UP Board Class 10 Science - 824 (CP) - 2025 Question Paper with Solutions

Time Allowed :3 Hours	**Maximum Marks :**70	**Total questions :**35

General Instructions

Instruction:

i) *All* questions are compulsory. Marks allotted to each question are given in the margin.

ii) In numerical questions, give all the steps of calculation.

iii) Give relevant answers to the questions.

iv) Give chemical equations, wherever necessary.

Q1. The focal length of a spherical mirror is 10 cm. Then its radius of curvature will be:

(A) 5 cm

(B) 10 cm

(C) 20 cm

(D) 40 cm

Correct Answer: (C) 20 cm

Solution:

Step 1: Formula for focal length and radius of curvature.

The relationship between the focal length (f) and the radius of curvature (R) of a spherical mirror is given by:

$$f = \frac{R}{2}$$

This means that the radius of curvature is twice the focal length.

Step 2: Substituting the given values.

We are given that the focal length (f) is 10 cm. Using the formula, we calculate the radius of curvature as:

$$R = 2 \times f = 2 \times 10 = 20\,\text{cm}$$

Step 3: Conclusion.

Thus, the radius of curvature of the mirror is 20 cm.

Final Answer:

$$\boxed{\text{The correct answer is (C) 20 cm.}}$$

Quick Tip

For spherical mirrors, the radius of curvature is always twice the focal length.

Q2. Which of the following colours of white light is least deviated by a prism?

(A) Green

(B) Violet

(C) Indigo

(D) Yellow

Correct Answer: (A) Green

Solution:

Step 1: Understanding dispersion of light.

When white light passes through a prism, the different colors are refracted by different amounts. The extent of deviation depends on the wavelength of light. Violet light, being of shorter wavelength, is refracted the most, while red light, with the longest wavelength, is refracted the least.

Step 2: Green light behavior.

Green light lies between red and violet in terms of wavelength, and it is refracted the least among the visible spectrum when passing through a prism.

Step 3: Conclusion.

Therefore, the least deviated color of white light by a prism is green.

Final Answer:

The correct answer is (A) Green.

Quick Tip

Green light experiences the least deviation through a prism compared to other visible colors.

Q3. An object is placed between f and $2f$ of a convex lens. Which of the following statements is correct for the image?

(A) Real, larger than the object

(B) Erect, smaller than the object

(C) Inverted, same size as object

(D) Virtual, larger than the object

Correct Answer: (A) Real, larger than the object

Solution:

Step 1: Object placement between f and $2f$.

When an object is placed between the focal point f and twice the focal length $2f$ of a convex lens, the image formed is real, inverted, and larger than the object.

Step 2: Application of lens formula.

According to the lens formula:

$$\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$$

where v is the image distance and u is the object distance. The image formed is real and magnified when the object is between f and $2f$.

Step 3: Conclusion.

Thus, the correct answer is that the image is real and larger than the object.

Final Answer:

The correct answer is (A) Real, larger than the object.

Quick Tip

When the object is placed between f and $2f$ of a convex lens, the image formed is real, inverted, and magnified.

Q4. The amount of light entering the eye is controlled by:

(A) Ciliary muscle

(B) Eye lens

(C) Iris

(D) Cornea

Correct Answer: (C) Iris

Solution:

Step 1: Function of the iris.

The iris is the colored part of the eye and it controls the amount of light entering the eye by adjusting the size of the pupil. The pupil dilates or contracts based on the amount of light available.

Step 2: Other parts of the eye.

The ciliary muscles control the shape of the lens, the eye lens focuses light onto the retina, and the cornea helps in the refraction of light but does not control the amount of light entering.

Step 3: Conclusion.

Therefore, the iris is responsible for regulating the amount of light that enters the eye.

Final Answer:

The correct answer is (C) Iris.

Quick Tip

The iris controls the amount of light entering the eye by adjusting the size of the pupil.

Q5. A 4 ohm resistance is connected across the terminals of 16 volt battery. The charge passing per second through the resistance is:

(A) 0.25 coulomb

(B) 0.4 coulomb

(C) 4 coulomb

(D) 64 coulomb

Correct Answer: (B) 0.4 coulomb

Solution:

Step 1: Formula used: We can use the formula for current $I = \frac{V}{R}$, where V is the potential difference (16 V) and R is the resistance (4 ohms). The charge passing per second, or the amount of charge, $Q = I \times t$, where t is 1 second.

Step 2: Calculation of current The current is given by:

$$I = \frac{V}{R} = \frac{16}{4} = 4\,\text{A}$$

Step 3: Finding the charge passing per second Since $I = \frac{Q}{t}$ and $t = 1\,\text{s}$,

$$Q = I \times t = 4 \times 0.1 = 0.4\,\text{coulomb}$$

Final Answer:

The correct answer is (B) 0.4 coulomb.

Quick Tip

The charge passing per second through the resistance can be found by calculating the current first and then using the formula for charge.

Q6. The resistance of a wire is $R = 9\,\Omega$. It is cut into three equal parts. These pieces of wire are then connected in parallel. If the equivalent resistance of the combination be R', then their ratio $\frac{R}{R'}$ is:

(A) $\frac{1}{9}$

(B) $\frac{1}{3}$

(C) 3

(D) 9

Correct Answer: (B) $\frac{1}{3}$

Solution:

Step 1: Understanding the problem. The original resistance R is 9 ohms, and it is cut into three equal parts. Each piece will have a resistance of:

$$R_{\text{new}} = \frac{R}{3} = \frac{9}{3} = 3\,\Omega$$

Step 2: Parallel connection of three resistors. When resistors are connected in parallel, the equivalent resistance R' is given by:

$$\frac{1}{R'} = \frac{1}{R_{\text{new}}} + \frac{1}{R_{\text{new}}} + \frac{1}{R_{\text{new}}}$$

Substituting the value of $R_{\text{new}} = 3\,\Omega$, we get:

$$\frac{1}{R'} = \frac{1}{3} + \frac{1}{3} + \frac{1}{3} = 1$$

So,

$$R' = 1\,\Omega$$

Step 3: Finding the ratio $\frac{R}{R'}$. Now,

$$\frac{R}{R'} = \frac{9}{1} = 9$$

Final Answer:

$$\boxed{\text{The correct answer is (B) } \frac{1}{3}.}$$

Quick Tip

When resistors are cut into equal parts and connected in parallel, the equivalent resistance decreases and the ratio $\frac{R}{R'}$ can be calculated by using the formula for parallel resistance.

Q7. The magnetic lines of force in the middle of a current-carrying solenoid are:

(A) circular

(B) irregular

(C) parallel to the axis of the solenoid

(D) perpendicular to the axis of the solenoid

Correct Answer: (C) parallel to the axis of the solenoid

Solution:

Step 1: Understanding magnetic lines of force in a solenoid. Inside a current-carrying solenoid, the magnetic lines of force are uniform and parallel to the axis of the solenoid. This is due to the nature of the magnetic field produced by the current flowing through the solenoid.

Step 2: Conclusion. Thus, the magnetic lines of force in the middle of a current-carrying solenoid are parallel to its axis.

Final Answer:

The correct answer is (C) parallel to the axis of the solenoid.

Quick Tip

The magnetic field inside a current-carrying solenoid is uniform and parallel to the axis of the solenoid. This makes it useful for generating a uniform magnetic field.

Q8. The pH value of water in acid rain is:

(A) more than 5.6

(B) less than 5.6

(C) 7.0

(D) none of these

Correct Answer: (B) less than 5.6

Solution:

Step 1: Understanding acid rain.

Acid rain occurs when the pH of rainwater falls below the neutral value of 7, which indicates that the water is acidic. The pH of acid rain is usually below 5.6, due to the presence of sulfuric and nitric acids formed by the reaction of pollutants with water vapor in the atmosphere.

Step 2: Conclusion.

Thus, the pH value of water in acid rain is typically less than 5.6.

Final Answer:

The correct answer is (B) less than 5.6.

Quick Tip

Acid rain has a pH less than 5.6, which is due to the presence of sulfuric and nitric acids formed by pollutants in the air.

Q9. In the reaction, $Zn(s) + CuO(s) \rightarrow Cu(s) + ZnO(s)$, which of the following is correct?

(A) Zinc is reduced

(B) CuO is reduced

(C) Copper is reduced

(D) ZnO is reduced

Correct Answer: (A) Zinc is reduced

Solution:

Step 1: Identifying reduction in the reaction.

In a redox reaction, reduction refers to the gain of electrons. In this case, Zn is going from an oxidation state of 0 to +2, which means it is losing electrons and being oxidized. Conversely, CuO is reduced because Cu^{2+} (in CuO) is reduced to metallic copper (Cu).

Step 2: Conclusion.

Thus, in this reaction, zinc is being oxidized, and copper oxide is being reduced.

Final Answer:

The correct answer is (A) Zinc is reduced.

Quick Tip

Reduction occurs when a substance gains electrons. In this reaction, copper oxide (CuO) is reduced to copper (Cu).

Q10. Valency of carbon atom is:

(A) 2

(B) 4

(C) 3

(D) 6

Correct Answer: (B) 4

Solution:

Step 1: Definition of valency.

Valency is the ability of an atom to combine with other atoms. For carbon (C), its valency is 4, as it can form four covalent bonds, which corresponds to its 4 available electrons in its outer shell.

Step 2: Conclusion.

The valency of carbon is 4 because it needs 4 electrons to fill its outer shell.

Final Answer:

The correct answer is (B) 4.

Quick Tip

Carbon has 4 valence electrons, which gives it a valency of 4. It can form four covalent bonds to satisfy the octet rule.

Q11. Washing soda is:

(A) Acidic salt

(B) Basic salt

(C) Neutral salt

(D) Not salt

Correct Answer: (B) Basic salt

Solution:

Step 1: Definition of Washing Soda.

Washing soda is a basic salt known as sodium carbonate (Na_2CO_3), which is obtained by heating sodium bicarbonate. It reacts with acids to produce carbon dioxide gas and water, indicating its basic nature.

Step 2: Conclusion.

Thus, washing soda is a basic salt.

Final Answer:

The correct answer is (B) Basic salt.

Quick Tip

Washing soda is sodium carbonate, a basic salt that reacts with acids to form carbon dioxide gas.

Q12. Reaction of sodium metal with ethanol produces:

(A) $O_2(g)$

(B) $H_2(g)$

(C) $N_2(g)$

(D) $CO_2(g)$

Correct Answer: (B) $H_2(g)$

Solution:

Step 1: Reaction Description.

When sodium metal reacts with ethanol, it forms sodium ethoxide (C_2H_5ONa) and hydrogen gas (H_2). This reaction occurs due to the metal's reactivity with alcohols.

Step 2: Conclusion.

Thus, the reaction produces hydrogen gas (H_2).

Final Answer:

The correct answer is (B) $H_2(g)$.

Quick Tip

Sodium reacts with ethanol to form sodium ethoxide and hydrogen gas.

Q13. Reaction, $HCl(aq) + NaOH(aq) \rightarrow NaCl(aq) + H_2O(l)$, is:

(A) Decomposition reaction

(B) Oxidation-reduction reaction

(C) Elimination reaction

(D) Neutralisation reaction

Correct Answer: (D) Neutralisation reaction

Solution:

Step 1: Definition of Neutralisation.

A neutralisation reaction occurs when an acid reacts with a base to form a salt and water. In this case, hydrochloric acid (HCl) reacts with sodium hydroxide ($NaOH$) to form sodium chloride ($NaCl$) and water (H_2O).

Step 2: Conclusion.

Thus, the reaction is a neutralisation reaction.

Final Answer:

The correct answer is (D) Neutralisation reaction.

Quick Tip

Neutralisation reactions occur between an acid and a base to form a salt and water.

Q14. Which of the following is a heterotrophic organism?

(A) Fungus

(B) Green grass

(C) Mango tree

(D) Banana tree

Correct Answer: (A) Fungus

Solution:

Step 1: Understanding Heterotrophs.

Heterotrophs are organisms that cannot synthesize their own food and depend on other organisms for nutrition. Fungus is an example of a heterotrophic organism, as it feeds on decaying organic matter.

Step 2: Conclusion.

Thus, the correct answer is (A) Fungus.

Final Answer:

The correct answer is (A) Fungus.

Quick Tip

Heterotrophic organisms like fungi rely on other organisms for food, unlike autotrophs like plants that can make their own food.

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Q15. Which of the following is an example of an artificial ecosystem?

(A) Forest

(B) River

(C) Garden

(D) Desert

Correct Answer: (C) Garden

Solution:

Step 1: Definition of Artificial Ecosystem.

An artificial ecosystem is one that is created or influenced by human intervention, such as gardens, parks, or farms.

Step 2: Conclusion.

Thus, a garden is an example of an artificial ecosystem because it is managed and maintained by humans.

Final Answer:

The correct answer is (C) Garden.

Quick Tip

Artificial ecosystems are those that humans have designed or modified, like gardens and farms.

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Q16. Pulmonary cells are found in:

(A) Stomata

(B) Liver

(C) Kidney

(D) Lung

Correct Answer: (D) Lung

Solution:

Step 1: Understanding Pulmonary Cells.

Pulmonary cells are the cells found in the lungs that are responsible for the exchange of gases (oxygen and carbon dioxide) in the body.

Step 2: Conclusion.

Thus, pulmonary cells are found in the lungs, making the correct answer (D).

Final Answer:

The correct answer is (D) Lung.

Quick Tip

Pulmonary cells are specialized cells in the lungs, involved in breathing and gas exchange.

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Q17. Chlorofluorocarbons (CFCs) deplete which gas?

(A) Oxygen

(B) Ozone

(C) Nitrogen

(D) Carbon dioxide

Correct Answer: (B) Ozone

Solution:

Step 1: Understanding CFCs.

Chlorofluorocarbons (CFCs) are man-made compounds that damage the ozone layer. The ozone layer is important for protecting Earth from harmful ultraviolet radiation.

Step 2: Conclusion.

CFCs are responsible for depleting ozone in the atmosphere, so the correct answer is (B) Ozone.

Final Answer:

The correct answer is (B) Ozone.

Quick Tip

CFCs are harmful chemicals that break down the ozone layer, leading to increased exposure to UV rays.

Q18. Which of the following is correctly matched?

(A) Planaria - Vegetative propagation

(B) Spirogyra - Fragmentation

(C) Sugarcane - Fission

(D) Amoeba - Regeneration

Correct Answer: (D) Amoeba - Regeneration

Solution:

Step 1: Understanding the biological processes.

Amoeba reproduces by regeneration. In the case of planaria, it regenerates, but it is not vegetative propagation. Spirogyra undergoes fragmentation, and sugarcane propagates through cuttings, not fission.

Step 2: Conclusion.

The correct answer is (D) Amoeba - Regeneration.

Final Answer:

The correct answer is (D) Amoeba - Regeneration.

Quick Tip

Regeneration is a process where an organism can regrow lost parts or form new organisms from parts of its body, like in Amoeba.

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Q19. Event(s) occurring during the photosynthesis process is/are:

(A) Absorption of light energy by chlorophyll

(B) The light energy is converted into chemical energy and the water molecules split into hydrogen and oxygen

(C) Carbon dioxide is reduced to carbohydrates

(D) All of these

Correct Answer: (D) All of these

Solution:

Step 1: Understanding the photosynthesis process.

Photosynthesis is a process by which plants convert light energy into chemical energy. In this process: - Light energy is absorbed by chlorophyll (option A). - Water molecules split into hydrogen and oxygen (option B). - Carbon dioxide is reduced to carbohydrates, producing glucose (option C).

Step 2: Conclusion.

All of the above steps are involved in the process of photosynthesis.

Final Answer:

The correct answer is (D) All of these.

Quick Tip

Quick Tip

Photosynthesis involves light absorption, water splitting, and carbon dioxide reduction to form glucose, providing energy for the plant.

Q20. The function of insulin hormone is:

(A) To control the level of fat in blood

(B) To control the level of protein in blood

(C) To control the level of sugar in blood

(D) To control the level of salt in blood

Correct Answer: (C) To control the level of sugar in blood

Solution:

Step 1: Understanding insulin function.

Insulin is a hormone secreted by the pancreas. Its primary function is to regulate glucose (sugar) levels in the blood. It facilitates the uptake of glucose into cells for energy production and storage as glycogen, helping to maintain a balanced blood sugar level.

Step 2: Conclusion.

Therefore, the function of insulin is to control the level of sugar in the blood, making option (C) the correct answer.

Final Answer:

The correct answer is (C) To control the level of sugar in blood.

Quick Tip

Insulin plays a key role in regulating blood sugar, preventing both hyperglycemia (high sugar levels) and hypoglycemia (low sugar levels).

Part B

Q1. (i) Which type of mirror is usually used as a rear-view mirror in motor cars? State its reason also.

Solution:

Step 1: Identifying the type of mirror.

A convex mirror is commonly used as a rear-view mirror in motor cars. This is because convex mirrors diverge light rays, which causes the image formed to be smaller than the object. This allows the driver to see a larger area behind them in the rear-view mirror.

Step 2: Reason for using convex mirror.

Convex mirrors are preferred for rear-view mirrors because they provide a wider field of view. Even though the image formed is diminished, it allows the driver to see a broader area, improving safety. The small size of the image helps to reduce the blind spots when driving.

Step 3: Conclusion.

Thus, convex mirrors are used as rear-view mirrors in motor vehicles because they provide a larger field of view and ensure safety while driving.

Final Answer:

The correct answer is convex mirror.

Quick Tip

Convex mirrors always provide a wide field of view, which makes them ideal for use as rear-view mirrors in vehicles.

Q1. (ii) What do you mean by the accommodating power of an eye? What is the least distance of distinct vision for a healthy eye of a person?

Solution:

Step 1: Understanding accommodating power.

The accommodating power of the eye refers to the ability of the eye to change the shape of its lens to focus on objects at different distances. This is achieved by the ciliary muscles, which alter the curvature of the lens to either focus on nearby or distant objects.

Step 2: The least distance of distinct vision.

The least distance of distinct vision is the nearest point at which a person can see an object clearly. For a healthy human eye, this distance is typically 25 cm. This is referred to as the near point, and it is the closest distance at which the eye can focus without strain.

Step 3: Conclusion.

Thus, the least distance of distinct vision for a healthy eye is 25 cm, which is a standard value for normal human vision.

Final Answer:

$$\boxed{\text{The least distance of distinct vision is 25 cm.}}$$

Quick Tip

The near point of the eye increases with age, which can result in conditions like presbyopia, where the near point becomes farther than usual.

Q2. (i) Find the focal length of that lens whose power is -2.5 D. What type of lens is this?

Solution:

Step 1: Formula for Power and Focal Length.

The relation between power (P) and focal length (f) is given by the formula:

$$P = \frac{1}{f}$$

where P is the power in diopters (D) and f is the focal length in meters.

Step 2: Given Data.

From the question, the power of the lens is $P = -2.5\,\text{D}$. We need to calculate the focal length f.

Step 3: Calculate the Focal Length.

Using the formula:

$$f = \frac{1}{P} = \frac{1}{-2.5} = -0.4\,\text{m}$$

So, the focal length of the lens is $f = -0.4\,\text{m}$.

Step 4: Type of Lens.

A lens with a negative focal length is a concave lens. Hence, the lens in question is a concave lens.

Final Answer:

$$\boxed{\text{The focal length is } -0.4\,\text{m}, \text{ and the type of lens is concave.}}$$

Quick Tip

A concave lens always has a negative focal length, and the power of a concave lens is negative.

Q2. (ii) State two effects produced by scattering of light by the atmosphere.

Solution:

Step 1: Understanding Scattering of Light.

When light passes through the atmosphere, it interacts with molecules and small particles, causing it to scatter in all directions. This phenomenon is called scattering of light.

Step 2: Effects of Scattering.

The two major effects produced by scattering of light are:

Effect 1: Sky appears blue.

Due to Rayleigh scattering, shorter wavelengths (blue light) are scattered more than longer wavelengths (red light). This causes the sky to appear blue during the day.

Effect 2: Red Sun during sunset.

During sunset or sunrise, the light path through the atmosphere is longer, and most of the blue light is scattered away. The remaining light is predominantly red, making the sun appear red or orange.

Final Answer:

The two effects are: (1) The sky appears blue, (2) The sun appears red during sunset.

Quick Tip

Rayleigh scattering explains why the sky appears blue and the sun appears red at sunset. The scattering effect is more significant for shorter wavelengths like blue.

Q3. (i) Why are the coils of electric iron made of alloy instead of pure metal? Give two reasons.

Solution:

Step 1: Reason 1: High Resistance.

Alloys, such as nichrome, are preferred for making electric iron coils because they have higher resistance than pure metals. The high resistance helps the coils to heat up quickly and efficiently when an electric current flows through them.

Step 2: Reason 2: Durability and Corrosion Resistance.

Alloys are more durable and resistant to oxidation or corrosion compared to pure metals. Since electric iron coils are heated frequently, using alloys like nichrome ensures longer-lasting coils that can withstand high temperatures and environmental factors.

Final Answer:

The coils of electric iron are made of alloys instead of pure metals because alloys have higher resistance

Quick Tip

Alloys are used in electric iron coils because they provide the necessary resistance and last longer than pure metals under heat and stress.

Q3(ii). (ii) In the circuit diagram given below, four resistances of 20, 30, 40, and 15 respectively are connected to a battery of 10 volts. Calculate the potential difference across the ends of the 15 resistor.

Solution:

Step 1: Understanding the circuit.

We have four resistors connected in a combination. To calculate the potential difference across the 15 resistor, we first need to find the total resistance in the circuit.

Step 2: Calculation of Total Resistance.

The resistors 20, 30, and 40 are in series. The total resistance of resistors in series is simply the sum of their individual resistances:

$$R_{\text{total series}} = 20 + 30 + 40 = 90$$

Now, this combination of 90 is in parallel with the 15 resistor. The total resistance of two resistors in parallel is given by the formula:

$$\frac{1}{R_{\text{total parallel}}} = \frac{1}{R_1} + \frac{1}{R_2}$$

where $R_1 = 90$ and $R_2 = 15$. Substituting the values:

$$\frac{1}{R_{\text{total parallel}}} = \frac{1}{90} + \frac{1}{15}$$

$$\frac{1}{R_{\text{total parallel}}} = \frac{1}{90} + \frac{6}{90} = \frac{7}{90}$$

Thus,

$$R_{\text{total parallel}} = \frac{90}{7} 12.86$$

Step 3: Applying Ohm's Law.

Now, the total resistance of the circuit is $R_{\text{total}} = 12.86 + 10 = 22.86$. Using Ohm's law to find the total current, where the battery voltage is 10V:

$$I = \frac{V}{R_{\text{total}}} = \frac{10}{22.86} 0.438\,\text{A}$$

Step 4: Finding the Potential Difference.

Now, we can find the potential difference across the 15 resistor using Ohm's law again:

$$V = IR = 0.438 \times 156.57V$$

Final Answer:

The potential difference across the 15 resistor is approximately 6.57V.

Quick Tip

When resistors are in series, their resistances add up, while in parallel, the total resistance is less than the smallest individual resistor.

Q4.

(i) The current passing through a room heater is doubled. What will be the effect on the heat produced by it?

Solution:

Step 1: Understanding the Power Formula.

The heat produced by a room heater is related to the power consumed, which is given by the formula:

$$P = I^2R$$

where P is the power (heat produced), I is the current, and R is the resistance of the heater.

Step 2: Effect of Doubling the Current.

If the current is doubled, i.e., $I \to 2I$, the new power P' will be:

$$P' = (2I)^2R = 4I^2R$$

This shows that the heat produced will increase by a factor of 4 when the current is doubled.

Final Answer:

The heat produced will increase by a factor of 4 when the current is doubled.

Quick Tip

The heat produced by a current in a resistor is proportional to the square of the current. Doubling the current increases the heat produced by four times.

Q4(ii).

(ii) State two ways to increase the force acting on a current carrying conductor in a magnetic field.

Solution:

Step 1: Method 1 - Increase the Current.

The force F acting on a current-carrying conductor in a magnetic field is given by the formula:

$$F = BIL\sin\theta$$

where B is the magnetic field strength, I is the current, L is the length of the conductor in the magnetic field, and θ is the angle between the magnetic field and the current. To increase the force, one way is to increase the current I.

Step 2: Method 2 - Increase the Magnetic Field Strength.

Another way to increase the force is to increase the strength of the magnetic field B. This will directly increase the force according to the formula.

Final Answer:

The force can be increased by either increasing the current or by increasing the magnetic field strength.

Quick Tip

Force on a current-carrying conductor in a magnetic field can be increased by either increasing the current or the magnetic field strength.

Q4(iii).

(iii) Draw a sketch to show the magnetic lines of force with direction due to a current-carrying straight conductor.

Solution:

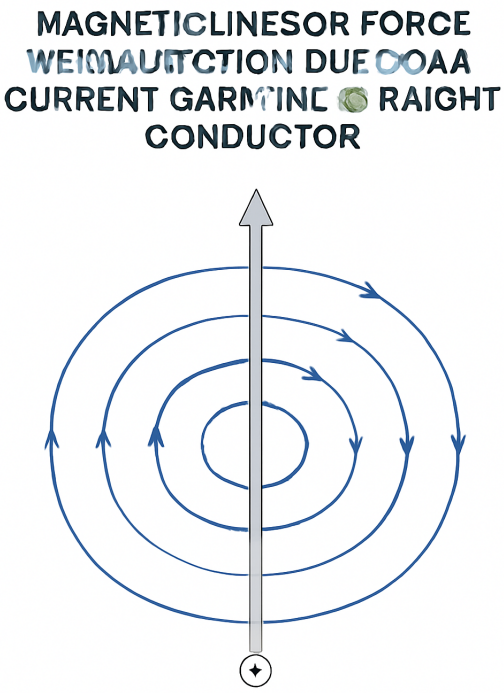
Step 1: Sketch Description.

The magnetic field around a straight current-carrying conductor forms concentric circles. The direction of the magnetic field lines is given by the right-hand thumb rule, which states: if the right hand is held with the thumb pointing in the direction of the current, the curled fingers show the direction of the magnetic field.

Step 2: Magnetic Field Lines.

The magnetic field lines are shown as concentric circles surrounding the conductor. The direction of the magnetic field lines is anticlockwise when viewed from above for a current flowing upward.

Diagram:



Final Answer: The diagram above shows the magnetic field lines around a straight current-carrying conductor.

Quick Tip

The right-hand rule helps in determining the direction of the magnetic field around a current-carrying conductor.

OR

Q4(i). Give two reasons why different electrical appliances in a domestic circuit are connected in parallel.

Solution:

Step 1: Reason 1 - Independent Control of Appliances.

In a parallel circuit, each appliance is connected across the same potential difference, which allows each appliance to operate independently. This means if one appliance stops working, others continue to function without interruption.

Step 2: Reason 2 - Equal Voltage Across Appliances.

In a parallel circuit, all appliances receive the same voltage, which is necessary for each appliance to work efficiently and according to its designed voltage requirement.

Final Answer:

The appliances are connected in parallel for independent control and equal voltage across each applianc

Quick Tip

In a parallel connection, appliances get the same voltage, and they can be controlled independently without affecting others.

Q4(ii). What is a current carrying solenoid? Give three measures by which the magnetic strength of a current carrying solenoid can be increased.

Solution:

Step 1: Definition of Current Carrying Solenoid.

A solenoid is a long coil of wire wound in the form of a cylinder. When a current flows through the wire, a magnetic field is produced around the solenoid. The solenoid generates a uniform magnetic field inside it, resembling the magnetic field of a bar magnet.

Step 2: Measures to Increase Magnetic Strength.

The magnetic strength (field strength) of a current carrying solenoid can be increased by the following measures: 1. **Increasing the Current.** The strength of the magnetic field is directly proportional to the current passing through the solenoid. More current means a stronger magnetic field.

2. **Increasing the Number of Turns.** The magnetic field strength is directly proportional to the number of turns in the solenoid. Adding more turns increases the magnetic field.

3. **Placing a Ferromagnetic Core Inside the Solenoid.** A ferromagnetic material like iron placed inside the solenoid increases the magnetic field strength because the material becomes magnetized and strengthens the magnetic field inside the solenoid.

Final Answer:

The magnetic strength of a current carrying solenoid can be increased by increasing the current, increas

Quick Tip

Increasing the current, the number of turns, and using a ferromagnetic core are key methods to strengthen the magnetic field inside a solenoid.

Q5(i). Write two properties of metals and non-metals.

Solution:

Properties of Metals: 1. **Good Conductors of Heat and Electricity.** Metals are excellent conductors of heat and electricity due to the free movement of electrons within the metallic structure.

2. **Malleability and Ductility.** Metals are malleable, meaning they can be hammered into thin sheets, and ductile, meaning they can be drawn into wires without breaking.

Properties of Non-Metals: 1. **Poor Conductors of Heat and Electricity.** Non-metals generally do not conduct heat or electricity well, except for graphite, which is a good conductor of electricity.
2. **Brittleness.** Non-metals are typically brittle in nature and break or shatter easily when struck, unlike metals which are malleable.

Final Answer:

Metals are good conductors and malleable, while non-metals are poor conductors and brittle.

Quick Tip

Metals are ductile and malleable, while non-metals are generally brittle and poor conductors of heat and electricity.

Q5(ii). Explain important points for obtaining impure metal from concentrated carbonate ore.

Solution:

Step 1: Concentration of Ore.

The first step is to concentrate the ore to remove the impurities such as sand, clay, and other unwanted minerals. This can be achieved by methods like froth flotation or magnetic separation.

Step 2: Conversion to Oxide.

The concentrated ore, which is usually a carbonate (such as calcium carbonate), is then heated in the presence of oxygen or a reducing agent to convert it into the metal oxide (e.g., zinc carbonate heated to form zinc oxide).

Step 3: Reduction of Oxide to Metal.

The metal oxide is then reduced to its pure or impure form using a reducing agent like carbon (coke) at high temperatures. For example, zinc oxide is reduced by carbon to give impure zinc metal.

Step 4: Impure Metal.

The metal obtained at this stage is often impure and contains other elements. Impure metals are then purified using methods like electrolysis or distillation, depending on the metal.

Final Answer:

To obtain impure metal from carbonate ore: concentrate the ore, convert it to oxide, reduce the oxide, a

Quick Tip

For carbonate ores, the metal is first extracted by heating to convert it into an oxide, followed by reduction to get impure metal.

Q6(i). Write a note on Homologous series.

Solution:

The **Homologous series** is a group of organic compounds that share a similar general formula and differ from each other by a CH_2 group (methylene group) in their molecular structure. These compounds have similar chemical properties, but their physical properties change gradually with an increase in molecular size (due to the increase in the number of carbon atoms). Examples of homologous series include alkanes (C_nH_{2n+2}), alkenes (C_nH_{2n}), alkynes (C_nH_{2n-2}), and carboxylic acids ($C_nH_{2n}O_2$).

Final Answer:

Homologous series is a group of organic compounds that differ by a CH_2 group and have similar chemi

Quick Tip

Homologous series contain compounds with similar chemical properties and a regular change in physical properties with increasing molecular size.

Q6(ii). Write I.U.P.A.C. name of the following organic compound:

$$CH_3 - CH_2 - C(=O) - CH_3$$

Solution:

The given organic compound is a **carboxylic acid** where the functional group is a carboxyl group (-COOH).

The I.U.P.A.C. name of this compound is **propanoic acid**.

Final Answer:

The I.U.P.A.C. name of the compound is Propanoic acid.

Quick Tip

For a compound with a carboxyl group (-COOH) and three carbon atoms, the I.U.P.A.C. name is propanoic acid.

Q6(iii). Define corrosion.

Solution:

Corrosion is the process of deterioration or destruction of metals, usually due to chemical reactions with the environment. The most common example is the rusting of iron, which occurs when iron reacts with oxygen and moisture to form iron oxide (rust). Corrosion can also occur in other metals like copper and aluminum, but the products and processes may vary. It is a natural electrochemical process, and the presence of electrolytes like water speeds up the corrosion process.

Final Answer:

Corrosion is the gradual destruction or deterioration of metals due to chemical reactions with their envi

Quick Tip

Corrosion often results from the interaction of metals with oxygen, moisture, and other environmental factors, causing long-term damage.

Q7(i). Write the chemical equation of any three chemical properties of ethyl alcohol.

Solution:

Ethyl alcohol (C_2H_5OH), also known as ethanol, reacts in several ways. Here are three chemical properties along with their equations:

1. **Reaction with Sodium (Na):** Ethanol reacts with sodium metal to form sodium ethoxide and hydrogen gas. The reaction is as follows:

$$2C_2H_5OH + 2Na \longrightarrow 2C_2H_5ONa + H_2 \uparrow$$

This reaction produces hydrogen gas and sodium ethoxide.

2. **Reaction with Oxygen (Combustion):** Ethanol burns in the presence of oxygen to form carbon dioxide and water. The combustion of ethanol is represented by the following equation:

$$C_2H_5OH + 3O_2 \longrightarrow 2CO_2 + 3H_2O$$

This is an exothermic reaction that releases energy in the form of heat and light.

3. **Reaction with Acidified Potassium Dichromate (Oxidation):** Ethanol can be oxidized in the presence of acidified potassium dichromate to form acetic acid. The oxidation reaction is as follows:

$$C_2H_5OH + [O] \longrightarrow CH_3COOH$$

In this reaction, ethanol is oxidized to acetic acid in the presence of an oxidizing agent (usually potassium dichromate).

Final Answer:

Three chemical properties of ethyl alcohol are:1. Reaction with Sodium: $2\ C_2H_5OH + 2Na \longrightarrow 2C_2H_5$

Quick Tip

Ethanol undergoes several important reactions such as oxidation, combustion, and reaction with sodium, which are vital in organic chemistry.

Q7(ii). Explain the versatile nature of carbon.

Solution:

The **versatile nature of carbon** refers to the ability of carbon atoms to form a wide variety of compounds. This versatility is attributed to the following properties:

1. **Tetravalency:** Carbon has four valence electrons, which allows it to form four covalent bonds with other atoms (including other carbon atoms), making it capable of forming long chains and complex structures. This is the basis for the diversity of organic compounds.
2. **Catenation:** Carbon atoms have the unique ability to bond with each other, forming chains (either straight or branched) and rings. This ability to form long chains or complex structures is known as catenation, which is the foundation of organic chemistry.
3. **Formation of Multiple Bonds:** Carbon can form double or triple bonds with other atoms, particularly with oxygen, nitrogen, and other carbon atoms. This allows for the formation of various functional groups, such as alkenes (C=C), alkynes (CC), and carbonyl groups (C=O), increasing the variety of compounds.
4. **Formation of Stable Compounds:** Carbon can form stable bonds with other elements, such as hydrogen, oxygen, nitrogen, and halogens. This stability contributes to the vast array of organic compounds found in nature.

Final Answer:

The versatility of carbon is due to its tetravalency, catenation property, and the ability to form multiple b

Quick Tip

Carbon's ability to form multiple bonds and stable chains makes it central to the formation of organic molecules.

Or

Q7(i). Write the chemical equations of any three chemical properties of ethanoic acid.

Solution:

Ethanoic acid (CHCOOH) is a weak carboxylic acid and reacts in several ways. Here are three chemical properties along with their chemical equations:

1. **Reaction with Sodium Bicarbonate (NaHCO):** Ethanoic acid reacts with sodium bicarbonate to form sodium acetate, water, and carbon dioxide. The equation is as follows:

$$CH_3COOH + NaHCO_3 \longrightarrow CH_3COONa + H_2O + CO_2 \uparrow$$

This is an acid-base reaction that produces carbon dioxide.

2. **Reaction with Sodium Hydroxide (NaOH):** Ethanoic acid reacts with sodium hydroxide to form sodium acetate and water. The neutralization reaction is represented as:

$$CH_3COOH + NaOH \longrightarrow CH_3COONa + H_2O$$

In this reaction, ethanoic acid neutralizes sodium hydroxide to produce sodium acetate and water.

3. **Reaction with Alcohols (Esterification):** Ethanoic acid reacts with an alcohol (such as ethanol) in the presence of an acid catalyst to form an ester. The reaction is as follows:

$$CH_3COOH + C_2H_5OH \longrightarrow CH_3COOC_2H_5 + H_2O$$

This is an esterification reaction that produces ethyl acetate (an ester) and water.

Final Answer:

The three chemical properties of ethanoic acid are:1. Reaction with Sodium Bicarbonate: $CH_3COOH +$

Quick Tip

Ethanoic acid undergoes neutralization with bases, reacts with bicarbonates to produce CO, and forms esters in esterification reactions.

Q7(ii). Explain the cleansing action of soap on the basis of the formation of micelle.

Solution:

Soap molecules are made up of long hydrocarbon chains with a hydrophilic (water-attracting) head and a hydrophobic (water-repelling) tail. The mechanism of soap's cleansing action is explained by the formation of micelles:

1. **Micelle Formation:** When soap is added to water, the hydrophilic heads of the soap molecules are attracted to the water, while the hydrophobic tails are repelled by water and are directed inward. This results in the formation of a structure called a **micelle**, where the hydrophobic tails trap the oily dirt or grease in the center, and the hydrophilic heads face outward, interacting with the water.
2. **Action on Dirt and Oil:** The dirt and grease, being non-polar substances, get trapped in the hydrophobic center of the micelle. The outer hydrophilic surface of the micelle allows the dirt to be suspended in water. This makes it easy to wash away the dirt and oil particles from surfaces.
3. **Removal of Dirt:** When the soapy water is rinsed, the micelles, along with the trapped dirt and oil particles, are carried away by the water, effectively cleansing the surface.

Final Answer:

The cleansing action of soap is based on the formation of micelles, where soap molecules trap dirt and g

Quick Tip

Soap cleans by forming micelles, trapping dirt and oil in the center, and allowing it to be washed away.

Q8(i). Write a short note on the movement in plants.

Solution:

Plants are generally immobile; however, they do exhibit various forms of movement. These movements are broadly classified into two categories: **tropic movements** and **nastic movements**.
1. **Tropic Movements:** These are directional movements in response to an environmental stimulus. The movement can be towards (positive) or away (negative) from the stimulus. - **Phototropism:** Movement in response to light. For example, plant stems grow towards light. - **Geotropism:** Movement in response to gravity. Roots grow downwards (positive

geotropism) while stems grow upwards (negative geotropism). - **Hydrotropism:** Movement in response to water. Roots grow towards moist areas in search of water.
2. **Nastic Movements:** These are non-directional movements that occur in response to external stimuli, but not dependent on the direction of the stimulus. - **Nyctinasty:** Movement that occurs in response to the day and night cycle, like the closing of flowers at night. - **Thigmonasty:** Movement in response to touch, such as the closing of the Mimosa pudica (sensitive plant) leaves when touched.

Final Answer:

Plants show tropic and nastic movements, where tropic movements are directional and nastic movemen

Quick Tip

Tropic movements are directed towards or away from stimuli, while nastic movements are non-directional.

Q8(ii). Write a short note on detergents and their role in the ecosystem.

Solution:

Detergents are chemical compounds used for cleaning purposes, commonly found in household and industrial cleaning products. They are surfactants that lower the surface tension of water, making it easier to remove dirt and grease.
1. **Types of Detergents:** - **Anionic Detergents:** Have a negative charge on the surfactant molecule (e.g., sodium lauryl sulfate). - **Cationic Detergents:** Have a positive charge on the surfactant molecule (e.g., benzalkonium chloride). - **Nonionic Detergents:** Do not carry a charge (e.g., alkyl polyglucoside).
2. **Role in Ecosystem:** Detergents, when released into the environment, can cause pollution and disrupt the balance of ecosystems. They affect aquatic life by: - **Toxicity to Aquatic Organisms:** Detergents, especially synthetic ones, are toxic to aquatic organisms like fish and amphibians. They can interfere with the respiratory processes and cause death in some cases. - **Oxygen Depletion:** Detergents can lead to the reduction in oxygen

levels in water bodies, as bacteria break down the organic compounds in detergents, consuming oxygen in the process. - **Disruption of Water Quality:** Detergents lead to foaming, which can block sunlight and reduce the oxygen available to aquatic organisms, thereby disrupting the aquatic food chain.
3. **Environmental Impact:** - Biodegradable detergents are less harmful as they break down faster, while non-biodegradable detergents can persist in the environment, leading to long-term contamination.

Final Answer:

Detergents are surfactants used for cleaning, but they can pollute water and harm aquatic life. Their role

Quick Tip

Use biodegradable detergents to minimize the environmental impact, especially in aquatic ecosystems.

Q9. Describe the flow of energy in food chain and food web with diagram.

Solution:

Energy flow in ecosystems occurs through the food chain and food web. The process begins with the producers (plants) and moves through the consumers (herbivores, carnivores, etc.), ultimately reaching the decomposers. Here is a breakdown of the energy flow in both concepts:
1. **Food Chain:** A food chain is a linear sequence of organisms through which energy and nutrients are passed. The flow of energy in a food chain starts from producers (plants) and moves through herbivores (primary consumers), carnivores (secondary consumers), and apex predators (tertiary consumers).

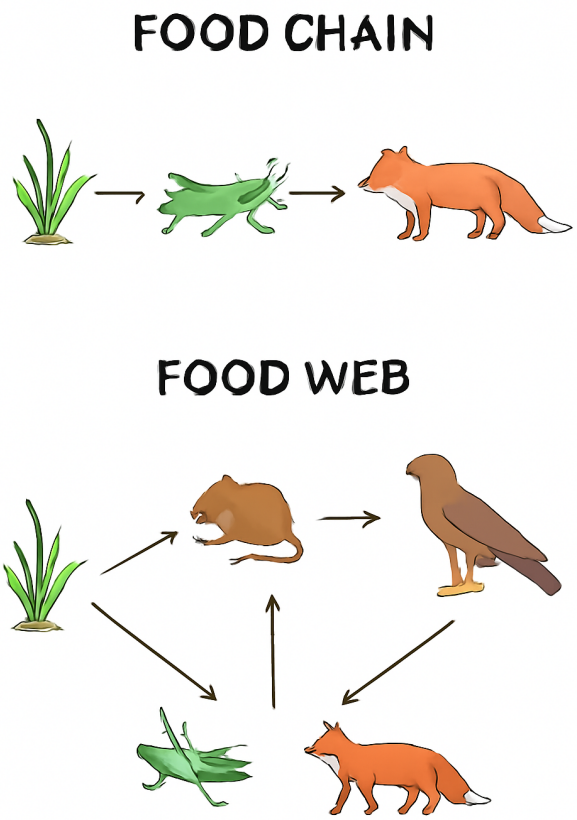
- **Producers (Plants):** Plants are the first step in any food chain as they convert solar energy into chemical energy through photosynthesis. They are called producers.
- **Primary Consumers (Herbivores):** Herbivores eat plants and thus, they consume the chemical energy stored in plants.

- **Secondary Consumers (Carnivores):** Carnivores feed on herbivores. They obtain energy by eating the primary consumers.
- **Tertiary Consumers (Top Carnivores):** These are the apex predators that feed on other carnivores and are at the top of the food chain.

Energy transfer in a food chain follows a 10
2. **Food Web:** A food web is a more complex and interconnected system of food chains in an ecosystem. It shows how different food chains in an ecosystem are connected. Food webs provide a more accurate representation of energy flow in nature because they account for the multiple feeding relationships that organisms can have.

- The food web is formed by the interconnection of multiple food chains.
- Organisms may play multiple roles in the ecosystem. For example, a species may be both a primary and secondary consumer.
- Energy transfer in a food web is more efficient as it accounts for multiple sources of energy and energy pathways.

Diagram: Below is a simple diagram of a food chain and food web:



Final Answer:

The flow of energy in a food chain is linear, from producers to consumers, whereas in a food web, energ

Quick Tip

Energy transfer in ecosystems is inefficient. About 90

Q10. Write short notes on the following: (i) Human brain

(ii) Platelets

Solution:

(i) **Human Brain:**

The human brain is one of the most important organs in the body, responsible for controlling all functions of the body. It is a part of the central nervous system (CNS), which also includes the spinal cord. The brain is located in the skull and consists of three main parts:

- **Cerebrum:** The largest part of the brain, responsible for higher functions like reasoning, memory, speech, and emotions.
- **Cerebellum:** Located at the back of the brain, responsible for coordination and balance.
- **Brainstem:** It connects the brain to the spinal cord and controls basic life functions such as heart rate, respiration, and blood pressure.

The brain works by sending electrical signals through neurons (nerve cells) to various parts of the body. It processes sensory information, controls motor functions, and helps in cognitive processes.

(ii) **Platelets:**
Platelets, also known as thrombocytes, are small, irregularly shaped cell fragments found in the blood. They play a crucial role in blood clotting and preventing excessive bleeding. When a blood vessel is injured, platelets gather at the site of injury, become activated, and form a plug by sticking together. They also release chemicals that promote the formation of fibrin, a protein that helps form a stable blood clot.
Platelets are produced in the bone marrow from large cells called megakaryocytes. Although they do not have a nucleus, they are essential for wound healing and maintaining hemostasis (stopping bleeding).

The human brain is the control center of the body, while platelets are crucial for blood clotting.

Quick Tip

The brain is the control center for all body activities, while platelets are vital in preventing excessive blood loss.

Q11. Describe the respiratory system of humans.

Solution:

The respiratory system in humans is a complex network of organs that enables the exchange of gases, specifically oxygen and carbon dioxide, between the body and the environment.

Key Components of the Human Respiratory System:

- **Nostrils:** Air enters through the nostrils where it is filtered by hairs and mucous membranes.
- **Pharynx (Throat):** The air passes through the pharynx, which serves as a common passage for air and food.
- **Larynx (Voice box):** Air moves into the larynx, where the vocal cords are located. The larynx helps in speech production and prevents food from entering the airways.
- **Trachea (Windpipe):** The air travels through the trachea, a rigid tube that leads to the lungs.
- **Bronchi and Bronchioles:** The trachea divides into two primary bronchi, which enter the lungs and further divide into smaller bronchioles.
- **Alveoli:** Tiny air sacs located at the end of the bronchioles where gas exchange occurs. Oxygen diffuses into the blood, and carbon dioxide diffuses out into the alveoli.

The Process of Breathing:

- **Inhalation:** The diaphragm contracts and moves downward, and the intercostal muscles pull the ribs outward, expanding the chest cavity and causing air to be drawn into the lungs.
- **Exhalation:** The diaphragm relaxes and moves upward, while the intercostal muscles relax, causing the chest cavity to shrink and air to be expelled.

Gas Exchange in Alveoli:

Oxygen from the air enters the blood through the thin walls of the alveoli, and carbon dioxide from the blood diffuses into the alveoli to be exhaled.

Quick Tip

Remember that the alveoli have a large surface area to maximize gas exchange and are surrounded by capillaries, which transport the oxygenated blood to the heart and the carbon dioxide to be exhaled.

OR

Q11. Describe different methods of reproduction in unicellular organisms with examples.

Solution:

Unicellular organisms reproduce mainly through asexual reproduction, where one parent cell divides into two or more offspring without the involvement of gametes.

Methods of Reproduction:

- **Binary Fission (e.g., Bacteria):** In this process, a single cell divides into two identical daughter cells. The DNA of the parent cell duplicates, and the cell splits in two to form two genetically identical cells.
- **Budding (e.g., Yeast, Hydra):** A small bud forms on the parent organism. The bud grows, detaches, and becomes an independent organism. This is common in yeast and some protozoa.
- **Spore Formation (e.g., Fungi):** Unicellular fungi or algae produce spores, which are released into the environment. Under favorable conditions, these spores grow into new organisms.
- **Fragmentation (e.g., Some Algae, Protozoa):** In this type of reproduction, the organism splits into pieces (fragments), and each fragment develops into a new individual.

Examples of Organisms:

- **Bacteria:** Reproduce through binary fission, where one bacterium divides into two identical daughter cells.

- **Yeast:** Reproduce through budding, forming new individuals that detach from the parent.
- **Amoeba:** Reproduces by binary fission, splitting into two equal parts.

Advantages of Asexual Reproduction:

- Quick reproduction, allowing rapid population growth under favorable conditions.
- No need for a mate, allowing solitary organisms to reproduce alone.

Quick Tip

Asexual reproduction ensures fast population expansion, but it also leads to genetic uniformity, which can be a disadvantage in changing environments.
