have the same molecular formula but different structural arrangements of atoms. This means that the connectivity or bonding of atoms is different in each isomer.

Structural Isomers of Butane: The two structural isomers of butane (C₄H₁₀) are:

n-Butane: A straight chain of 4 carbon atoms.

Isobutane (Methylpropane): A branched structure with 3 carbon atoms in a chain and one methyl group (-CH₃) attached to the second carbon.

Why Propane Has No Structural Isomers: Propane (C₃H₈) has no structural isomers because there is only one way to arrange 3 carbon atoms and 8 hydrogen atoms. Any rearrangement would result in the same compound.

Question 34. (A) (ii):

What happens when butane is burnt in air? Write the chemical equation for the reaction. Differentiate between the flames obtained when butane and butyne both are burnt in air in similar conditions.

Correct Answer:

Reaction of Butane Burning in Air:

When butane (C₄H₁₀) is burned in air, it reacts with oxygen to form carbon dioxide and water:
 $2C_4H_{10} + 13O_2 \rightarrow 8CO_2 + 10H_2O$

This is a complete combustion reaction.

Difference Between the Flames of Butane and Butyne:

Butane (C₄H₁₀): When butane burns in air, it produces a clean, blue flame due to complete combustion, resulting in carbon dioxide and water.

Butyne (C₄H₆): When butyne burns, the flame is generally yellowish and smoky due to incomplete combustion, producing carbon monoxide and carbon dioxide along with water.

Question 34 (b)(i):

Give reason why carbon can neither form C⁴⁺ cations nor C⁴⁻ anions but forms covalent compounds.

Correct Answer:

Reason: Carbon cannot form C⁴⁺ or C⁴⁻ ions because it has a relatively high ionization energy (for C⁴⁺) and a relatively low electron affinity (for C⁴⁻). As a result, it is energetically unfavorable for carbon to lose 4 electrons or gain 4 electrons. Instead, carbon forms covalent bonds by sharing electrons with other elements to achieve a stable electron configuration, typically forming compounds like methane (CH₄).

Question 34 (b)(ii):

What is meant by functional group in carbon compounds? Write in tabular form the structural formula and the functional group present in the following compounds:

(a) Ethanol

(b) Ethanoic acid

Correct Answer:

Functional Group: A functional group in carbon compounds is a group of atoms that is responsible for the characteristic reactions of the compound. It defines the reactivity and properties of the compound.

Table of Structural Formula and Functional Groups:

Compound	Structural Formula	Functional Group
Ethanol	CH ₃ CH ₂ OH	Hydroxyl group (-OH)
Ethanoic acid	CH ₃ COOH	Carboxyl group (-COOH)

Question 35 (a)(i):

Draw the pattern of the magnetic field lines for the two parallel straight conductors carrying current of same magnitude 'I' in opposite directions as shown. Show the direction of

magnetic field at a point O which is equidistant from the two conductors. (Consider that the conductors are inserted normal to the plane of a rectangular cardboard.)

Correct Answer:

When two conductors carry currents in opposite directions, the magnetic field produced by each conductor at any point in space will be in opposite directions. For conductors with current flowing in opposite directions, the field lines will be arranged such that:

For the first conductor (current flowing in one direction), the magnetic field lines will circle the conductor in a clockwise direction (if viewed from above).

For the second conductor (current flowing in the opposite direction), the magnetic field lines will circle the conductor in a counterclockwise direction.

At a point OO, which is equidistant from both conductors, the magnetic field contributions from both conductors will cancel out if the currents are of equal magnitude and flow in opposite directions.

The field lines will form circular loops around each conductor, with opposite directions of field due to opposite current directions.

Question 35 (a)(ii):

In our houses we receive A.C. electric power of 220 V. In electric iron or electric heater cables having three wires with insulation of three different colours – red, black and green are used to draw current from the mains.

What are these three different wires called? Name them colourwise.

What is the potential difference between the red wire and the black wire?

What is the role of the wire with green insulation in case of accidental leakage of electric current to the metallic body of an electrical appliance?

Correct Answer:

(i) The three wires in an electric circuit with different colour insulation are:

Red wire: Live wire (or Phase wire) – carries current from the power source.

Black wire: Neutral wire – completes the circuit by providing a return path for the current.

Green wire: Earth wire – provides a safety path for current to flow to the ground in case of a fault or leakage.

(ii) The potential difference between the red (live) wire and the black (neutral) wire is typically 220V/220V in standard domestic power systems.

(iii) The green wire (earth wire) provides a path for the electric current to safely flow into

the ground if there is a leakage of current to the metallic body of an electrical appliance. This prevents electric shock by diverting the current away from the user.

Question 35. (B) (i):

By using the given experimental set-up, how can it be shown that:

A force is exerted on the current-carrying conductor AB when it is placed in a magnetic field.

The direction of the force can be reversed in two ways.

Correct Answer:

(a) A force on the current-carrying conductor:

The force on the conductor AB is shown experimentally using a simple setup, as shown in the figure. The magnetic field is applied by a magnet (N and S poles), and a current is passed through the conductor AB. When the current-carrying conductor is placed in a magnetic field, a force is exerted on the conductor due to the interaction between the current in the conductor and the magnetic field.

This force is given by:

$$F = BIL \sin \theta$$

where:

F is the force on the conductor,

B is the magnetic field strength,

I is the current in the conductor,

L is the length of the conductor in the magnetic field,

θ is the angle between the magnetic field and the current direction.

(b) Reversing the direction of force:

The direction of the force on the conductor can be reversed by either:

1. Reversing the direction of the current in the conductor AB.
2. Reversing the direction of the magnetic field (by reversing the poles of the magnet).

Question 35. (B) (ii):

When will the magnitude of the force be highest?

Correct Answer:

The magnitude of the force is highest when the angle θ between the direction of the current and the magnetic field is 90° , as the sine of 90° is 1. Therefore, the force is maximum when the conductor is placed perpendicular to the magnetic field.

Thus, the magnitude of the force is maximum when:

$F_{\max} = BIL$
 $F_{\max} = BIL$
Quick Tip: The force is maximum when the angle between the magnetic field and current is 90° , and it is zero when they are parallel.

Question 35. (B) (iii):

State Fleming's left-hand rule.

Correct Answer: [View Solution](#)

Fleming's left-hand rule states that if you stretch the thumb, the index finger, and the middle finger of your left hand at right angles to each other, then:

The thumb gives the direction of the force (motion of the conductor),

The index finger gives the direction of the magnetic field,

The middle finger gives the direction of the current in the conductor.

This rule helps to determine the direction of the force acting on a current-carrying conductor in a magnetic field.

Question 36(a)(i):

What is regeneration? Give one example of an organism that shows this process and one organism that does not. Why does regeneration not occur in the latter?

Correct Answer:

Regeneration:

Regeneration is the biological process by which an organism is able to regrow certain parts of its body that have been lost or damaged. It is an example of asexual reproduction in certain organisms where new cells grow and differentiate to replace the lost body parts.

Example of an organism showing regeneration:

The starfish is a good example of an organism that shows regeneration. If a starfish loses an arm, it can regenerate a new one from the remaining part of the body.

Example of an organism not showing regeneration:

Humans do not show regeneration. Once a part of the body, like a limb, is lost, it cannot grow back.

Why regeneration does not occur in humans:

Humans have a more complex body structure, and their cells are more specialized. Regeneration, which requires the ability to produce undifferentiated cells, is limited in humans due to the complexity of their cell differentiation and repair mechanisms.

Question 36(a)(ii):

Water in a pond appears dark green and contains filamentous structures. Name these structures and the method by which they reproduce. Explain the process.

Correct Answer:

Filamentous Structures:

The filamentous structures present in the water are green algae (e.g., Spirogyra).

Reproduction:

These green algae reproduce by fragmentation, which is a form of asexual reproduction. The filaments break into smaller pieces (fragments), and each fragment can grow into a new organism, thus increasing the population.

Explanation of the process:

Fragmentation is a type of vegetative reproduction where each broken part of the organism can regenerate into a whole new individual. It helps in the rapid multiplication of algae in favorable conditions.

Question 36(b)(i):

Name the part performing the following functions in the human male reproductive system:

- (a) Carries sperm
- (b) Production of male gametes
- (c) Whose secretion makes the transport of sperm easier
- (d) Provides suitable temperature for sperm formation

Correct Answer:

(a) Carries sperm:

The vas deferens is the part that carries sperm from the testes to the urethra.

(b) Production of male gametes:

The testes are responsible for producing male gametes (sperm).

(c) Whose secretion makes the transport of sperm easier:

The seminal vesicles secrete a fluid that aids in the transport of sperm and provides nutrients.

(d) Provides suitable temperature for sperm formation:

The scrotum helps regulate the temperature required for sperm production by keeping the testes cooler than the body temperature.

Question 36(b)(ii):

Write any two characteristics of sperm.

Correct Answer:

Characteristics of sperm:

Sperm are microscopic, single-celled male gametes.

They consist of a head containing the nucleus, a midpiece with mitochondria for energy, and a tail (flagellum) for motility.

Question 36(b)(iii):

What are surgical contraceptive methods? Give the side effect caused by this procedure.

Correct Answer:

Surgical contraceptive methods:

Surgical contraceptive methods include vasectomy for males and tubectomy for females.

Vasectomy involves cutting or sealing the vas deferens, and tubectomy involves cutting or blocking the fallopian tubes.

Side effects:

Some possible side effects include:

Post-surgical complications like pain, swelling, and infection.

In rare cases, there can be psychological effects due to the permanence of the procedure.

For women, tubectomy can sometimes cause hormonal imbalance or menstrual irregularities.

Question 37:

The students in a class took a thick sheet of cardboard and made a small hole in its centre. Sunlight was allowed to fall on this small hole and they obtained a narrow beam of white light. A glass prism was taken and this white light was allowed to fall on one of its faces. The prism was turned slowly until the light that comes out of the opposite face of the prism appeared on the nearby screen. They studied this beautiful band of light and concluded that it is a spectrum of white light.

(i) Give any one more instance in which this type of spectrum is observed.

Correct Answer:

Another instance in which a spectrum similar to the one observed with a glass prism is seen is when white light passes through water droplets in the atmosphere during a rainstorm, forming a rainbow. This process is called dispersion, where the different colors of light are separated due to their different wavelengths.

Question 37(ii):

What happens to white light in the above case?

Correct Answer:

In the above case, when white light enters the glass prism, it undergoes refraction. The different colors (wavelengths) of light travel at different speeds in the prism, causing them to spread out or disperse. This results in the formation of a spectrum of white light, displaying the colors of the visible spectrum: red, orange, yellow, green, blue, indigo, and violet. Quick Tip: The dispersion of light occurs when different colors bend at different angles due to varying wavelengths as they pass through a medium.

Question 37(iii)(a):

List two conditions necessary to observe a rainbow.

Correct Answer:

There must be water droplets or another transparent medium to refract and disperse the light. The observer must be positioned at the correct angle (typically around 42°) relative to the direction of sunlight and the water droplets.

Question 37(iii)(b):

Draw a ray diagram to show the formation of a rainbow. Mark on it, points (a), (b) and (c) as given below:

- (a) Where dispersion of light occurs.
- (b) Where light gets reflected internally.
- (c) Where final refraction occurs.

Correct Answer:

The formation of a rainbow occurs when sunlight is refracted and dispersed through water droplets in the atmosphere. The diagram of rainbow formation consists of the following steps:

Dispersion of light (Point a): As the sunlight enters the water droplet, it bends or refracts due to the change in medium. Since different colors of light have different wavelengths, they refract by different amounts, resulting in dispersion (splitting of white light into its constituent colors).

Internal reflection (Point b): After dispersion, the light travels through the water droplet and strikes the inner surface of the droplet. The light gets reflected internally at the back of the droplet, which is the cause of the rainbow's curved appearance.

Refraction again (Point c): After internal reflection, the light exits the droplet. As it exits, the light refracts again, further separating the colors and creating the visible spectrum of light (the rainbow).

The final rainbow seen by the observer is a result of multiple droplets refracting, reflecting, and refracting again, each displaying different colors at different angles.

Question 38:

Common salt is a very important chemical compound for our daily life. Its chemical name is sodium chloride and it is used as a raw material in the manufacture of caustic soda, washing soda, baking soda etc. It is also used in the preservation of pickles, butter, meat etc.

- (i) Name the acid and the base from which common salt can be obtained.
- (ii) State the nature (acidic/basic/neutral) of sodium chloride. Give reason for the justification for your answer.
- (iii) (A) What happens when electric current is passed through an aqueous solution of sodium chloride (called brine)? Name the products obtained along with the corresponding places in the electrolytic cell where each of these products is obtained.

Correct Answer:

- (i) The acid and the base from which common salt (sodium chloride) is obtained are:

Acid: Hydrochloric acid (HCl)

Base: Sodium hydroxide (NaOH)

The reaction between hydrochloric acid and sodium hydroxide gives sodium chloride (NaCl) and water as products:
$$\text{HCl} + \text{NaOH} \rightarrow \text{NaCl} + \text{H}_2\text{O}$$

- (ii) Sodium chloride (NaCl) is a neutral salt. This is because it is formed by the neutralization reaction between a strong acid (HCl) and a strong base (NaOH). Since both acid and base completely neutralize each other, the resultant salt is neutral in nature.

- (iii) (A) When electric current is passed through an aqueous solution of sodium chloride (brine), the process is called electrolysis of brine. The products obtained are:

At the cathode, hydrogen gas (H_2) is produced.

At the anode, chlorine gas (Cl_2) is produced.

The reactions at each electrode

are: At cathode: $2\text{H}_2\text{O} + 2\text{e}^- \rightarrow \text{H}_2 + 2\text{OH}^-$ At anode: $2\text{Cl}^- \rightarrow \text{Cl}_2 + 2\text{e}^-$

Question 38(b):

How is washing soda obtained from sodium chloride? Give the chemical equations of the reactions involved in the process.

Correct Answer:

Washing soda ($\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$) is obtained from sodium chloride (NaCl) through the Solvay process. The process involves the following steps:

Formation of Sodium Bicarbonate:

In the Solvay process, sodium chloride (NaCl) reacts with ammonia (NH_3) and carbon dioxide (CO_2) in water to form sodium bicarbonate (NaHCO_3), which precipitates out.



Conversion of Sodium Bicarbonate to Sodium Carbonate:

Sodium bicarbonate is heated to form sodium carbonate (Na_2CO_3).



Formation of Washing Soda:

Sodium carbonate (Na_2CO_3) is dissolved in water and recrystallized to obtain washing soda ($\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$).



The final product, washing soda, is used in cleaning and water softening.

Question 39(i):

In life, there are certain changes in the environment called 'stimuli' to which we respond appropriately. Touching a flame suddenly is a dangerous situation for us. One way is to think consciously about the possibility of burning and then moving the hand. But our body has been designed in such a way that we save ourselves from such situations immediately.

Name the action by which we protect ourselves in the situation mentioned above and define it.

Correct Answer:

The action by which we protect ourselves is called reflex action. Reflex action is an automatic and involuntary response to a stimulus. In the case of touching a hot object, the sensory neurons detect the heat and send signals to the spinal cord, which quickly sends a signal to the muscles to withdraw the hand, all without the need for conscious thought.

Question 39(ii):

Write the role of (a) motor and (b) relay neuron.

Correct Answer:

(a) Motor Neuron: The role of the motor neuron is to carry impulses from the central nervous system (CNS) to the muscles or glands, which then execute the appropriate response.

(b) Relay Neuron: Relay neurons, also known as interneurons, transmit impulses between sensory neurons and motor neurons in the central nervous system, facilitating communication within the body.

Question 39(iii)(a):

What are the two types of nervous system in the human body? Name the components of each of them.

Correct Answer:

The two types of nervous systems in the human body are:

1. Central Nervous System (CNS): Composed of the brain and spinal cord, the CNS processes and integrates information from the body and sends signals to the rest of the body.
2. Peripheral Nervous System (PNS): Composed of all the nerves that branch off the spinal cord and brain, the PNS connects the CNS to limbs and organs.

Question 39. (iii) (B):

Which part of the human brain is responsible for:

- (a) thinking
- (b) picking up a pencil
- (c) controlling blood pressure
- (d) controlling hunger

Correct Answer:

[(a)] Thinking: The cerebrum is responsible for thinking, reasoning, and decision-making.

[(b)] Picking up a pencil: The motor cortex, located in the cerebrum, controls voluntary movements like picking up a pencil.

[(c)] Controlling blood pressure: The medulla oblongata controls autonomic functions like blood pressure.

[(d)] Controlling hunger: The hypothalamus is responsible for controlling hunger and other homeostatic functions.