



CHAPTERWISE SOLUTION

Based on **NCERT** Textbook

SCIENCE

Class

10



Student Advisor
(Editorial Team)



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Chemical Reactions and Equations

Intext Questions

Page-6

Q.1. Why should a Magnesium ribbon be cleaned before burning in air?

Ans. Magnesium ribbon should be cleaned before burning in air because Magnesium metal reacts with the atmospheric oxygen and forms Magnesium Oxide (MgO) layer which is a very stable compound. In order to prevent further reactions with Oxygen, it is therefore necessary to clean the ribbon to remove the layer of MgO.

Q.2. Write the balanced equation for the following chemical reactions.

- Hydrogen + Chlorine → Hydrogen chloride
- Barium chloride + Aluminium sulphate → Barium sulphate + Aluminium chloride
- Sodium + Water → Sodium hydroxide + Hydrogen

Ans. (a) $\text{H}_2 + \text{Cl}_2 \rightarrow 2\text{HCl}$

(b) $3\text{BaCl}_2 + \text{Al}_2(\text{SO}_4)_3 \rightarrow 3\text{BaSO}_4 + 2\text{AlCl}_3$

(c) $2\text{Na} + 2\text{H}_2\text{O} \rightarrow 2\text{NaOH} + \text{H}_2$

Q.3. Write a balanced chemical equation with state symbols for the following reactions

- Solutions of barium chloride and sodium sulphate in water react to give insoluble barium sulphate and solution of sodium chloride.
- Sodium hydroxide solution (in water) reacts with hydrochloric acid solution (in water) to produce sodium chloride solution and water.

Ans. (a) $\text{BaCl}_2(aq) + \text{Na}_2\text{SO}_4(aq) \rightarrow \text{BaSO}_4(s) + 2\text{NaCl}(aq)$

(b) $\text{NaOH}(aq) + \text{HCl}(aq) \rightarrow \text{NaCl}(aq) + \text{H}_2\text{O}(l)$

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Q.1. A solution of a substance 'X' is used for whitewashing.

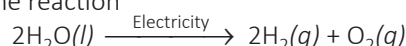
- Name the substance 'X' and write its formula.
- Write the reaction of the substance 'X' named in (a) above, with water.

Ans. (a) The substance 'X' which is used in whitewashing is quick lime or Calcium Oxide and its formula is CaO.

(b) $\text{CaO}(s) + \text{H}_2\text{O}(l) \rightarrow \text{Ca}(\text{OH})_2(aq) + \text{Heat}$

Q.2. Why is the amount of gas collected in one of the test tubes during the electrolysis of water double of the amount collected in the other? Name this gas.

Ans. On electrolysis, water decomposes according to the reaction

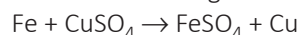


Thus, water decomposes to give hydrogen and oxygen in the ratio of 2:1 by volume. The double volume of the gas collected is hydrogen.

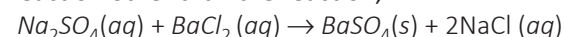
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Q.1. Why does the colour of copper sulphate solution change when an iron nail is dipped in it?

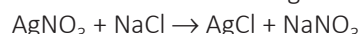
Ans. When an iron nail is dipped in the Copper sulphate solution, iron displaces copper from the copper sulphate because iron is more reactive than copper. Therefore, the colour of the Copper sulphate solution changes. The reaction is



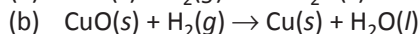
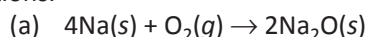
Q.2. Give an example of a double displacement reaction other than the reaction,



Ans. Reaction between Silver nitrate (AgNO_3) and Sodium chloride (NaCl) is an example of a double displacement reaction. During the reaction, negative and positive ions change positions as a result of the formation of white silver chloride precipitate. The chemical reaction is given below.



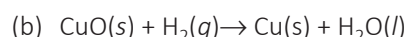
Q.3. Identify the substances that are oxidised and the substances that are reduced in the following reactions.



Ans. (a) $4\text{Na}(s) + \text{O}_2(g) \rightarrow 2\text{Na}_2\text{O}(s)$

Reduction

Na is oxidised and O_2 is reduced.
oxidation.

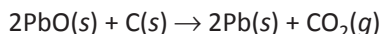


Reduction

H_2 is oxidised and CuO is reduced.

NCERT Exercise

Q.1. Which of the statements about the reaction below are incorrect?



- (a) Lead is getting reduced
- (b) Carbon dioxide is getting oxidised
- (c) Carbon is getting oxidised
- (d) Lead oxide is getting reduced
- (i) (a) and (b) (ii) (a) and (c)
- (iii) (a), (b) and (c) (iv) all the above

Ans. The incorrect statements are:

- (a) Lead is getting reduced
- (b) Carbon dioxide is getting oxidised. Hence (i) is the correct answer.

Q.2. $\text{Fe}_2\text{O}_3 + 2\text{Al} \rightarrow \text{Al}_2\text{O}_3 + 2\text{Fe}$

The above reaction is an example of a

- (a) Combination reaction
- (b) Double displacement reaction
- (c) Decomposition reaction
- (d) Displacement reaction

Ans. The answer is (d). Displacement reaction

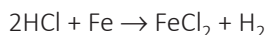
Explanation: The Oxygen from the Ferrous oxide is getting displaced to the Aluminium metal to form Aluminium Oxide. In this reaction, Aluminum is a more reactive metal than Fe. Therefore, Al will displace Fe from its oxide. This type of chemical reaction, called displacement reaction.

Q.3. What happens when dil. Hydrochloric acid is added to iron fillings? Tick the correct answer.

- (a) Hydrogen gas and Iron chloride are produced.
- (b) Chlorine gas and Iron hydroxide are produced.
- (c) No reaction takes place.
- (d) Iron salt and water are produced.

Ans. (a) Hydrogen gas and Iron chloride are produced.

Explanation: The Chlorine from Hydrogen chloride is displaced by the Iron fillings to undergo the following reaction.



Q.4. What is a balanced chemical equation? Why should chemical equations be balanced?

Ans. The chemical equation in which the number of atoms of each element on both sides of the equation is equal is called balanced chemical equation.

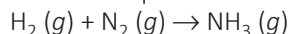
For example: $2\text{H}_2 + \text{O}_2 \rightarrow 2\text{H}_2\text{O}$

A chemical equation should be balanced because there is no loss or gain of any matter during the chemical reaction, *i.e.*, the law of conservation must hold good for the reaction.

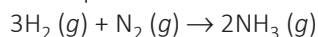
Q.5. Translate the following statements into chemical equations and then balance them.

- (a) Hydrogen gas combines with nitrogen to form Ammonia.
- (b) Hydrogen sulphide gas burns in air to give water and sulphur dioxide.
- (c) Barium chloride reacts with aluminium sulphate to give aluminium chloride and a precipitate of barium sulphate.
- (d) Potassium metal reacts with water to give potassium hydroxide and hydrogen gas.

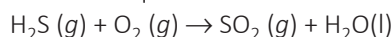
Ans. (a) Chemical equation



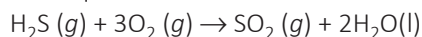
Balanced equation



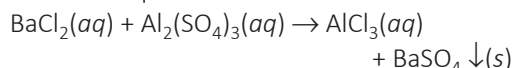
(b) Chemical equation



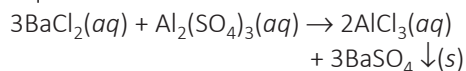
Balanced equation



(c) Chemical equation



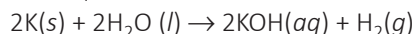
Balanced equation



(d) Chemical



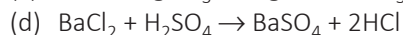
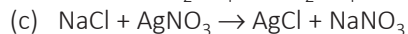
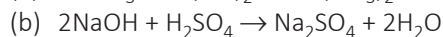
Balanced equation



Q.6. Balance the following chemical equations :

- (a) $\text{HNO}_3 + \text{Ca}(\text{OH})_2 \rightarrow \text{Ca}(\text{NO}_3)_2 + \text{H}_2\text{O}$
- (b) $\text{NaOH} + \text{H}_2\text{SO}_4 \rightarrow \text{Na}_2\text{SO}_4 + \text{H}_2\text{O}$
- (c) $\text{NaCl} + \text{AgNO}_3 \rightarrow \text{AgCl} + \text{NaNO}_3$
- (d) $\text{BaCl}_2 + \text{H}_2\text{SO}_4 \rightarrow \text{BaSO}_4 + \text{HCl}$

Ans. (a) $2\text{HNO}_3 + \text{Ca}(\text{OH})_2 \rightarrow \text{Ca}(\text{NO}_3)_2 + 2\text{H}_2\text{O}$



Q.7. Write the balanced chemical equations for the following reactions :

- (a) Calcium hydroxide + Carbon dioxide $\rightarrow$ Calcium carbonate + Water
- (b) Zinc + Silver nitrate $\rightarrow$ Zinc nitrate + Silver
- (c) Aluminium + Copper chloride $\rightarrow$ Aluminium chloride + Copper

(d) Barium chloride + Potassium sulphate $\rightarrow$ Barium sulphate + Potassium chloride

Ans. (a) $\text{Ca(OH)}_2 + \text{CO}_2 \rightarrow \text{CaCO}_3 + \text{H}_2\text{O}$
 (b) $\text{Zn} + 2\text{AgNO}_3 \rightarrow \text{Zn(NO}_3)_2 + 2\text{Ag}$
 (c) $2\text{Al} + 3\text{CuCl}_2 \rightarrow 2\text{AlCl}_3 + 3\text{Cu}$
 (d) $\text{BaCl}_2 + \text{K}_2\text{SO}_4 \rightarrow \text{BaSO}_4 + 2\text{KCl}$

Q.8. Write the balanced chemical equation for the following and identify the type of reaction in each case :

(a) Potassium bromide(aq) + Barium iodide(aq) $\rightarrow$ Potassium iodide(aq) + Barium bromide(s)

(b) Zinc carbonate(s) $\rightarrow$ Zinc oxide(s) + Carbon dioxide(g)

(c) Hydrogen(g) + Chlorine(g) $\rightarrow$ Hydrogen chloride(g)

(d) Magnesium(s) + Hydrochloric acid(aq) $\rightarrow$ Magnesium chloride(aq) + Hydrogen(g)

Ans. (a) $2\text{KBr(aq)} + \text{BaI}_2\text{(aq)} \rightarrow 2\text{KI(aq)} + \text{BaBr}_2\text{(s)}$

Type : Double displacement reaction

(b) $\text{ZnCO}_3\text{(s)} \rightarrow \text{ZnO(s)} + \text{CO}_2\text{(g)}$

Type : Decomposition reaction

(c) $\text{H}_2\text{(g)} + \text{Cl}_2\text{(g)} \rightarrow 2\text{HCl(g)}$

Type : Combination reaction

(d) $\text{Mg(s)} + 2\text{HCl(aq)} \rightarrow \text{MgCl}_2\text{(aq)} + \text{H}_2\text{(g)}$

Type : Displacement reaction

Q.9. What does one mean by exothermic and endothermic reactions? Give examples.

Ans. Exothermic reactions: Those reactions in which heat is evolved are known as exothermic reactions.

Example:

(i) $\text{C(s)} + \text{O}_2\text{(g)} \rightarrow \text{CO}_2\text{(g)} + \text{Heat}$

(ii) $\text{N}_2\text{(g)} + 3\text{H}_2\text{(g)} \rightarrow 2\text{NH}_3\text{(g)} + \text{Heat}$

Endothermic reactions: Those reactions in which heat is absorbed are known as endothermic reactions.

Examples:

(i) $\text{C(s)} + 2\text{S(s)} \rightarrow \text{CS}_2\text{(l)} - \text{Heat}$

(ii) $\text{N}_2\text{(g)} + \text{O}_2\text{(g)} \rightarrow 2\text{NO(g)} - \text{Heat}$

Q.10. Why is respiration considered an exothermic reaction? Explain.

Ans. Respiration is an exothermic process because during respiration glucose combines with oxygen in the cells of our body to form carbon dioxide and water along with the production of energy.

$\text{C}_6\text{H}_{12}\text{O}_6\text{(aq)} + 6\text{O}_2\text{(g)} \rightarrow 6\text{CO}_2\text{(g)} + 6\text{H}_2\text{O(l)} + \text{Energy}$
 Glucose Oxygen Carbon dioxide

Q.11. Why are decomposition reactions called the opposite of combination reactions? Write equations for these reactions.

Ans. In a combination reaction, two or more substances combine to form a single product. Also, a large amount of heat is evolved.

$\text{N}_2 + 3\text{H}_2 \rightarrow 2\text{NH}_3 + \text{Heat (combination)}$

The decomposition reactions require energy either in the form of heat, light or electricity for breaking down the reactants.

$2\text{NH}_3 \xrightarrow{\text{Heat}} \text{N}_2 + 3\text{H}_2 \text{ (decomposition)}$

Q.12. Write one equation each for decomposition reactions where energy is supplied in the form of heat, light and electricity.

Ans. $\text{CaCO}_3\text{(s)} \xrightarrow{\text{Heat}} \text{CaO(s)} + \text{CO}_2\text{(g)}$
 Calcium carbonate Calcium oxide Carbon dioxide

$2\text{AgBr(s)} \xrightarrow{\text{Light}} 2\text{Ag(s)} + \text{Br}_2\text{(g)}$
 Silver bromide Silver Bromine

$2\text{H}_2\text{O(l)} \xrightarrow{\text{Electric current}} 2\text{H}_2\text{(g)} + \text{O}_2\text{(g)}$
 Water Hydrogen Oxygen

Q.13. What is the difference between displacement and double displacement reactions? Write equations for these reactions.

Ans. In displacement reactions, a more reactive metal displaces a less reactive metal from its solution. For example,

$\text{Fe(s)} + \text{CuSO}_4\text{(aq)} \rightarrow \text{Cu(s)} + \text{FeSO}_4\text{(aq)}$

This is a displacement reaction where iron displaces copper from its solution.

In double displacement reactions, two reactants in solution exchange their ions. For example,

$\text{AgNO}_3\text{(aq)} + \text{NaCl(aq)} \rightarrow \text{AgCl(s)} + \text{NaNO}_3\text{(aq)}$

This is a double displacement reaction where silver nitrate and sodium chloride exchange Cl^- and NO_3^- ions between them.

Q.14. In the refining of silver, the recovery of silver from silver nitrate solution involved displacement by copper metal. Write down the reaction involved.

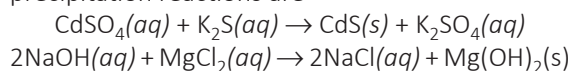
Ans. The reaction involved is

$2\text{AgNO}_3\text{(aq)} + \text{Cu(s)} \rightarrow \text{Cu(NO}_3)_2\text{(aq)} + 2\text{Ag(s)}$
 Silver nitrate Copper Copper (II) nitrate Silver

Q.15. What do you mean by a precipitation reaction? Explain by giving examples.

Ans. When two solutions containing soluble salts are combined, a double displacement reaction takes place in which the ions are exchanged

between the compounds. When one of such compounds formed is in solid form (that is insoluble in aqua), then it settles down at the bottom of the container. This solid is known as the precipitate and the respective reaction is termed as the precipitation reaction. A few examples of precipitation reactions are

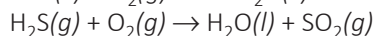
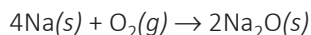


Q.16. Explain the following in terms of gain or loss of oxygen with two examples each.

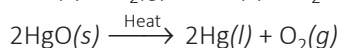
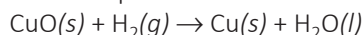
(a) Oxidation

(b) Reduction

Ans. (a) In a chemical reaction, when the oxygen is added to the element to form its respective oxide. Then the element is said to be oxidised. Example:

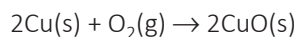


(b) In a chemical reaction, when the oxygen is removed from the compound, then it is said to be reduced. Example:



Q.17. A shiny brown coloured element 'X' on heating in air becomes black in colour. Name the element 'X' and the black-colored compound formed.

Ans. The shiny brown-colored element is Copper metal (Cu). When the metal is heated in air, it reacts with atmospheric oxygen to form copper oxide. Hence, the black-colored compound is copper oxide.



Q.18. Why do we apply paint on iron articles?

Ans. Iron articles are painted to prevent them from rusting. When left unpainted, the metal surface comes in contact with the atmospheric oxygen and in the presence of moisture it forms Iron (III) oxide. But if painted, the surface does not come in contact with moisture and air, thus preventing rusting.

Q.19. Oil and fat containing food items are flushed with Nitrogen. Why?

Ans. The main purpose of flushing Nitrogen into food packets that contain oil and fat items is to prevent rancidity which occurs when the oil or fat reacts with the oxygen letting out an unpleasant smell and taste. Therefore, by flushing Nitrogen, an unreactive surrounding is created, thus preventing rancidity.

Q.20. Explain the following terms with one example each. (a) Corrosion (b) Rancidity

Ans. (a) Corrosion is a process where a refined metal is oxidised by atmospheric oxygen to form a more stable compound, such as oxides. The metal gradually degrades during the corrosion process. Rusting of iron is a good example of corrosion where the iron is converted to Iron oxide. Millions of dollars are spent annually to prevent rusting on bridges and other monuments.

(b) The condition produced by the aerial oxidation of the oil and fat present in the food material that produces an unpleasant taste and smell is known as rancidity. The rancidity is retarded when the food is kept inside the refrigerator since the low temperature does not promote the oxidation reaction.



2

Acids, Bases and Salts

Intext Questions

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Q.1. You have been provided with three test tubes. One of them contains distilled water and the other two contain an acidic solution and a basic solution respectively. If you are given only red litmus paper, how will you identify the contents of each test tube?

Ans. Divide the litmus paper in 3 parts and dip one part in each test tube. The test tube in which litmus paper turns blue contains basic solution. The one in which red colour of litmus paper becomes light or purple contains water and the one in which there is no change in colour or it becomes more reddish contains an acidic solution.

NOTE: After immediate distillation, distilled water has a pH of 7. However, within a few hours after

distillation, it absorbs carbon dioxide from the atmosphere and turns slightly acidic with a pH of 5.8.

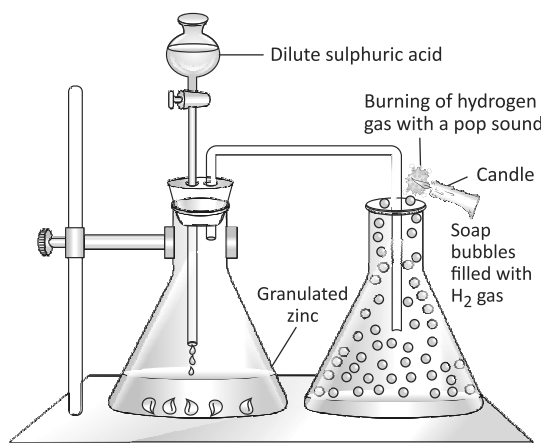
Page-22

Q.1. Why should curd and sour substances not be kept in brass and copper vessels?

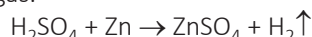
Ans. Curd and sour substances should not be kept in brass and copper vessels because curd and sour substances contain organic acids. Brass and copper react with these acids slowly and produce poisonous substances.

Q.2. Which gas is usually liberated when an acid reacts with a metal? Illustrate with an example. How will you test for the presence of this gas?

Ans. Hydrogen gas is usually liberated when an acid reacts with a metal.



Take a few pieces of zinc granules and add 5 ml of dilute H_2SO_4 . Shake it and pass the gas produced into a soap solution. The bubbles of the soap solution are formed. These soap bubbles contain hydrogen gas.



We can test evolved hydrogen gas by its burning with a pop sound when a candle is brought near the soap bubbles.

Q.3. Metal compound A reacts with dilute hydrochloric acid to produce effervescence. The gas evolved extinguishes a burning candle. Write a balanced chemical equation for the reaction if one of the compounds formed is calcium chloride.

Ans. As the metal compound released is calcium chloride, the gas evolved here is CO_2 . Hence, metal A should be calcium carbonate. Hence, the reaction between calcium carbonate and HCl is $\text{CaCO}_3(\text{s}) + 2\text{HCl}(\text{aq}) \rightarrow \text{CaCl}_2(\text{aq}) + \text{CO}_2(\text{g}) + \text{H}_2\text{O}(\text{l})$

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Q.1. Why do HCl, HNO_3 , etc., show acidic characters in aqueous solutions while solutions of compounds like alcohol and glucose do not show an acidic character?

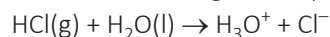
Ans. HCl and HNO_3 get ionized in their aqueous solutions and produce free ions, H^+ and Cl^- and H_3O^+ and NO_3^- respectively. Due to the presence of free H^+ (aq) ions, HCl and HNO_3 show acidic character. $\text{C}_2\text{H}_5\text{OH}$ and glucose ($\text{C}_6\text{H}_{12}\text{O}_6$) are covalent compounds and do not produce free H^+ ions in solutions. So these compounds do not show acidic character.

Q.2. Why does an aqueous solution of acid conduct electricity?

Ans. Charged particles are responsible for the conductance of electricity in an acid. These charged particles, called ions, are the reason behind the conductance of electricity in acid.

Q.3. Why does dry HCl gas not change the colour of the dry litmus paper?

Ans. Dry HCl gas does not give out Hydrogen ions; therefore, dry HCl does not show any acidic behaviour, and the colour of the litmus paper remains the same on reacting with dry HCl gas.



Q.4. While diluting an acid, why is it recommended that the acid should be added to water and not water to the acid?

Ans. While diluting an acid, it is recommended that the acid should be added to water and not water to the acid because if water is added to a concentrated acid, it releases a huge amount of heat which may result in an explosion and can cause acid burns on the face, clothes and body parts. Hence, it is safe to add acid to water but not water to acid.

Q.5. How is the concentration of hydronium ions (H_3O^+) affected when a solution of an acid is diluted?

Ans. When acid is added to water, there will be a fixed amount of hydronium present in the fixed volume of the solution. If we dilute the solution, hydronium ions per volume of the solution decrease, and this, in turn, decreases hydronium ions concentration in the solution.

Q.6. How is the concentration of hydroxide ions (OH^-) affected when excess base is dissolved in a solution of sodium hydroxide?

Ans. When a base is dissolved in sodium hydroxide solution, its hydroxide ions increase, but it reaches saturation at some point. After saturation point, hydroxide ion concentration is not affected even after adding base further.

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Q.1. You have two solutions, A and B. The pH of solution A is 6 and pH of solution B is 8. Which solution has more hydrogen ion concentration? Which of this is acidic and which one is basic?

Ans. A pH value of less than 7 indicates an acidic solution, while greater than 7 indicates a basic solution. Therefore, the solution with pH = 6 is acidic and has more hydrogen ion concentration than the solution of pH = 8 which is basic.

Q.2. What effect does the concentration of $H^+(aq)$ ions have on the nature of the solution?

Ans. Hydrogen ion concentration decides the nature of the solution. If hydrogen ion concentration increases, then the solution turns acidic and similarly, if hydrogen ion concentration decreases, then the solution turns basic.

Q.3. Do basic solutions also have $H^+(aq)$ ions? If yes, then why are these solutions basic?

Ans. Basic solutions have H^+ ions, but hydroxide ions present in basic solution are more in basic solution. Hence, Hydroxide ions turn the solution into basic.

Q.4. Under what soil condition do you think a farmer would treat the soil of his fields with quick lime (calcium oxide) or slaked lime (calcium hydroxide), or chalk (calcium carbonate)?

Ans. If the soil is acidic in nature (pH below 7), then such fields should be treated with quick lime (calcium oxide) or slaked lime (calcium hydroxide) or chalk (calcium carbonate).

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Q.1. What is the common name of the compound $CaOCl_2$?

Ans. The common name of $CaOCl_2$ is bleaching powder.

Q.2. Name the substance, which on treatment with chlorine, yields bleaching powder.

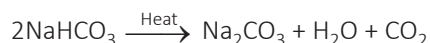
Ans. The substance, which on treatment with chlorine yields bleaching powder, is calcium hydroxide.

Q.3. Name the sodium compound which is used for softening hard water.

Ans. Sodium carbonate is the compound which is used for softening hard water.

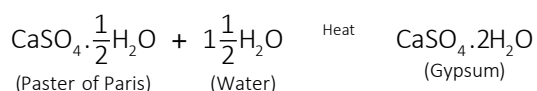
Q.4. What will happen if a solution of sodium hydrocarbonate is heated? Give the equation of the reaction involved.

Ans. Heating sodium hydrocarbonate yields sodium carbonate, and carbon dioxide gas is liberated in the process.



Q.5. Write an equation to show the reaction between Plaster of Paris and water.

Ans. The chemical equation for the reaction of Plaster of Paris and water is



NCERT Exercise

Q.1. A solution turns red litmus blue, its pH is likely to be

- (a) 1 (b) 4 (c) 5 (d) 10

Ans. (d) **Explanation:** The answer is 10 because litmus paper turns blue when the solution reacts with a basic solution (pH more than 7). Hence, 10 is the answer.

Q.2. A solution reacts with crushed egg-shells to give a gas that turns lime-water milky. The solution contains

- (a) NaCl (b) HCl (c) LiCl (d) KCl

Ans. (b) **Explanation:** The answer is HCl. Eggshells contain calcium carbonate, which on reaction with HCl liberates CO_2 gas, which turns lime water milky.

Q.3. 10 mL of a solution of NaOH is found to be completely neutralized by 8 mL of a given solution of HCl. If we take 20 mL of the same solution of NaOH, the amount HCl solution (the same solution as before) required to neutralize it will be:

- (a) 4 mL (b) 8 mL (c) 12 mL (d) 16 mL

Ans. (d)

Q.4. Which one of the following types of medicines is used for treating indigestion?

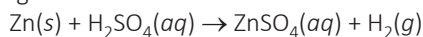
- (a) Antibiotic (b) Analgesic
(c) Antacid (d) Antiseptic

Ans. (c) **Explanation:** Indigestion is due to the excess production of acid in the stomach. A medicine used to treat indigestion is called Antacid.

Q.5. Write word equations and then balanced equations for the reaction taking place when

- (a) Dilute sulphuric acid reacts with zinc granules.
 (b) Dilute hydrochloric acid reacts with magnesium ribbon.
 (c) Dilute sulphuric acid reacts with aluminium powder.
 (d) Dilute hydrochloric acid reacts with iron filings.

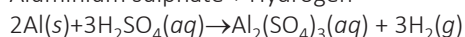
Ans. (a) Zinc + dilute sulphuric acid $\rightarrow$ Zinc sulphate + Hydrogen



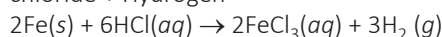
- (b) Magnesium ribbon + dil. Hydrochloric acid $\rightarrow$ Magnesium chloride + Hydrogen



- (c) Aluminium powder + dil. Sulphuric acid $\rightarrow$ Aluminium sulphate + Hydrogen

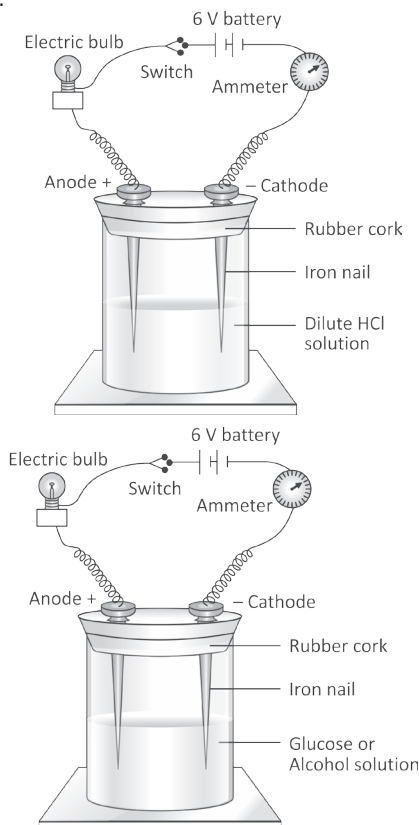


- (d) Iron filings + Dilute hydrochloric acid $\rightarrow$ Ferric chloride + Hydrogen



Q.6. Compounds such as alcohols and glucose also contain hydrogen but are not categorized as acids. Describe an activity to prove it.

Ans. Insert two nails into the wooden or rubber cork and place them in a beaker, as shown in the figure.



Connect the iron nail to a bulb, a 6-volt battery and

a wire connected to the switch. Pour some alcohol or glucose so as to dip the nails in glucose or alcohol. Turn the switch on, and you see the bulb not glowing despite of connection to the switch. Now empty the beaker and add the HCl solution. This time, the bulb glows. This proves acid can conduct electricity, but alcohol and glucose do not conduct electricity.

Q.7. Why does distilled water not conduct electricity, whereas rain water does?

Ans. Rain water contains ions of acids so it conducts electricity whereas there is no ion in distilled water.

Q.8. Why do acids not show acidic behaviour in the absence of water?

Ans. Acids in water give hydronium ions which are responsible for their acidic behaviour but in the absence of water, acids do not generate hydronium ions and thus, do not show acidic behaviour.

Q.9. Five solutions, A, B, C, D and E, when tested with a universal indicator, showed pH as 4, 1, 11, 7 and 9, respectively. Which solution is

- (a) neutral? (b) strongly alkaline? (c) strongly acidic? (d) weakly acidic? (e) weakly alkaline?

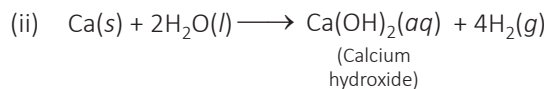
Arrange the pH in increasing order of hydrogen-ion concentration.

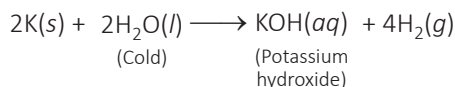
- Ans.** (a) Neutral $\rightarrow$ Solution D with pH 7
 (b) Strongly alkaline $\rightarrow$ Solution C with pH 11
 (c) Strongly acidic $\rightarrow$ Solution B with pH 1
 (d) Weakly acidic $\rightarrow$ Solution A with pH 4
 (e) Weakly alkaline $\rightarrow$ Solution E with pH 9

The pH can be arranged in the increasing order of the concentration of hydrogen ions as: $11 < 9 < 7 < 4 < 1$ or $C < E < D < A < B$.

Q.10. Equal lengths of magnesium ribbons are taken in test tubes A and B. Hydrochloric acid (HCl) is added to test tube A, while acetic acid (CH_3COOH) is added to test tube B. In which test tube will the fizzing occur more vigorously and why?

Ans. Fizzing will occur more vigorously in test tube A. Hydrochloric acid (HCl) is a strong acid whereas acetic acid (CH_3COOH) is a weak acid. Being strong acid, the hydrochloric acid solution contains a much greater amount of hydrogen ions in it due to which the fizzing will occur more vigorously in test tube A (containing hydrochloric acid). The fizzing is due to the evolution of hydrogen gas which is formed by the action of acid on the magnesium metal of magnesium ribbon.





Q.3. Samples of four metals A, B, C and D were taken and added to the following solution one by one. The results obtained have been tabulated as follows:

Metal	Iron(II) sulphate	Copper(II) sulphate	Zinc sulphate	Silver nitrate
A	No reaction	Displacement	—	—
B	Displacement	—	No reaction	—
C	No reaction	No reaction	No reaction	Displacement
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 most reactive metal ? (ii) What would you observe if B is added to a solution of copper (II) sulphate? (iii) Arrange the metals A, B, C and D in the order of decreasing reactivity.

Ans. According to the reactivity series of minerals and the result given in the table, the relative position of metals is $Zn > Fe > Cu > Ag$

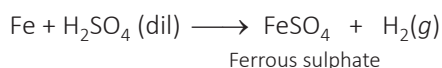
(i) Metal B is the most reactive metal because it gives displacement reaction with iron sulphate.

(ii) Copper metal will get deposited and the colour of solution will change. (iii) The arrangement of metals in the order of decreasing reactivity is :



Q.4. Which gas is produced when dilute hydrochloric acid is added to a reactive metal? Write the chemical reaction when iron reacts with dilute H_2SO_4 .

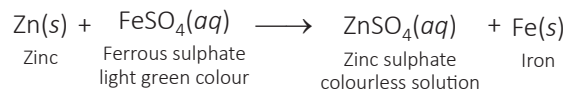
Ans. Hydrogen gas is produced when dilute hydrochloric acid is added to a reactive metal. Chemical reaction when iron reacts with dilute H_2SO_4 :



Q.5. What would you observe when zinc is added to a solution of iron (II) sulphate? Write the chemical reaction that takes place.

Ans. Zinc is more reactive than iron. Therefore, when zinc is added to a solution of iron (II) sulphate, then the greenish colour of iron (II)

sulphate solution fades gradually due to the formation of colourless zinc sulphate solution and iron metal is deposited on zinc.



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Q.1. (i) Write the electron-dot structures for sodium, oxygen and magnesium.

(ii) Show the formation of Na_2O and MgO by the transfer of electrons.

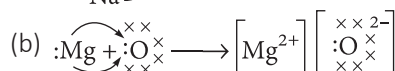
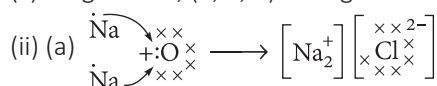
(iii) What are ions present in these compounds?

Ans. (i) The representation of elements with valence electrons as dots crosses around the elements is referred to as electron dot structure for elements.

(a) Sodium (2, 8, 1) = $Na \bullet$

(b) Oxygen (2, 6) = $:\ddot{O}:$

(c) Magnesium, (2, 8, 2) = Mg



(iii) The ions present in Na_2O and Na^+ are O^{2-} ions and in MgO are Mg^{2+} and O^{2-} ions.

Q.2. Why do ionic compounds have high melting points?

Ans. Ionic compounds are the ones which have both positive and negative charges. Hence, there will be strong force of attraction between them. This needs a lot of heat to break this force of attraction, hence ionic compounds have high melting points.

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Q.1. Define the following terms:

(i) Mineral (ii) Ore (iii) Gangue

Ans. (i) **Mineral:** Most of the elements occur in nature in combined state are called as minerals. The chemical composition of minerals is fixed.

(ii) **Ore:** Minerals, from which metals can be extracted conveniently and profitably, are known as ores.

(iii) **Gangue:** The impurities (sand, silt, soil, gravel, etc.) present in the ore are called gangue.

Q.2. Name two metals which are found in nature in the free state.

Ans. The metals at the bottom of the reactivity series are mostly found in free state. e.g., gold and silver.

Q.3. What chemical process is used for obtaining a metal from its oxide?

Ans. The chemical process used for obtaining a metal from its oxide is reduction. In this process metal oxides are reduced by using suitable reducing agents such as carbon or by highly reactive metals to displace the metals from their oxides.

For example: Zinc oxide is reduced to metallic zinc by heating with carbon.



Manganese dioxide is reduced to manganese by treating it with aluminium powder. In this case, aluminium displaces manganese from its oxide.



Oxides of more reactive metals are reduced by electrolysis.

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Q.1. Metallic oxides of Zinc, Magnesium and Copper were heated with the following metals:

Metal	Zinc	Magnesium	Copper
Zinc oxide	—	—	—
Magnesium oxide	—	—	—
Copper oxide	—	—	—

In which cases will you find displacement reactions taking place?

Ans.

Metal	Zinc	Magnesium	Copper
Zinc oxide	No reaction	Displacement	No reaction
Magnesium oxide	No reaction	No reaction	No reaction
Copper oxide	Displacement	Displacement	No reaction

Q.2. Which metals do not corrode easily?

Ans. The unreactive metals do not corrode easily. This is why gold plating provides high resistance to corrosion.

Q.3. What are alloys?

Ans. Alloys are homogeneous mixtures of two or more elements. The elements could be two metals, or a metal and a non-metal. For example, steel is an alloy of iron and carbon.

NCERT Exercise

Q.1. Which of the following pairs will give displacement reactions?

- (a) NaCl solution and copper metal.
- (b) MgCl_2 solution and aluminium metal.
- (c) FeSO_4 solution and silver metal.
- (d) AgNO_3 solution and copper metal.

Ans. (d) AgNO_3 solution and copper metal.

Q.2. Which of the following methods is suitable for preventing an iron frying pan from rusting?

- (a) Applying grease
- (b) Applying paint.
- (c) Applying a coating of zinc
- (d) All the above.

Ans. (c) Applying a coating of zinc.

Q.3. An element reacts with oxygen to give a compound with a high melting point. This compound is also soluble in water. The element is likely to be

- (a) calcium
- (b) carbon
- (c) silicon
- (d) iron

Ans. (a) Calcium.

Q.4. Food cans are coated with tin and not with zinc because

- (a) zinc is costlier than tin
- (b) zinc has a higher melting point than tin
- (c) zinc is more reactive than tin
- (d) zinc is less reactive than tin.

Ans. (c) Zinc is more reactive than tin.

Q.5. You are given a hammer, a battery, a bulb, wires and a switch.

(a) How could you use them to distinguish between samples of metals and non-metals?

(b) Assess the usefulness of these tests in distinguishing between metals and non-metals.

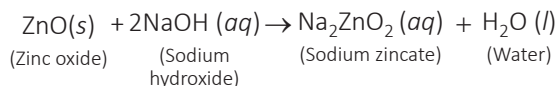
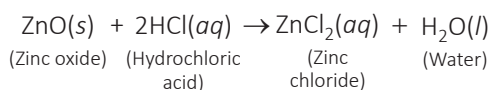
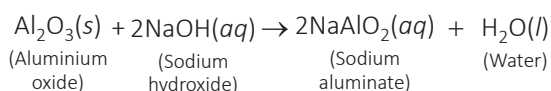
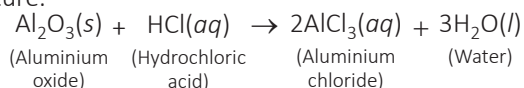
Ans. (a) Metals can be beaten into thin sheets with a hammer without breaking. Non-metals cannot be beaten with a hammer to form thin sheets. Non-metals break into pieces when hammered. Metals are malleable, while non-metals are non-malleable. When metals are connected into circuit using a battery, bulb, wires and switch, current passes through the circuit and the bulb glows. When non-metals (like sulphur) are connected, the bulb does not light up at all. Metals are good conductors of electricity.

(b) Because of malleability, metals can be casted into sheets. Metals are good conductors of electricity so these can be used for electrical cables.

Q.6. What are amphoteric oxides? Give two examples of amphoteric oxides?

Ans. Those metal oxides which show basic as well as acidic behaviour are known as amphoteric oxides.

Aluminium oxide and zinc oxide are amphoteric in nature.



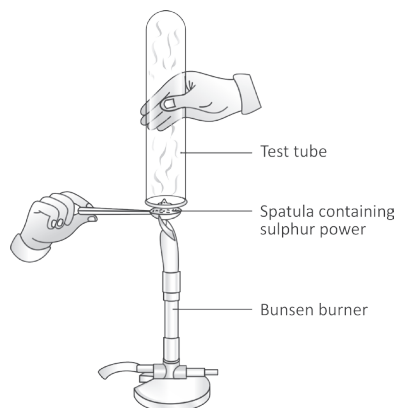
Q.7. Name two metals which will displace hydrogen from dilute acids, and two metals which will not.

Ans. Zinc (Zn) and Magnesium (Mg) will displace hydrogen from dilute acids while Gold (Au) and Silver (Ag) will not.

Q.8. In the electrolytic refining of a metal M, what would you take as the anode, the cathode and the electrolyte?

Ans. In the process of electrolytic refining of metal called 'M', an impure and thick block of metal M is considered as anode, a thin strip or wire of pure metal M is taken as cathode. A suitable salt solution of metal M is considered as the electrolyte.

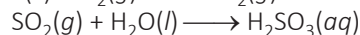
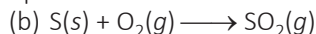
Q.9. Pratyush took sulphur powder on a spatula and heated it. He collected the gas evolved by inverting a test tube over it, as shown in the figure.



(a) What will be the action of gas on (i) dry litmus paper ? (ii) moist litmus paper ?

(b) Write a balanced chemical equation for the reaction taking place.

Ans. (a) (i) There will be no action on dry litmus paper. (ii) Since the gas is sulphur dioxide (SO_2), it turns moist blue litmus paper to red because sulphur dioxide reacts with moisture to form sulphurous acid.



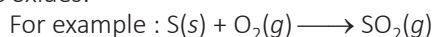
Q.10. State two ways to prevent the rusting of iron.

Ans. Two ways to prevent the rusting of iron are:

(i) **Oiling, greasing or painting:** By applying oil, grease, or paint, the surface becomes water proof and the moisture and oxygen in the air cannot come into direct contact with iron. Hence, rusting is prevented. (ii) **Galvanization:** An iron article is coated with a layer of Zinc metal, which prevents the iron to come in contact with oxygen and moisture. Hence, rusting is prevented.

Q.11. What type of oxides are formed when non-metal combine with oxygen?

Ans. Non-metals combine with oxygen to form acidic oxides:



Q.12. Give reasons: (a) Platinum, gold and silver are used to make jewellery. (b) Sodium, Potassium and Lithium are stored under oil. (c) Aluminium is a highly reactive metal, yet it is used to make utensils for cooking. (d) Carbonate and sulphide ores are usually converted into oxides during the process of extraction.

Ans. (a) Platinum, gold, and silver are used to make jewellery because they are less reactive and do not corrode easily.

(b) Sodium, Potassium, and Lithium are very reactive metals and react very vigorously with air as well as water. Therefore, they are kept immersed in kerosene oil in order to prevent their contact with air and moisture.

(c) Aluminium reacts with oxygen present in air to form a thin layer of Aluminium oxide. This oxide layer is very stable and prevents further reaction of Aluminium with Oxygen. Hence, it is used to make cooking utensils.

(d) Carbonate and sulphide ores are usually converted into oxides during the process of extraction because metals can be easily extracted from their oxides rather than from their carbonate and sulphide.

Q.13. You must have seen tarnished copper vessels being cleaned with lemon or tamarind juice. Explain why these sour substances are effective in cleaning the vessels.

Ans. Tarnished copper vessels are cleaned with lemon or tamarind because this sour substance contains acids which dissolve the coating of copper oxide or basic copper carbonate present on the surface of tarnished copper vessels. This makes them shining red-brown again. Hence, they are very effective in cleaning tarnished copper vessels.

Q.14. Differentiate between metal and non-metal on the basis of their chemical properties.

Ans.

Metal	Non-Metals
Metals react with oxygen to form basic oxides.	Non-metals react with oxygen to form acidic or neutral oxides.
Most metals displace hydrogen from dilute acids.	Non-metals do not react with dilute acids.
Only a few metals combine with hydrogen to form ionic hydrides. (Eg: Na, Ca)	Non-Metals combine with hydrogen to form covalent hydrides.
Most metals displace hydrogen from water/steam to form metal hydroxides.	Usually, non-metals do not react with water/steam.

Metals react with Cl to form ionic chlorides

Non-metals react with Cl to form covalent chlorides

Q.15. A man went door to door posing as a goldsmith. He promised to bring back the glitter of old and dull gold ornaments. An unsuspecting lady gave a set of gold bangles to him which he dipped in a particular solution. The bangles sparkled like new but their weight was reduced drastically. The lady was upset but after a futile argument the man beat a hasty retreat. Can you play the detective to find out the nature of the solution he had used?

Ans. The goldsmith used a solution called Aqua regia which is referred to as royal water in Latin. It is the mixture of concentrated hydrochloric acid and concentrated nitric acid in the ratio of 3:1. Aqua regia is capable of dissolving noble metals like gold and platinum. When upper-layer of dull gold ornament is dissolved they lose their weight.

Q.16. Give reasons why copper is used to make hot water tanks and not steel (an alloy of iron).

Ans. Copper is used to make hot water tanks and not steel (an alloy of iron) because copper does not react with either water or steam, whereas iron reacts with steam to corrode the tank.



4

Carbon and Its Compounds

Intext Questions

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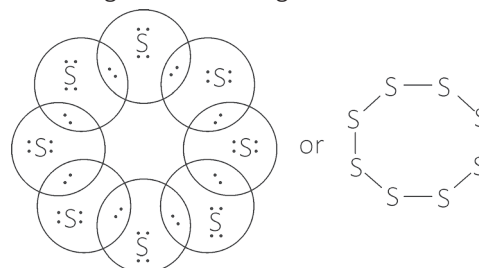
Q.1. What would be the electron dot structure of carbon dioxide which has the formula CO_2 ?

Ans.  or $\text{O}=\text{C}=\text{O}$

Q.2. What would be the electron dot structure of a molecule of sulphur which is made up of eight atoms of sulphur?

Ans. Sulphur atom has 6 electrons in the valence shell. Thus, it requires two more electrons to complete its octet. Each sulphur atom shares two

of its valence electrons, one electron each with the other two sulphur atoms forming an eight member ring as shown in figure below.



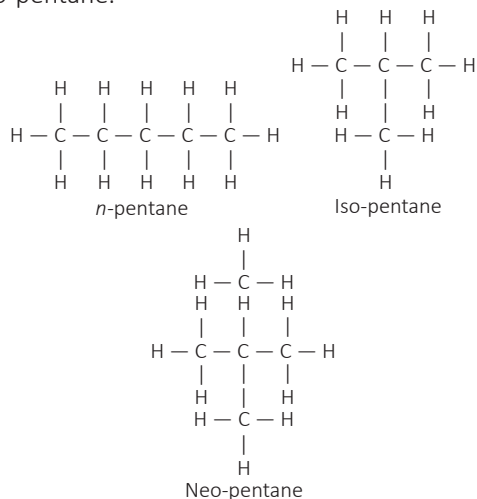
Electron dot structure of sulphur molecule, S_8

Structure of S_8 molecule,

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Q.1. How many structural isomers can you draw for pentane?

Ans. Three, these are n-pentane, iso-pentane and neo-pentane.



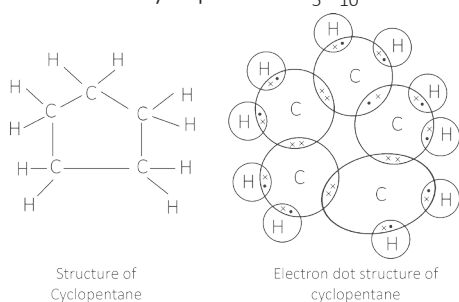
Q.2. What are the two properties of carbon which lead to the huge number of carbon compounds we see around us?

Ans. Two properties of carbon which lead to the huge number of carbon compounds we see around us are as given below:

1. Carbon has four valence electrons which is actually a high number of valency. 2. Covalent bonding happens easily with carbon atoms and numerous others, such as oxygen, chlorine, nitrogen, sulphur, hydrogen, etc.

Q.3. What will be the formula and electron dot structure of cyclopentane?

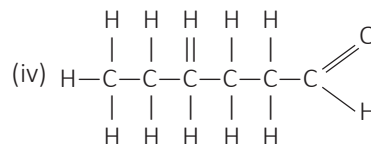
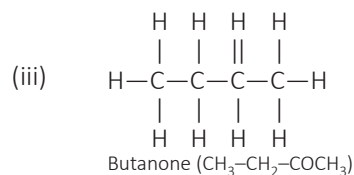
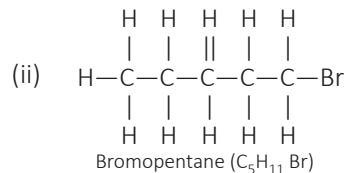
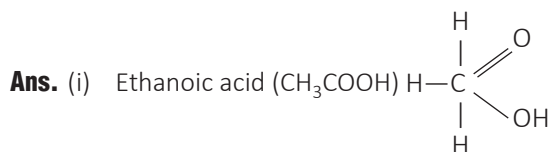
Ans. Formula of Cyclopentane C₅H₁₀



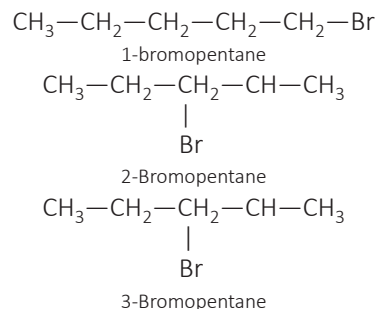
Q.4. Draw the structures for the following compounds:

- (i) Ethanoic acid (ii) Bromopentane
(iii) Butanone (iv) Hexanal

Are structural isomers possible for bromopentane?

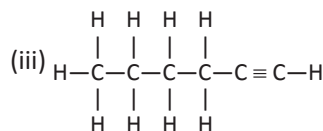
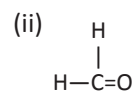


Yes, the structural isomers of bromopentane are possible:



Q.5. How would you name the following compounds:

(i) CH₃-CH₂-Br

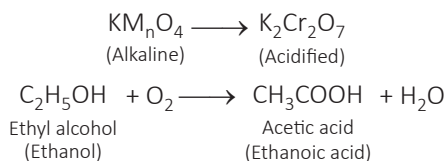


Ans. (i) Bromoethane (ii) Methanal (iii) Hex-1-yne or Hexyne.

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Q.1. Why is the conversion of ethanol to ethanoic acid an oxidation reaction?

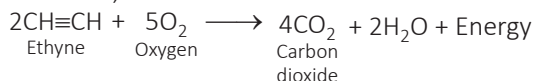
Ans. The conversion of ethanol to ethanoic acid is given in the following reaction:



Ethanol (Ethyl alcohol) contains one atom of oxygen and that of acetic acid contains two atoms of oxygen. Since oxidation involves addition of oxygen, thus, conversion of ethyl alcohol to ethanoic acid is an oxidation reaction. Alternatively, a molecule of ethanol contains six hydrogen atoms and that of ethanoic acid contains four hydrogen atoms. Since oxidation involves removal of hydrogen, thus, conversion of ethyl alcohol to ethanoic acid is an oxidation reaction.

Q.2. A mixture of oxygen and ethyne is used for welding. Can you tell why do you think a mixture of ethyne and air is not used?

Ans. Ethyne is an unsaturated hydrocarbon. Hence, combustion of ethyne in air produces a yellow flame with a lot of black smoke due to the presence of unburnt carbon in it. Due to incomplete combustion, heat thus, produced is also very low and a high temperature generally required for welding cannot be attained. Thus, to ensure complete combustion and to obtain a high temperature required for welding, a mixture of ethyne and oxygen is used instead of ethyne and air. That is,

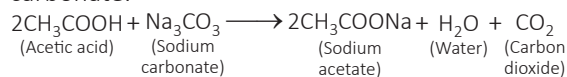


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Q.1. How would you distinguish experimentally between an alcohol and a carboxylic acid?

Ans. In reaction with sodium carbonate, carboxylic acids produce carbon dioxide gas which turns lime water milky, whereas alcohols do not give this reaction. This experiment can be used to distinguish alcohol and carboxylic acid.

The reaction of the carboxylic acid with sodium carbonate:



Q.2. What are oxidizing agents?

Ans. Oxidizing agents are the substances which give oxygen to another substances or which remove hydrogen from a substance. For example, acidic $\text{K}_2\text{Cr}_2\text{O}_7$ is an oxidizing agent that converts (oxidizes) ethanol into ethanoic acid.

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Q.1. Would you be able to check if water is hard by using a detergent?

Ans. No, it is not possible to check the hardness, i.e., whether water is hard or not by using detergents. Hardness of water can only be checked by using soaps.

Q.2. People use a variety of methods to wash clothes. Usually after adding the soap, they beat the clothes on a stone, or beat them with a paddle, scrub with a brush or the mixture is agitated in a washing machine. Why is agitation necessary to get clean clothes?

Ans. On soaking the dirty clothes in soap solution, soap micelles containing the oily dirt at the centre are formed. In these micelles, there is attraction of soap both by the oily dirt and water. As a result of this, the surface tension of water decreases and a stable emulsion of oil in water is formed. In order to wash away the loosened dirt particles in form of micelles from the surface of the cloth, the cloth is either scrubbed mechanically or beaten on a surface of stone or spin in a washing machine.

NCERT Exercise

Q.1. Ethane, with the molecular formula C_2H_6 has:

- (a) 6 covalent bonds (b) 7 covalent bonds
(c) 8 covalent bonds (d) 9 covalent bonds.

Ans. (b) 7 covalent bonds

Q.2. Butanone is a four carbon compound with the functional group:

- (a) Carboxylic acid (b) Aldehyde
(c) Ketone (d) Alcohol.

Ans. (c) Ketone

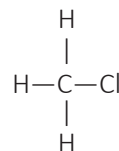
Q.3. While cooking, if the bottom of the vessel is getting blackened on the outside, it means that:

- (a) The food is not cooked completely
(b) The fuel is not burning completely
(c) The fuel is wet
(d) The fuel is burning completely.

Ans. (b) The fuel is not burning completely.

Q.4. Explain the nature of the covalent bond using the bond formation is CH_3Cl .

Ans. The bond structure of CH_3Cl is:

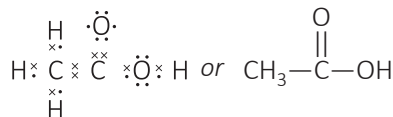


The type of bond in CH_3Cl is single covalent bond.

Q.5. Draw the electron dot structures for:

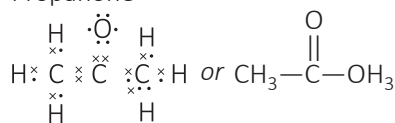
- (a) ethanoic acid (b) H_2S
(c) propanone (d) F_2

Ans. (a) Ethanoic acid (CH_3COOH)



- (b) H_2S $\text{H} \times \text{S} \times \text{H}$ or $\text{H}-\text{S}-\text{H}$

- (c) Propanone



- (d) F_2 $\cdot\ddot{\text{F}}\cdot \times \cdot\ddot{\text{F}}\cdot$ or $\text{F}-\text{F}$

Q.6. What is a homologous series? Explain with an example.

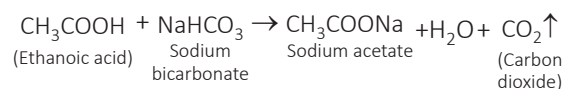
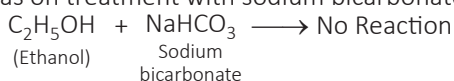
Ans. It is a group of members of same class of organic compounds having similar chemical properties, they have same general formula. They have same functional group, when arranged in the ascending order of molecular mass they differ by 14 u or $-\text{CH}_2$ group.

Example: Alkane has general formula $\text{C}_n\text{H}_{2n+2}$

- (i) CH_4 Methane (ii) C_2H_6 Ethane
(iii) C_3H_8 Propane (iv) C_4H_{10} Butane
(v) C_5H_{12} Pentane

Q.7. How can ethanol and ethanoic acid be differentiated on the basis of their physical and chemical properties?

Ans. Ethanol has pleasant smell and ethanoic acid has pungent smell. Ethanol does not react with sodium bicarbonate whereas ethanoic acid gives CO_2 gas on treatment with sodium bicarbonate.



Q.8. Why does micelle formation take place when soap is added to water? Will a micelle be formed in other solvents such as ethanol also?

Ans. There are two ends of a soap molecule which have different properties, one end is polar in nature, i.e., hydrophilic end is water soluble, whereas the other end is non-polar in nature, i.e., hydrophobic end is insoluble in water. On addition of soap to water, the polar ends get dissolved in

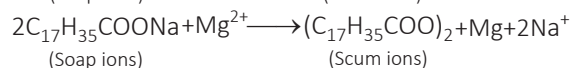
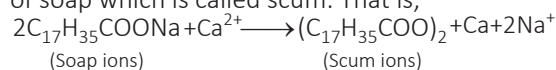
water while the non-polar ends get dissolved in each other. Due to this, reason spherical ionic micelles are produced. As soap is soluble in ethanol, thus, micelle formation does not occur.

Q.9. Why are carbon and its compounds used as fuels for most applications?

Ans. When carbon is burnt in presence of excess of air or oxygen, it forms carbon dioxide. During the formation of CO_2 , a large amount of heat and light is released. Further, once ignited, carbon and its compounds keep on burning without needing additional heat energy. Thus, carbon and its compounds are used as fuels for most applications.

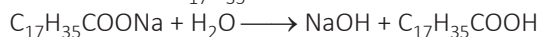
Q.10. Explain the formation of scum when hard water is treated with soap.

Ans. Hard water contains calcium and magnesium ions these combine with soap molecules to form white precipitate of calcium and magnesium salts of soap which is called scum. That is,



Q.11. What change will you observe if you test soap with litmus paper (red and blue)?

Ans. Soaps are mildly alkaline in nature. Since soap solution ionizes in water to form Na^+ and $\text{C}_{17}\text{H}_{35}\text{COO}^-$, Na^+ ions combine with OH^- ions of water to form NaOH and $\text{C}_{17}\text{H}_{35}\text{COO}^-$ combines with H^+ to form $\text{C}_{17}\text{H}_{35}\text{COOH}$.

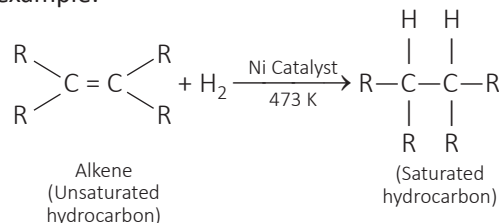


Thus, the soap solution is slightly alkaline in nature. Hence, it turns red litmus blue. However, it does not have any effect on blue litmus.

Q.12. What is hydrogenation? What is its industrial application?

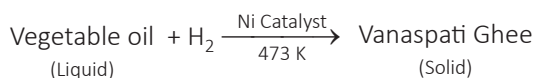
Ans. Addition of hydrogen to unsaturated hydrocarbons in presence of a catalyst such as nickel or palladium to give saturated hydrocarbons is called hydrogenation.

For example:



Industrial application: The process of hydrogenation is used in industry to convert

vegetable oils to Vanaspati Ghee.



Q.13. Which of the following hydrocarbons undergo addition reactions?

C_2H_6 , C_3H_8 , C_3H_6 , C_2H_2 , and CH_4

Ans. As we know that only unsaturated hydrocarbons undergo addition reactions. Since out of the given hydrocarbons only C_3H_6 (propene) and C_2H_2 (ethyne) are unsaturated. Thus, these two hydrocarbons undergo addition reactions.

Q.14. Give a test that can be used to differentiate between saturated and unsaturated hydrocarbons.

Ans. Bromine water test is usually used to differentiate between saturated (alkanes) and

unsaturated (alkenes) compounds. Unsaturated compound decolourises the red-brown colour of bromine water whereas saturated compound does not decolourise bromine water solution.

Q.15. Explain the mechanism of cleaning action of soaps.

Ans. Micelle formation takes place when soap is added to water because the hydrocarbon chains of soap molecules are hydrophobic which are insoluble in water but the ionic ends of soap molecules are hydrophilic and hence, soluble in water. Another point to be noted is that micelle formation will not take place when soap is added to organic solvents like ethanol because the hydrocarbon chains of soap molecules are soluble in organic solvents like ethanol.



5

Life Processes

Intext Questions

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Q.1. Why is diffusion insufficient to meet the oxygen requirements of multicellular organisms like humans?

Ans. In multicellular organisms like humans the requirement of oxygen is very high. Diffusion is a slow process and is insufficient to deliver enough oxygen to all parts of the body. Each and every cell of the body requires oxygen and by diffusion oxygen cannot reach to deep seated cells, because in multicellular organism only the cells present on the surface layer are in direct contact with surrounding environment. Moreover the outer layer of skin is made of dead cells which are impermeable to oxygen.

Q.2. What criteria do we use to decide whether something is alive?

Ans. Walking, breathing, growth and other visible changes can be used to determine whether something is alive or dead. However, some living things will have changes that are not visible to our eye; Hence, the presence of the life process is a fundamental criterion to decide whether

something is alive.

Q.3. What are outside raw materials used by an organism?

Ans. Raw materials used by organisms differ according to their mode of nutrition.

These are: • Autotrophs—Carbon dioxide, water and minerals, for photosynthesis. • Heterotrophs—Readymade organic food and water. • Oxygen is needed by both autotrophs and heterotrophs for the process of respiration.

Q.4. What processes would you consider essential for maintaining life?

Ans. Life processes such as respiration, digestion, excretion, circulation and transportation are essential for maintaining life.

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Q.1. What are the differences between autotrophic nutrition and heterotrophic nutrition?

Ans. In autotrophic nutrition an organism prepares its food with the help of simple raw materials like carbon dioxide and water. While in heterotrophic nutrition organisms get readymade organic food prepared by other organisms.

Q.2. Where do plants get each of the raw materials required for photosynthesis?

Ans. Plants require the following raw material

for photosynthesis: • CO_2 is obtained from the atmosphere through stomata • Water is absorbed by plant roots from the soil. • Sunlight is an essential raw material for photosynthesis • Nutrients are obtained from soil by plant roots

Q.3. What is the role of the acid in our stomach?

Ans. The acid (HCl) present in the stomach dissolves food particles and creates an acidic medium. In an acidic environment, protein-digesting enzymes, pepsinogen, are converted into pepsin. HCl in the stomach also acts as a protective barrier against many disease-causing pathogens.

Q.4. What is the function of digestive enzymes?

Ans. Digestive enzymes are biological catalysts. They convert complex, larger and insoluble food molecules into simple, smaller and soluble molecules. In simple words digestive enzymes make the food usable by the organism.

Q.5. How is the small intestine designed to absorb digested food?

Ans. The small intestine has small projections called microvilli, which increase the surface volume, making the absorption more effective. Within the villi, there are numerous blood vessels that absorb digested food and carry it to the bloodstream. Blood transports food to each part of our body.

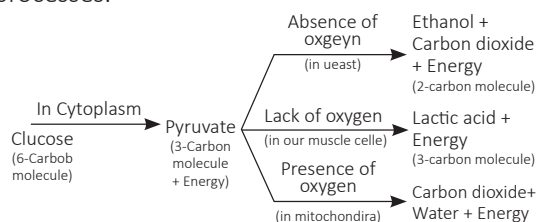
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Q.1. What advantage over an aquatic organism does a terrestrial organism have with regard to obtaining oxygen for respiration?

Ans. Terrestrial organisms breathe by using atmospheric oxygen, whereas aquatic organisms take oxygen dissolved in water. The oxygen level is high in the atmosphere when compared to oxygen in the water. Hence, terrestrial organisms need not breathe fast to obtain organisms, whereas aquatic organisms need to breathe faster to get the required oxygen.

Q.2. What are the different ways in which glucose is oxidized to provide energy in various organisms?

Ans. In the cytoplasm, Glucose is first broken down into 3 carbon compound called pyruvate by the process known as Glycolysis. Further breakdown takes place in different organisms by different processes.



Q.3. How is oxygen and carbon dioxide transported in human beings?

Ans. In human beings the oxygen and carbon dioxide are transported in following manner

• Oxygen is transported from lungs to various tissues by haemoglobin. Haemoglobin has a very high affinity with oxygen and forms oxyhaemoglobin with oxygen. • Carbon dioxide is more soluble in water than oxygen. Therefore, most of the carbon dioxide produced during respiration is transported in dissolved form in our body (as bicarbonate ions).

Q.4. How are the lungs designed in human beings to maximise the area for exchange of gases?

Ans. Our lungs are two lobes, which provide a spongy, elastic, and large surface area. The lungs contain millions of alveoli, which are thin-walled sacs designed for gaseous exchange. The presence of such a large number of alveoli provides a vast surface area for gas exchange. These adaptations allow for efficient exchange of oxygen and carbon dioxide during respiration.

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Q.1. What are the components of the transport system in human beings? What are the functions of these components?

Ans. The heart, blood and blood vessels are the main components of the transport system in human beings.

Functions of these components

• **Heart:** The heart pumps oxygenated blood throughout the body. It receives deoxygenated blood from the various body parts and sends impure blood to the lungs for oxygenation. • **Blood:** Blood transports oxygen, nutrients, CO_2 , and nitrogenous wastes. • **Blood vessels:** Blood vessels, arteries and veins carry blood to all parts of the body.

Q.2. Why is it necessary to separate oxygenated and deoxygenated blood in mammals and birds?

Ans. The mammals and birds are warm blooded animals. To maintain their body temperature their energy requirements are very high. In other words, they have high metabolic rate. To fulfil this they need a highly efficient supply of oxygen to the body cells. This can be done by keeping the oxygenated and deoxygenated blood separated in mammals and birds.

Q.3. What are the components of the transport system in highly organized plants?

Ans. Plants have two transport system-xylem and phloem. Xylem transports water and minerals. Phloem transports sugars and amino acids dissolved in water.

Q.4. How are water and minerals transported in plants?

Ans. Water and minerals are transported in plants by vascular tissue xylem. Transpiration creates a suction pressure which forces water into the xylem cells of roots. This results in a steady movement of water from the root xylem to all parts of the plant connected through conducting interconnected water-conducting channels.

Q.5. How is food transported in plants?

Ans. Food is transported in plants by a special organ called the phloem. Phloem transports food materials from leaves to different parts of a plant. Transportation of food in phloem is achieved by the expenditure of energy from ATP. This increases osmotic pressure in the tissue, causing water to move. This pressure moves material in the Phloem to the tissues with less pressure. This helps in the transportation of food materials as per the needs. Example, Sucrose

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Q.1. Describe the structure and functioning of nephrons.

Ans. Nephrons are the filtration units of the kidney, which are large in numbers. Some substances in the initial filtrate, such as glucose, amino acids, salts and a major amount of water, are selectively re-absorbed as the urine flows along the tube.

The main components of Nephrons are

• Glomerulus • Bowman's Capsule • Long Renal Tube • Structure of Nephron

Function of Nephron

The function of the nephron is to make urine by the filtration of blood. The blood brought by renal artery is filtered in the glomerulus of the Bowman's capsule. By this filtration, nitrogenous wastes along with many useful substances like glucose, amino acids, minerals and lot of water reach the Bowman's capsule and tubule. In the tubule the useful substance are reabsorbed. Lot of water is also reabsorbed. Whatever being left in tubule is drained into collecting duct. It forms urine.

Q.2. What are the methods used by plants to get rid of excretory products?

Ans. Plants get rid of excretory products in following manner • In plants oxygen is a byproduct

of photosynthesis and carbon dioxide and water are waste products of respiration. The plants get rid of these gaseous waste products through stomata or lenticels. Water is also lost in the process of transpiration. • Plants have lot of dead tissue. Some of the waste are stored in dead tissue like cork, bark, wood etc. • Some wastes are sent to parts like mature leaves and fruits, which are shed periodically. • Some wastes are kept in cellular vacuoles. • Some wastes are secreted in the form of gums and resin. • Some are released into soil by roots.

Q.3. How is the amount of urine produced regulated?

Ans. About 180 litres of fluid is collected in human nephrons daily after filtration. But most of this water is re-absorbed by the tubule. The amount of urine produced is regulated by the process of re-absorption. If input of water is more then there is less re-absorption of water. When water is to be conserved in the body, reabsorption increases. This is called Osmoregulation.

NCERT Exercise

Q.1. The kidneys in human beings are a part of the system for:

- (a) nutrition (b) respiration
- (c) excretion (d) transportation

Ans. (c) excretion

Q.2. The xylem of plants are responsible for

- (a) transport of water (b) transport of food
- (c) transport of amino acids
- (d) transport of oxygen

Ans. (a) transport of water

Q.3. The autotrophic mode of nutrition requires.

- (a) carbon dioxide and water (b) chlorophyll
- (c) sunlight (d) all of these

Ans. (d) all of these

Q.4. The breakdown of pyruvate to give carbon dioxide, water and energy takes place in:

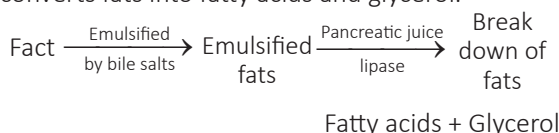
- (a) cytoplasm (b) mitochondria
- (c) chloroplast (d) nucleus

Ans. (b) mitochondria.

Q.5. How are fats digested in our bodies? Where does this process take place?

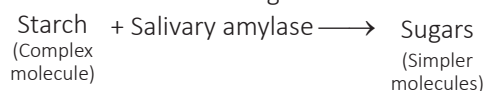
Ans. Digestion of fats takes place in the small intestine. Bile juice secreted by the liver poured in the intestine along with pancreatic juice. The bile salts present in the bile juice emulsify the large globules of fats. Therefore, by emulsification large

globules break down into fine globules to provide larger surface area to act upon by the enzymes. Lipase enzyme present in the pancreatic juice causes break down of emulsified fats. Glands present in the wall of small intestine secrete intestinal juice which contains lipase enzyme that converts fats into fatty acids and glycerol.



Q.6. What is the role of saliva in the digestion of food?

Ans. Saliva contains salivary amylase enzyme that breaks down starch into sugars like maltose.



Saliva keeps the mouth cavity clean and moistens the food that help in chewing and breaking down the big pieces of food into smaller ones.

Q.7. What are the necessary conditions for autotrophic nutrition and what are its by products?

Ans. In autotrophic nutrition green plants make their food in the process of photosynthesis. This food is prepared from simple inorganic raw materials. The requirement for autotrophic nutrition are (a) raw materials like carbon dioxide and water. (b) green coloured pigment chlorophyll for trapping energy (present in chloroplast).

(c) source of energy—sunlight.

By product of photosynthesis is oxygen.

Q.8. What are the differences between aerobic and anaerobic respiration? Name some organisms that use the anaerobic mode of respiration.

Ans.

Aerobic respiration	Anaerobic respiration
The process takes place in the presence of free oxygen.	The process takes place in the absence of free oxygen.
The products of aerobic respiration are CO ₂ , water and energy.	The products of anaerobic respiration are ethyl alcohol, CO ₂ and a little energy.
The first step of aerobic respiration (glycolysis) takes place in the cytoplasm, while the next step takes place in mitochondria.	Even in anaerobic respiration, the first step takes place in the cytoplasm, while the next step takes place in mitochondria.

The process of aerobic respiration takes place in all higher organisms.

In this process, the glucose molecules are incompletely broken down.

In this process, complete oxidation of glucose takes place.

The process of anaerobic respiration takes place in lower organisms like yeast, some species of bacteria and parasites like tapeworms.

Q.9. How are the alveoli designed to maximize the exchange of gases?

Ans. Structural features of alveoli to maximize the exchange of gases. • There are millions of alveoli in lungs and they have vast surface area (If spreaded they cover about 802 m area). So they have very large surface area. • Their wall is just one cell thick to facilitate diffusion. • The alveoli are richly supplied by blood (they are covered by a network of capillaries). • They are kept moist and are permeable to gases.

Q.10. What would be the consequences of deficiency of haemoglobin in our bodies?

Ans. Haemoglobin is a protein responsible for the transportation of oxygen to the body cells for cellular respiration. A deficiency of Haemoglobin can affect the oxygen-carrying capacity of RBCs. This lead to a lack of oxygen in our body cells. Haemoglobin deficiency leads to a disease called anaemia.

Q.11. Describe double circulation of blood in human beings. Why is it necessary?

Ans. Double circulation means, in a single cycle, blood goes twice in the heart. The process helps in separating oxygenated and deoxygenated blood to maintain a constant body temperature. (i) The right ventricle pumps deoxygenated blood into the lungs, where it is oxygenated. The oxygenated blood is brought back to the left atrium, and from there, it is pumped into the left ventricle. Finally, blood goes into the aorta for systemic circulation.

(ii) The oxygenated blood is pumped to various parts of the body from the left ventricle. The deoxygenated blood from different parts of the body passes through the vena cava to reach the right atrium. The right atrium transfers the blood into the right ventricle.

Q.12. What are the differences between the transport of materials in xylem and phloem?

Ans. Differences between Transport by Xylem and Phloem

S. No.	Transport by Xylem	Transport by Phloem
1.	Inorganic substances like water and minerals are transported.	Organic food prepared in photosynthesis is transported.
2.	Transport does not require energy (It takes place by simple physical forces).	Energy is needed for transport of food.
3.	It is unidirectional (only upward transportation).	Movement is in both the directions (upward and downwards).
4.	Xylem is mainly formed of dead cells, vessels and tracheids.	Phloem is mainly made of living cells. Sieve tube helped by companion cells.

Q.13. Compare the functioning of alveoli in the lungs and nephrons in the kidneys with respect to their structure and functioning.

Ans. Differences between alveoli and nephrons.

S. No.	Alveoli	Nephrons
1.	Shape —Like bunches of grapes individual alveolus is a sac or balloon like structure.	Shape —Nephron is tube like with a cup shaped mouth.
2.	Function —Exchange of gases by diffusion to get oxygen and release out carbon dioxide.	Function —Filtration of blood and selective reabsorption of filtrate to produce urine.



6

Control and Coordination

Intext Questions

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Q.1. What is the difference between a reflex action and walking?

Ans. Reflex action is a fast automatic, involuntary response to a stimulus. Such actions are not in our conscious control. One more thing about reflex action is that the same stimulus always produces the same response. On the other hand, walking is in our conscious control. We can increase or decrease the speed of walking, we can change the direction. Walking is a coordinated activity of many organs of our body while a reflex action involves a single reflex arc. Walking may become a conditioned reflex.

Q.2. What happens at the synapse between two neurons?

Ans. At the synapse between two neurons, electric signals are converted into chemicals that can easily cross over the gap and pass on the chemical messenger to the next neuron where it is converted back to electrical signal.

Q.3. Which part of the brain maintains posture and equilibrium of the body?

Ans. Cerebellum, which is a part of the brain, is responsible for controlling the motor functioning. Hence, it is the part engaged in the maintenance of posture and equilibrium of the body.

Q.4. How do we detect the smell of an agarbatti (incense stick)?

Ans. The smell of an agarbatti is detected by the nose. The olfactory receptors present in the nose sends electrical signal to the fore brain. The fore brain interprets this signal as the smell of the incense stick.

Q.5. What is the role of the brain in reflex action?

Ans. Conscious part of brain is not involved in reflex action as reflex actions are involuntary actions. Certain reflexes like breathing, coughing are controlled by hind brain, but here too thoughts or conscious part of brain is not involved. However, as an information it goes to brain for making memory.

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Q.1. What are plant hormones?

Ans. The chemical substances produced by plants to control and coordinate various events of their life cycle like germination of seeds, growth, development, flowering, fruiting and response to stimuli are called plant hormones. Examples are—auxins, gibberellins, cytokinins and abscisic acid etc.

Q.2. How is the movement of leaves of the sensitive plant different from the movement of a shoot towards light?

Ans. Movement of sensitive plant is an example of seismonasty while movement of a shoot towards light is an example of phototropism.

S. No.	Movement of Sensitive Plant	Movement of Shoot towards Light
1.	It is nastic movement.	It is a tropic movement Phototropism.
2.	Non-directional movement (It does not depend on direction of stimulus).	Directional movement (It depends on direction of the stimulus).
3.	Stimulus is touch, shaking or heat.	Stimulus is light.
4.	It is a quick response.	It is a slow response.

Q.3. Give an example of a plant hormone that promotes growth.

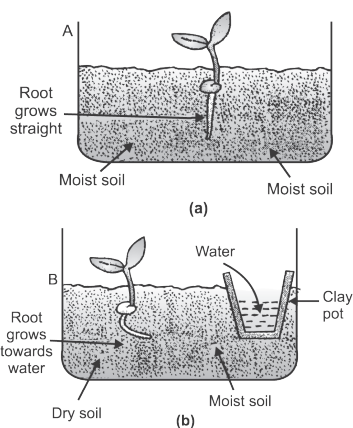
Ans. Auxins and Gibberellin are the hormone responsible for the growth of plant. Auxins are responsible for the cell elongation in shoot and also regulate growth. Gibberellin is responsible for stem elongation and germination.

Q.4. How do auxins promote the growth of a tendril around a support?

Ans. Auxin is a plant hormone. When the tip of the tendril touches a support, then the auxins present on tips moves to the side of tip which is away from the support, so due to more auxins in its tendrils away from the support grows faster.

Q.5. Design an experiment to demonstrate hydrotropism.

Ans. Hydrotropism can be demonstrated by following simple experiment: Two glass trough A and B are filled with soil. For this purpose large size trough are taken. In first trough a small seedling is planted. A similar, equally healthy seedling is planted in second trough also. But in this trough, before planting the seedling, a small clay pot is also placed beneath the soil surface. This pot is filled with water.



Demonstration of Hydrotropism

The plant of first trough (a) is watered daily. But no water is given to plant of second trough (b). Such set up is left as such for few days. After a few days when we dig up two seedlings carefully, we notice that the roots of the plant A are straight. The root of second plant is found bent towards the pot of water. This experiment clearly demonstrates that the roots are positively hydrotropic. This also proves that hydrotropism is stronger than geotropism.

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Q.1. How does chemical coordination take place in animals?

Ans. Chemical coordination takes place in animals with the help of chemical messengers called hormones. Hormones are the chemicals that are secreted by specific endocrine glands. Hormones regulate the growth, development and homeostasis of the animals.

Q.2. Why is the use of iodized salt advisable?

Ans. Iodine is required by thyroid gland to make thyroxine hormone. This thyroxine hormone plays a major role in carbohydrate, fat and protein metabolism of our body. Lack of iodine leads to deficiency of thyroxine hormone which, ultimately results in goitre. As thyroxine is crucial for physical and mental development of our body, iodised salt is advised. Iodine can be easily supplied in the form of iodised salt. As salt is used by all people the intake of iodine can be ensured.

Q.3. How does our body respond when adrenaline is secreted into the blood?

Ans. The heart beat increases when adrenaline is secreted into the blood so that more oxygen is supplied to our muscles. The blood supply to the digestive system and skin decreases because the small arteries around the muscles of these organs contract. This turns the direction of blood towards our skeletal muscles. The breathing rate also increases due to the contractions of the diaphragm and rib muscles. All these responses enable us to face the situations of fear and anger.

Q.4. Why are some patients of diabetes treated by giving injections of insulin?

Ans. Insulin hormone regulates blood sugar levels. If this is not secreted in proper amounts, the sugar level in the blood rises. This causes many harmful effects.

To treat harmful effects of increased level of blood sugar, the diabetic patients are treated by giving injections of insulin.

NCERT Exercise

Q.1. Which of the following is a plant hormone?

- (a) insulin (b) thyroxin
(c) oestrogen (d) cytokinin.

Ans. (d) cytokinin.

Q.2. The gap between two neurons is called a

- (a) dendrite (b) synapse
(c) axon (d) impulse

Ans. (b) synapse.

Q.3. The brain is responsible for

- (a) thinking
(b) regulating the heart beat
(c) balancing the body (d) all these.

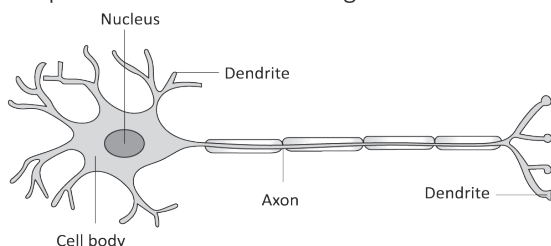
Ans. (d) all these

Q.4. What is the function of receptors in our body? Think of situations where receptors do not work properly. What problems are likely to arise?

Ans. Receptors are present throughout our body – mainly in sense organs. Receptors collect the information about changes that happen around us and send the signal/information to the brain which responds to the change detected. When receptors do not work properly, the environmental stimuli are not able to create nerve impulses and body does not respond.

Q.5. Draw the structure of a neuron and explain its function.

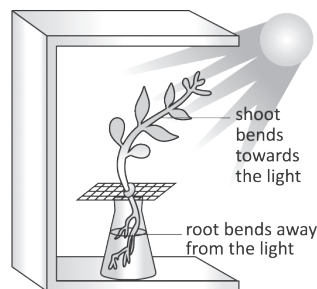
Ans. Neurons are the fundamental unit of the nervous system. Neurons are also called as nerve cells. The main function of the neurons is to pass the receiving information and send appropriate signals to the rest parts of the body. The signals received are in the form of electrical signals. Neuron comprises of dendrite, axon and cell body. Dendrites receives messages from the surrounding and sends it to the cell body. Cell body consists of nucleus, mitochondria and other organelles. Axon transmits the message away from the cell body and pass it to the next receiving neuron.



Structure of a Typical Neuron

Q.6. How does phototropism occur in plants?

Ans. Directional movement and growth of plant in response to light is called as phototropism. Phototropism occurs due to increased auxin on the dark side and decreased auxin on the illuminated side. Because of presence of more auxin, a leaf in the darker side grows faster causing it to bend towards the source of light.



Response of the plant to the direction of light

Q.7. Which signals will get disrupted in case of a spinal cord injury?

Ans. Spinal cord has nerve tracts of sensory and motor nerves. Spinal cord takes sensory messages to brain and also carries messages of brain to effector organs especially in lower part of our body. In case of spinal cord injury both sensory and motor signals will get disturbed. (Paralysis of body part). It will affect reflex actions also.

Q.8. How does chemical coordination occur in plants?

Ans. Chemical coordination in plants takes place with the help of plant hormones. In most of the regions where division takes place (meristematic regions) stimuli cells secrete chemical compounds (hormone). These substances identify the information by stimulating the other nearby cells and communicating the information.

Q.9. What is the need for a system of control and coordination in an organism?

Ans. An organism needs control and coordination system for the following functions :

- To save the body of the organisms from the harmful changes in the environment.
- To control the speed of voluntary and involuntary actions.
- To have the capability to think and learn for responding to any stimuli.

Q.10. How are involuntary actions and reflex actions different from each other?

Ans. Involuntary actions are not controlled by us

they are independent process means there is no stimulus involved in these actions but reflex action is also involuntary in nature but they involves stimulus means functions or respond according to it.

For example,

- **Involuntary actions:** heartbeat, breathing process, etc.
- **Reflex actions:** stepping out in bright light, changes in size of pupil of eyes.

Q.11. Compare and contrast nervous and hormonal mechanisms of control and coordination in animals.

Ans. Compare between hormonal mechanisms are as follow:

S. No.	Nervous control	Hormonal Control
1.	It consists of nerve impulses between PNS, CNS and Brain.	It consists of the endocrine system which secretes hormones directly into blood.
2.	Here response time is very short.	Here response time is very long.
3.	Nerve impulses are not specific in their action.	Each hormone has specific actions.

4.	The flow of information is rapid.	The flow of information is very slow.
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Q.12. What is the difference between the manner in which movement takes place in sensitive plant and the movement in our legs?

Ans. The difference between the movement in sensitive plant and our legs are as follows:

S. No.	Movement in sensitive plants	Movement in our legs
1.	The movement in a sensitive plant is a response to stimulus (touch) which is an involuntary action.	Movement in our legs is a voluntary action.
2.	No special tissue is there for the transfer of information.	A complete system CNS and PNS is there for the information exchanges.
3.	Plant cells do not have specialized protein for movements.	Animal cells have specialized protein which help muscles to contract.



7

How do Organisms Reproduce?

Intext Questions

Page-114

Q.1. What is the importance of DNA copying in reproduction?

Ans. DNA copying has following importance in reproduction: • It maintains the characteristics of species. • It maintains the continuity of life. • From this, the characteristics and features of organisms are transformed to their progeny. • It produces variations in organisms which is the basis of evolution of new species.

Q.2. Why is variation beneficial to the species but not necessarily for the individual?

Ans. The reason why the variation is beneficial to the species rather than individuals is because sometimes the climatic changes have a drastic effect on the species, which makes their survival

difficult. For examples, if the temperature of the water body increases, there might be certain species of microorganisms which might die. This may result in disturbance in the environment. So, variation is beneficial to species and not for the individuals.

Page-119

Q.1. How does binary fission differ from multiple fission?

Ans. Differences between binary fission and multiple fission are as follows

Binary fission

- It is the process of division of the parent body into two small, nearly equal sized daughter individuals.
- The nucleus divides once and is immediately followed by cytoplasmic division.
- It occurs under favourable conditions.

(iv) For example, Amoeba, Paramecium

Multiple fission

(i) It is the process of division of the parent body into many small daughter individuals simultaneously.

(ii) The nucleus divides several times, but is not followed by cytoplasmic division.

(iii) It occurs under unfavorable conditions.

(iv) For example, Plasmodium, Amoeba (under unfavourable conditions)

Q.2. How will an organism be benefited if it reproduces through spores?

Ans. Fungi and many lower plants reproduce by spore formation. The spore formation is beneficial because—

(i) Spores are generally produced in large number. Therefore, number of the organisms increases quickly. This is the main aim of reproduction.

(ii) Spores can survive in unfavourable conditions as they have a hard protective wall.

(iii) Spores are light in weight, hence carried to distant places (disseminate) through wind.

Q.3. Can you think of reasons why more complex organisms cannot give rise to new individuals through regeneration?

Ans. Regeneration is a process in which simple animals like Hydra and Planaria if cut into pieces would grow and develop into whole new organisms. Their simple bodies can be regenerated from a mass of cells but complex organisms like vertebrate animals have complex level of body organization. They develop inside the egg or womb. Their bodies have many complex tissues and differentiated cells. Regeneration requires de-differentiation, differentiation and re-differentiation. Differentiated cells of complex organisms do not have power of regeneration. Moreover, regeneration is not considered as a method of reproduction.

Q.4. Why is vegetative propagation practised for growing some types of plants?

Ans. The vegetative propagation is used to grow plants which do not produce seeds, like potato, rose, sugarcane etc.

(i) It is also used to produce plant which produce non-viable seeds like grass.

(ii) Vegetative propagation is a fast method of propagation, therefore, it is used to develop a lawn of grass. Fruit trees also develop fruit quickly if grown by vegetative method like cutting.

(iii) In many plants, the growers want to preserve

the desirable characteristics like taste and flavour of a mango variety. This may be lost if grown by sexual reproduction. Therefore, grown by vegetative method.

Q.5. Why is DNA copying an essential part of the process of reproduction?

Ans. Information of all the characteristics of an organism is stored in the DNA. The process of reproduction is production of same type of offspring by an individual. The design and blueprint of all the characteristics is transmitted to the next generation in the form of DNA only. That is why a mechanism of copying is required so that the blueprint of information can be provided to new generation.

Page-126

Q.1. How is the process of pollination different from fertilization?

Ans. Difference between pollination and fertilization.

Pollination	Fertilization
Pollination is the process of transferring pollen grains on the stigma of a flower.	Fertilization is the process wherein the male and female germ cell of a flower fuse to produce a zygote.
The site of pollination is the stigma of the flower.	The site of fertilization is the ovary of the flower.
Pollination sometimes requires external pollinating agents like birds, insects etc.	Fertilization requires no such external agents.
Pollination takes place at the early stages of reproduction.	Fertilization takes place after pollination.

Q.2. What is the role of seminal vesicles and prostate gland?

Ans. Sperms are living and highly active cells. They have a tail (flagellum) to help them move. For their movement these male gametes need energy and a fluid medium to move in. Both of these substances (nutrient source and fluid medium) are provided by seminal vesicles and prostate gland.

Q.3. What are the changes seen in girls at the time of puberty?

Ans. Changes seen in girls at the time of puberty are: • Hair growth appears in genital area. • Hair growth in other areas like underarms, face, hands and legs. • The size of uterus and ovary increases. • The size of the breast increases followed by

darkening of the nipple skin that is present at the tip of the breast. • Beginning of menstrual cycle.

• Appearance of pimples, as there is more oil secretion from the skin.

Q.4. How does the embryo get nourishment inside the mother's body?

Ans. The embryo gets nutrition from the mother's blood with the help of placenta. The placenta is a special tissue formed by foetal as well as maternal tissue. Foetal tissue is in the form of villi and maternal tissue is the lining of uterus having blood spaces. Villi increase the surface area so that lot of nutrients and oxygen can be absorbed from mother's blood. Therefore, the embryo gets nourishment inside the mother's body through placenta.

Q.5. If a woman is using a copper-T, will it help in protecting her from sexually transmitted diseases?

Ans. No, the usage of copper-T cannot stop the contact of body fluids. Hence, it cannot protect her from getting sexually transmitted diseases.

NCERT Exercise

Q.1. Asexual reproduction takes place through budding in:

- (a) Amoeba (b) Yeast
(c) Plasmodium (d) Leishmania.

Ans. (b) Yeast

Q.2. Which of the following is not a part of the female reproductive system in human beings?

- (a) Ovary (b) Uterus
(c) Vas deferens (d) Fallopian tube.

Ans. (c) Vas deferens.

Q.3. The anther contains:

- (a) Sepals (b) Ovules
(c) Pistil (d) Pollen grains

Ans. (d) Pollen grains.

Q.4. What are the advantages of sexual reproduction over asexual reproduction?

Ans. Following are the advantages of sexual reproduction:

(i) The offspring has the characters of both the parents. (ii) The survival of the species is ensured as there are more variations. (iii) The offspring can easily adapt to environmental changes. (iv) It also improves the health of humans.

Q.5. What are the functions performed by testis in human beings?

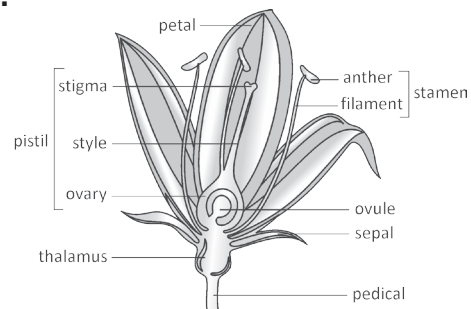
Ans. Testis serves two main functions in human beings: (i) Testis produces male gametes or sperms. (ii) Testis produces male sex hormone testosterone, which is responsible for the development of secondary sexual characters. It also promotes the growth of muscles and bones.

Q.6. Why does menstruation occur?

Ans. The female reproductive system, after the onset of puberty prepares itself for receiving fertilized egg and expected pregnancy. The ovaries release an egg every month. But if the egg is not fertilized, it dies in a day or two. After this there is no use of thickened lining of uterus as well. Therefore, lining of uterus breaks up. So some blood, mucus, some cells, and unfertilized egg are released out of the body through vagina. This is called menstruation. After menstruation the reproductive system again starts its preparation for the next month.

Q.7. Draw a labelled diagram of the longitudinal section of a flower.

Ans.



Q.8. What are the different methods of contraception?

Ans. There are several methods of contraception available to both men and women, including:

(i) **Hormonal methods:** These include oral contraceptives (the pill), injections, patches, and vaginal rings that release hormones to prevent pregnancy.

(ii) **Barrier methods:** These include condoms, diaphragms, cervical caps, and contraceptive sponges that physically block sperm from reaching the egg.

(iii) **Intrauterine devices (IUDs):** These are small, T-shaped devices that are inserted into the uterus to prevent pregnancy.

(iv) **Sterilization:** This includes permanent methods of contraception, such as tubal ligation for women or vasectomy for men.

(v) **Natural family planning:** This involves tracking a woman's menstrual cycle and abstaining from sex during ovulation.

(vi) **Emergency contraception:** This includes the "morning-after pill," which can be taken within a few days after unprotected sex to prevent pregnancy.

(vii) **Fertility awareness methods:** These involve tracking a woman's menstrual cycle and using various methods to identify when she is most likely to conceive, such as basal body temperature monitoring or cervical mucus analysis.

Q.9. How are the modes of reproduction different in unicellular and multicellular organisms?

Ans. Unicellular organisms have very simply design and structure and are made of a single cell. The cell can be multiplied easily. During reproduction this cell produces daughter cells (new organisms) by fission (binary or multiple) or budding. Therefore, asexual reproduction is the main method of reproduction in unicellular organisms. Multicellular organisms have complex body organization. They have a reproductive system made of many organs. Therefore, they use advance method of reproduction and reproduce

sexually by producing gametes.

Q.10. How does reproduction help in providing stability to populations of species?

Ans. Populations are dynamic. Death of existing members of population decreases its size. On the other hand, new organisms are added to population by the process of reproduction. When death rate and birth rates are almost equal the population stabilizes. In other words, reproduction compensates the loss of individuals that occurred due to death. Secondly, reproduction leads to variations. These variations increase the chances of survival of the population and make it stable.

Q.11. What could be the reasons for adopting contraceptive methods?

Ans. The contraceptive methods avoid pregnancy and child birth. These methods are adopted for family welfare. i.e., to keep the size of the family small. They are used to prevent undesirable conception, and to have sufficient gap between two successive births. Some of the contraceptive methods also provide protection from sexually transmitted diseases.



8

Heredity

Intext Questions

Page-129

Q.1. If a trait A exists in 10% of a population of an asexually reproducing species and a trait B exists in 60% of the same population, which trait is likely to have arisen earlier?

Ans. Trait B must have arisen earlier. In asexually reproducing organisms all traits are transferred to the next generation and get accumulated. If only few individuals are sharing the traits it means it must have arisen recently. New traits are in very small proportion than the traits already present. If a large population shows a trait it means that it must have arisen long back.

Q.2. How does the creation of variation in a species promote survival?

Ans. Genetic variations enable the species to better adapt to changes in its environment. Moreover, it is an important force in evolution as it allows

the frequency of alleles to increase or decrease through natural selection. These variations will determine the difference between extinction and continuation of the species.

Page-133

Q.1. How do Mendel's experiments show that traits may be dominant or recessive?

Ans. Mendel took pea plants with contrasting characteristics tall plant and dwarf (or short) plant. On cross pollination, he got all tall plants in first generation (F_1). But by the self-pollination of F_1 tall plants, the plants of second generation consisted of tall and short plants in the ratio of 3:1. On the basis of these experiments, the characteristics appeared in first generation were called dominant (i.e. tall plants) and the characteristics that did not appear were called recessive (dwarf i.e., plants).

Q.2. How do Mendel's experiments show that traits are inherited independently?

Ans. Mendel took two pairs of alternate expression of two traits and carried out dihybrid crosses by crossing them. The traits appeared in first generation were termed as dominant. When he used these F_1 progeny to generate F_2 progeny by self-pollination plants of different types were produced. In some plants both the traits were dominant, while in some plants both were recessive and some plants exhibited mixed traits. This indicates that traits are inherited independently.

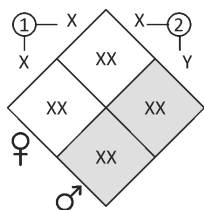
Q.3. A man with blood group A marries a woman with blood group O and their daughter has blood group O. Is this information enough to tell you which of the traits-blood group A or O-is dominant? Why or why not?

Ans. No. The information provided in the question is not enough. We can tell about the trait of F_1 , whether the individuals are dominant or recessive, only if the parents are true breeding. In question it is not mentioned that the parents are homozygous for the trait or heterozygous. For each trait there are two genes in a parent. They segregate during gamete formation and the paired condition is restored by random fusion of gametes. A man having blood group A may have a dominant gene and a recessive gene or he may have both the dominant gene for blood group A. Therefore, the information provided is incomplete.

Q.4. How is the sex of the child determined in human beings?

Ans. The sex of the child in humans is determined by the males. Males have XY chromosomes, while females have XX chromosomes. Hence, if:

(i) The male's X chromosomes combine with the female's X chromosomes, the mother gives birth to a girl. (ii) The male's Y chromosome combines with the female's X chromosome, the mother gives birth to a boy.



NCERT Exercise

Q.1. A Mendelian experiment consisted of breeding tall pea plants bearing violet flowers with short pea plants bearing white flowers. The progeny all bore violet flower, but almost half of

them were short. This suggests that the genetic make-up of the tall parent can be depicted as—

- (a) TTWW (b) TTww
(c) TtWW (d) TtWw

Ans. (c) TtWW.

Explanation: TtWW might be the genetic makeup of the tall parent. Since half the progenies are short, this implies that the parent plant also will have a collection of short genes; all progenies bore violet flowers, further suggesting that violet colour is dominant over white.

Q.2. A study found that children with light-coloured eyes are likely to have parents with light-coloured eyes. On this basis can we say anything about whether the light eye colour trait is dominant or recessive? Why or why not?

Ans. Knowledge of at least 3 generations is required to find if an attribute is dominant or recessive. Hence, it is not possible to identify if the given trait is dominant or recessive.

Q.3. Outline a project which aims to find the dominant coat colour in dogs.

Ans. Dogs have a certain set of genes that govern coat colour. There are a minimum of eleven known sequence series (A, B, C, D, E, F, G, M, P, S, T) that influence the colour of a dog. A dog inherits one copy from each of its parents. As an example, within the B series, a dog is genetically black or brown. Assume that one parent is homozygous black (BB), whereas the other parent is homozygous brown (bb).

		BB	
		B	B
bb	b	Bb	Bb
	b	Bb	Bb

In this case, all the offspring are going to be heterozygous (Bb).

Since black (B) is dominant, all the offspring are going to be black. However, they are going to have each B and b alleles. If such heterozygous pups are crossed, they are going to produce 25 homozygous blacks (BB), 50 heterozygous black (Bb), and 25 homozygous brown (bb) offspring.

	B	b
B	BB	Bb
b	Bb	bb

Q.4. How is the equal genetic contribution of male and female parents ensured in the progeny?

Ans. Sexual reproduction involves formation and fusion of gametes. The cells of parent's body are diploid *i.e.*, they have two sets of genes for each trait. They produce gametes by meiosis (reduction division). Gametes have only one gene of a pair of genes present in parents. When the gametes fuse in pair (male and female gametes fuse) then paired condition of genes is restored. Gametes

are the means which ensure equal contribution of male and female parent in the progeny. An offspring gets half the number of chromosomes from its father and half chromosome number from mother. In this way it obtains a set of chromosomes like its parents.



9

Light : Reflection and Refraction

Intext Questions

Page-142

Q.1. Define the principal focus of a concave mirror.

Ans. The rays of light parallel and closed to the principal axis of the mirror after reflection pass through a point on the principal axis, this point is called principal focus of the concave mirror.

Q.2. The radius of curvature of a spherical mirror is 20 cm. What is its focal length?

Ans. Focal length,

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

Here $R = 20 \text{ cm}$

$$\therefore f = \frac{20}{2} = 10 \text{ cm}$$

Q.3. Name a mirror that can give an erect and enlarged image of an object.

Ans. Concave mirror.

Q.4. Why do we prefer a convex mirror as a rear-view mirror in vehicles?

Ans. We prefer a convex mirror as a rear view mirror in vehicles due to following causes:

- (i) It always forms erect image of an object.
- (ii) It covers a wider view and enables us to see a wide area behind vehicles.

Page-145

Q.1. Find the focal length of a convex mirror whose radius of curvature is 32 cm.

Ans. Here, $R = 32 \text{ cm}$

$$\text{As } f = \frac{R}{2} = \frac{32}{2} = 16 \text{ cm}$$

Q.2. A concave mirror produces three times magnified (enlarged) real image of an object

placed at 10 cm in front of it. Where is the image located?

Ans. Here, $m = -3$

(-ve sign as image is real)

$$u = -10 \text{ cm}$$

$$\therefore m = -\frac{v}{u}$$

$$-3 = -\frac{v}{(-10)}$$

$$\Rightarrow v = -30 \text{ cm}$$

Hence the image is formed 30 cm in front of the mirror.

Page-150

Q.1. A ray of light travelling in air enters obliquely into water. Does the light ray bend towards the normal or away from the normal? Why?

Ans. The ray will bend towards the normal as the speed of light decreases when ray enters from air to water *i.e.*, from rarer to denser medium.

Q.2. Light enters from air to glass having refractive index 1.50. What is the speed of light in the glass? The speed of light in vacuum is $3 \times 10^8 \text{ ms}^{-1}$.

Ans. Given, $n = 1.5$

$$c = 3 \times 10^8 \text{ ms}^{-1}$$

$$v = ?$$

$$\text{As, } n = \frac{c}{v}$$

$$\Rightarrow 1.5 = \frac{3 \times 10^8}{v}$$

$$\Rightarrow v = 2 \times 10^8 \text{ ms}^{-1}$$

Q.3. Find out, from the table 9.2, the medium having the highest optical density. Also, find the medium with the lowest optical density.

Material medium	Refractive index	Material medium	Refractive index
Air	1.0003	Canada Balsam	1.53
Ice	1.31	Rock salt	1.54
Water	1.33		
Alcohol	1.36		
Kerosene	1.44	Carbon disulphide	1.63
Fused quartz	1.46	Dense flint glass	1.65
Turpentine oil	1.47	Ruby	1.71
Benzene	1.50	Sapphire	1.77
Crown glass	1.52	Diamond	2.42

Ans. The medium with highest optical density is diamond (refractive index = 2.42). The medium with lowest optical density is air (refractive index = 1.0003).

Q.4. You are given kerosene, turpentine and water. In which of these does the light travel fastest? Use the information above the question's table 9.2.

Ans. We know that,

$$n = \frac{c}{v} \Rightarrow v \propto \frac{1}{n}$$

In the medium with least refractive index, the speed of light is maximum. Therefore, among kerosene, turpentine and water, speed of light is maximum in water.

Q.5. The refractive index of diamond is 2.42. What is the meaning of this statement?

Ans. It means that when light travels through diamond its speed decreases by a factor of 2.42.

Page-158

Q.1. Define 1 dioptre of power of a lens.

Ans. The power of a lens whose focal length is one metre (1 m) is one dioptre.

Q.2. A convex lens forms a real and inverted image of a needle at a distance of 50 cm from it. Where is the needle placed in front of the convex lens if the image is equal to the size of the object? Also, find the power of the lens.

Ans. Given, Image distance $v = +50\text{ cm}$

Object distance $u = ?$

Power of lens $P = ?$

As size of the image is equal to that of object and the image is real and inverted, so

$$\begin{aligned} m &= -1 \\ \therefore m = \frac{v}{u} &\Rightarrow -1 = \frac{50}{u} \\ \Rightarrow u &= -50\text{ cm} \\ \therefore \frac{1}{f} &= \frac{1}{v} - \frac{1}{u} \\ \Rightarrow \frac{1}{f} &= \frac{1}{50} - \frac{1}{-50} \\ \Rightarrow \frac{1}{f} &= \frac{2}{50} \\ \Rightarrow f &= 25\text{ cm} = \frac{1}{4}\text{ m} \end{aligned}$$

$\therefore$ Power of lens, $P = \frac{1}{(1/4)} = 4$ dioptre

Q.3. Find the power of a concave lens of focal length 2 m.

Ans. Power, $P = ?$
Focal length $f = -\text{m}$ (concave lens)
 $\therefore P = \frac{1}{f} = \frac{1}{-2}$
 $\Rightarrow P = -0.5$ dioptre

NCERT Exercise

Q.1. Which one of the following materials cannot be used to make a lens?

(a) Water (b) Glass (c) Plastic (d) Clay

Ans. (d) Clay

Q.2. The image formed by a concave mirror is observed to be virtual, erect and larger than the object. Where should be the position of the object?

(a) between the principal focus and centre of curvature,
(b) at the centre of curvature,
(c) beyond the centre of curvature,
(d) between the pole of the mirror and focus.

Ans. (d) between the pole of the mirror and focus.

Q.3. Where should an object be placed in front of a convex lens to get a real image of the size of the object?

(a) At the principal focus of the lens
(b) At twice the focal length
(c) At infinity
(d) Between the optical centre of the lens and its principal focus.

Ans. (b) At twice the focal length

Q.4. A spherical mirror and a thin spherical lens have each a focal length of -15 cm. The mirror and lens are likely to be

- (a) Both concave (b) Both convex
(c) The mirror is concave, but the lens is convex
(d) The mirror is convex, but the lens is concave.

Ans. (a) Both concave

Q.5. No matter how far you stand from a spherical mirror, your image appears erect. The mirror is likely to be :

- (a) only plane (b) only concave
(c) only convex (d) either plane or convex.

Ans. (d) either plane or convex.

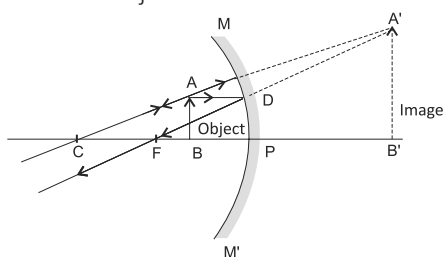
Q.6. Which of the following lenses would you prefer to use while reading small letters found in a dictionary?

- (a) A convex lens of focal length 50 cm
(b) A concave lens of focal length 50 cm
(c) A convex lens of focal length 5 cm
(d) A concave lens of focal length 5 cm

Ans. (c) A convex lens of focal length 5 cm

Q.7. We wish to obtain an erect image of an object, using a concave mirror of focal length 15 cm. What should be the range of distance of the object from the mirror? What is the nature of the image? Is the image larger or smaller than the object? Draw a ray diagram to show the image formation in this case.

Ans. To obtain erect image of an object in a concave mirror, the object should be placed between pole and principal focus of the mirror. Therefore, range of distance of the object from the mirror must be less than 15 cm. The image will be erect and virtual and size of the image would be larger than the size of the object.



Q.8. Name of type of mirror used in following situations:

- (a) Headlights of a car (b) Side/rear view mirror of a vehicle (c) Solar furnace

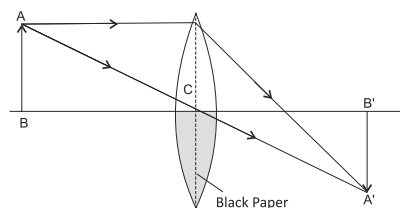
Support your answer with reason.

Ans. (a) Concave mirror: When light source is

placed at the focus of the mirror then on reflection a strong parallel beam of light emerges. (b) **Convex mirror:** Field of view of convex mirror is larger and it forms virtual, erect and diminished images of objects behind. (c) **Concave mirror:** Light rays from the sun on reflection from the mirror is converged at the focus of the mirror and produce heat.

Q.9. One half of a convex lens is covered with a black paper. Will this lens produce a complete image of the object? Verify your answer experimentally. Explain your observations.

Ans. Yes, it will produce a complete image of the object. This can be verified experimentally by observing the image of a distant object like a pole on a screen, when lower half of the lens is covered with a black paper, but the intensity of the image will be reduced.



Q.10. An object 5 cm in length is held 25 cm away from a converging lens of focal length 10 cm. Draw the ray diagram and find the position, size and the nature of the image formed.

Ans.

Object size $h = (+) 5$ cm

Object distance $u = -25$ cm

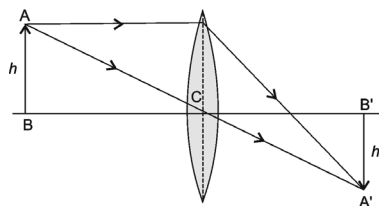
Focal length of lens $f = 10$ cm

Image distance $v = ?$,

Image size $h' = ?$

$$\begin{aligned} \text{As } \frac{1}{v} - \frac{1}{u} &= \frac{1}{f} \Rightarrow \frac{1}{v} = \frac{1}{f} + \frac{1}{u} \\ &= \frac{1}{10} - \frac{1}{25} = \frac{5-2}{50} \\ v &= \frac{50}{3} = (+) 16.67 \text{ cm} \end{aligned}$$

As v is positive, the image formed is real and on the right side of the lens. The ray diagram is drawn below:



Magnification, $m = \frac{h'}{h} = \frac{v}{u}$

$$\Rightarrow \frac{h'}{5} = \frac{50/3}{-25} = -\frac{2}{3}$$

$$\Rightarrow h' = \frac{1}{10} = -3.3 \text{ cm}$$

The sign of image is negative it shows that the image is inverted.

Q.11. A concave lens of focal length 15 cm forms an image 10 cm from the lens. How far is the object placed from the lens? Draw the ray diagram.

Ans. Given,

focal length of lens, $f = -15 \text{ cm}$

image distance, $v = -10 \text{ cm}$

object distance, $u = ?$

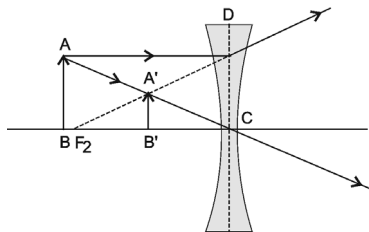
From, $\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$

$$\frac{1}{u} = \frac{1}{v} - \frac{1}{f} = \frac{1}{-10} - \frac{1}{15}$$

$$= \frac{-3+2}{30} = -\frac{1}{30}$$

$$\Rightarrow u = -30 \text{ cm}$$

The ray diagram of image formation is shown in figure.



Q.12. An object is placed at a distance of 10 cm from a convex mirror of focal length 15 cm. Find the position and nature of the image.

Ans. Object distance, $u = -10 \text{ cm}$

Focal length, $f = 15 \text{ cm}$

Image distance $v = ?$

By mirror formula $\frac{1}{v} + \frac{1}{u} = \frac{1}{f}$

$$\frac{1}{v} = \frac{1}{f} - \frac{1}{u} = \frac{1}{15} + \frac{1}{10}$$

$$= \frac{5}{30} = \frac{1}{6}$$

$$\Rightarrow v = 6 \text{ cm}$$

This shows that image is back of the mirror. It must be virtual, erect and smaller in size than the object.

Q.13. The magnification produced by a plane mirror is $m = +1$. What does this mean?

Ans. $m = \frac{h'}{h} = +1$

$$\Rightarrow h' = h$$

i.e. size of image is equal to size of the object.

Positive sign of m indicates that the image is erect and hence virtual.

Q.14. An object 5.0 cm in length is placed at a distance of 20 cm in front of a convex mirror of radius of curvature 30 cm. Find the position of the image, its nature and size.

Ans. Object size $h = 5.0 \text{ cm}$

Object distance $u = -20 \text{ cm}$

Radius of curvature $R = 30 \text{ cm}$

Image distance $v = ?$

Image size $h' = ?$

As, $\frac{1}{v} + \frac{1}{u} = \frac{1}{f} = \frac{2}{R}$

$$\frac{1}{v} = \frac{2}{R} - \frac{1}{u} = \frac{2}{30} + \frac{1}{20} = \frac{7}{60}$$

$$v = \frac{60}{7} = 8.57 \text{ cm}$$

Positive sign of v indicates that image is at the back of the mirror. It must be virtual and erect.

As, $m = \frac{h'}{h} = \frac{v}{u}$

$$\frac{h'}{5.0} = \frac{-60/7}{-20} = \frac{3}{7}$$

$$h' = \frac{3}{7} \times 5.0 = \frac{15.0}{7}$$

$$= 2.1 \text{ cm}$$

Q.15. An object of size 7.0 cm is placed at 27 cm in front of a concave mirror of focal length 18 cm. At what distance from the mirror, should a screen be placed, so that a sharp focused image can be obtained? Find the size and nature of the image.

Ans. Given, Object size $h = 7.0 \text{ cm}$

Object distance $u = -27 \text{ cm}$

Focal length $f = -18 \text{ cm}$

Image distance $v = ?$

Image size $h' = ?$

By mirror formula, $\frac{1}{v} + \frac{1}{u} = \frac{1}{f}$

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

$$= \frac{1}{-18} + \frac{1}{27}$$

$$\Rightarrow v = -54 \text{ cm}$$

Hence, the screen should be placed in front of the mirror at a distance of 54 cm from the mirror. The image obtained on the screen will be real.

Again, magnification $m = \frac{h'}{h} = \frac{v}{u}$

$$\therefore \frac{h'}{7.0} = -\frac{(-54)}{(-27)}$$

or $h' = -14.0 \text{ cm}$

The negative sign of h' shows that the image is inverted.

Q.16. Find the focal length of a lens of power -2.0 D . What type of lens is this?

Ans. Given, Focal length, $f = ?$

Power $P = -2.0 \text{ D}$

As $f = \frac{100}{P} = \frac{100}{-2.0}$

$$= -50 \text{ cm}$$

As power of lens is negative, the lens must be concave.

Q.17. A doctor has prescribed a corrective lens of power $+1.5 \text{ D}$. Find the focal length of the lens. Is the prescribed lens diverging or converging?

Ans. Here, $P = +1.5 \text{ D}$

$f = ?$

From $f = \frac{1}{P} = \frac{100}{1.5}$

$$= 66.7 \text{ cm}$$

As power is positive, the prescribed lens is converging or convex lens.



10

The Human Eye And The Colourful World

Intext Questions

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Q.1. What is meant by power of accommodation of the eye?

Ans. The eye can focus the images of all the objects, distant or nearby, at the same place (on the retina) by changing the focal length of its lens. The eye lens can change its focal length by changing its thickness with the help of its ciliary muscles. The property due to which eye lens is able to change its focal length is called accommodation of the eye.

Q.2. A person with a myopic eye cannot see objects beyond 1.2 m distinctly. What should be the type of corrective lens used to restore proper vision?

Ans. Given, distance of far point, $x = 1.2 \text{ m}$

For viewing distant objects, focal length of corrective lens, $f = -x = -1.2 \text{ m}$

$$\therefore \text{Power (P)} = \frac{1}{f} = \frac{1}{-1.2} = -0.83 \text{ D}$$

Thus lens must be concave.

Q.3. What is the far point and near point of the human eye with normal vision?

Ans. Far point is at infinity and near point is at 25 cm from the eye.

Q.4. A student has difficulty in reading the blackboard while sitting in the last row. What could be the defect the child is suffering from? How can it be corrected?

Ans. As the student has difficulty in reading the blackboard, he is suffering from myopia. To correct this defect, he has to use spectacles with concave lens of suitable focal length.

NCERT Exercise

Q.1. The human eye can focus objects at different distances by adjusting the focal length of the eye lens. This is due to:

- (a) presbyopia (b) near-sightedness
- (c) accommodation (d) far-sightedness

Ans. (c) accommodation

Q.2. The human eye forms the image of an object at it's:

- (a) cornea (b) pupil
(c) iris (d) retina

Ans. (d) retina

Q.3. The least distance of distinct vision for a young adult with normal vision is about:

- (a) 25 m (b) 25 cm (c) 2.5 cm (d) 2.5 m

Ans. (b) 25cm

Q.4. The change in focal length of an eye lens is caused by the action of the:

- (a) pupil (b) retina
(c) iris (d) ciliary muscles

Ans. (d) ciliary muscles

Q.5. A person needs a lens of power -5.5 D for correcting his distant vision. For correcting his near vision, he needs a lens of power $+1.5$ dioptre. What is the focal length of the lens required for correcting (i) distant vision (ii) near vision?

Ans. (i) For distance viewing $f = ?$

$$P = -5.5 \text{ D.}$$

$$\therefore f = \frac{1}{P} = \frac{1}{-5.5} = -\frac{10}{55} = -0.181 \text{ m} = -18.1 \text{ cm}$$

(ii) For near vision correction

$$P = +1.5 \text{ D.}$$

$$\therefore f = \frac{1}{P} = \frac{1}{1.5} = \frac{10}{15} = 0.66 \text{ m} = 66.7 \text{ cm}$$

Q.6. The far point of a myopic person is 80 cm in front of the eye. What is the nature and power of the lens required to correct the problem?

Ans. Distance of far point, $x = 80$ cm

Power $P = ?$

Focal length of the corrective lens

$$f = -x = -80 \text{ cm}$$

$$\therefore P = \frac{100}{f} = \frac{100}{-80} = -1.25 \text{ D}$$

The lens is concave.

Q.7. Make a diagram to show how hypermetropia is corrected. The near point of a hypermetropia eye is 1 metre. What is the power of the lens required to correct this defect? Assume that the near point of the normal eye is 25 cm.

Ans. Given $x' = 1\text{ m} = 100$ cm, $D = 25$ cm, $f = ?$

$$\text{From } f = \frac{x' D}{x' - D}$$

$$f = \frac{100 \times 25}{100 - 25} = 33.3 \text{ cm}$$

$$\therefore \text{Power } P = \frac{100}{f} = \frac{100}{33.3} = 3 \text{ D}$$

Q.8. Why is a normal eye not able to see clearly the objects placed closer than 25 cm?

Ans. The maximum accommodation of a normal eye is reached when the object is at a distance of 25 cm from the eye. The focal length of the eye lens cannot be adjusted below this minimum limit. The rays coming from the objects which are at a distance less than 25 cm are not focused at the retina and the image of the object appear blurred. Thus the image cannot be seen clearly.

Q.9. What happens to the image distance in the eye when we increase the distance of an object from the eye?

Ans. The image distance remains unchanged. As the distance of the object increases, the focal length of eye lens is adjusted by the ciliary muscles so that the image is always formed at the retina.

Q.10. Why do stars twinkle?

Ans. The twinkling of a star is due to atmospheric refraction of starlight. The light of star when enters into earth's atmosphere undergoes refraction continuously before it reaches the earth. As the atmospheric refraction occurs in a continuously changing refractive index, due to which the amount of light and apparent position of stars reaching to our eyes changes many times. and the stars appears to twinkle.

Q.11. Explain why the planets do not twinkle?

Ans. Planets are much closer to the earth, and are thus seen as much larger sources comparatively to stars from earth. Planets also act as a source of light made of different point sized sources of light. Due to atmospheric refraction one source of light nullify the effect of other source hence overall brightness of the planet remain same and they do not appear to be twinkled.

Q.12. Why does the sky appear dark instead of blue to an astronaut?

Ans. There is no atmosphere containing air space to scatter sunlight. As there is no scattering of light in space the sky appears dark instead of blue to an astronaut in outer space.



Electricity

Intext Questions

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Q.1. What does an electric circuit mean?

Ans. An electric circuit consists of closed path in which different components like cells, ammeter, voltmeter, resistance etc. are attached.

Q.2. Define the unit of current.

Ans. Ampere is the unit of current. 1 ampere is defined as the flow of 1 Coulomb of charge for one second.

Q.3. Calculate the number of electrons constituting one Coulomb of charge.

Ans. Charge on 1 electron (e) = 1.6×10^{-19} C
 $\therefore 1 \text{ Coulomb} = \frac{1}{1.6 \times 10^{-19}} \text{ electrons}$

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Q.1. Name a device that helps to maintain a potential difference across a conductor.

Ans. A cell or battery helps to maintain a potential difference across conductor.

Q.2. What is meant by saying that the potential difference between two points is 1 V?

Ans. Potential difference between two points in a current carrying conductor will be 1 V when 1 joule of work is done to move a charge of 1 coulomb from one point to other.

Q.3. How much energy is given to each coulomb of charge passing through 6 V battery?

Ans. Given, $V = 6 \text{ V}$, $Q = 1 \text{ C}$
 Energy (E) = $V \times Q = 6 \text{ V} \times 1 \text{ C} = 6 \text{ Joule}$.

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Q.1. On what factors does the resistance of conductor depend?

Ans. Resistance of a conductor depends on (i) length, (ii) area of cross-section, (iii) nature of material, (iv) temperature

Q.2. Will current flow more easily through a thick wire or a thin wire of the same material when connected to same source? Why?

Ans. As we know that resistance produces obstruction in the path of current which is inversely proportional to the area of cross-section

of the conductor. So a thick conductor offers lesser resistance than a thin wire.

Q.3. Let the resistance of an electrical components remains constant while the potential difference across the two ends of the component decreases to half of its former value. What change will occur in the current through it?

Ans. According to Ohm's law, $V \propto I$. As the value of potential difference decreases to half of its former value the value of current also changes to half of former value.

Q.4. Why are coils of electric toaster and electric irons made of an alloy rather than a pure metal?

Ans. Generally coils of electric toasters and electric irons are made of nichrome. Nichrome is an alloy of nickel (60%), chromium (12%), manganese (2%) and iron (26%).

We use alloy because:

- (i) Resistivity of an alloy is generally higher than that of pure metal.
- (ii) They have high melting point.
- (iii) On heating ($\approx 800^\circ\text{C}$), they do not oxidize easily.

Q.5. Use the data in the table given below and answer the following:

Table 11.2

	Material	Resistivity
Conductors	Silver	1.60×10^{-8}
	Copper	1.62×10^{-8}
	Aluminium	2.63×10^{-8}
	Tungsten	5.20×10^{-8}
	Nickel	6.84×10^{-8}
	Iron	10.0×10^{-8}
	Chromium	12.9×10^{-8}
	Mercury	94.0×10^{-8}
	Manganese	1.84×10^{-8}
Alloys	Constantan	49×10^{-6}
	Manganin	44×10^{-6}
	Nichrome	100×10^{-6}

Insulators	Glass	$10^{10} - 10^{14}$
	Hard rubber	$10^{13} - 10^{16}$
	Ebonite	$10^{16} - 10^{13}$
	Diamond	$10^{12} \times 10^{13}$
	Paper (dry)	10^{12}

(a) Which among iron and mercury is a better conductor?

(b) Which material is the best conductor?

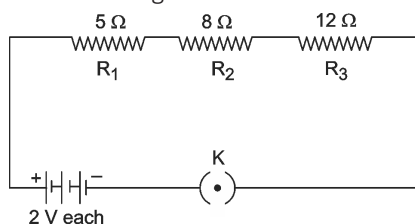
Ans. (a) Iron is a better conductor than mercury because the resistivity of mercury is more than the resistivity of iron.

(b) Among all the materials listed in the table, silver is the best conductor because the resistivity of silver is lowest among all, i.e., 1.60×10^{-8} .

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Q.1. Draw a schematic diagram of a circuit consisting of a battery of three cells of 2V each, a 5 Ω resistor, an 8 Ω resistor, and a 12 Ω resistor, and a plug key, all connected in series.

Ans. The circuit diagram is shown below.

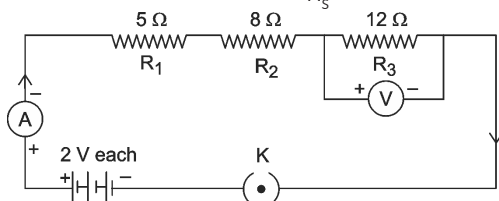


Q.2. Redraw the circuit of Question 1, putting in an ammeter to measure the current through the resistors and a voltmeter to measure the potential difference across the 12 Ω resistor. What would be the readings in the ammeter and the voltmeter?

Ans. The circuit diagram shown is equivalent resistance of the circuit

$$\begin{aligned} R_s &= R_1 + R_2 + R_3 \\ &= 5 + 8 + 12 \\ &= 25 \Omega \end{aligned}$$

Current in the circuit $I = \frac{V}{R_s}$



Here, there are three cells, so voltage supplied by

$$\text{battery} = 2V \times 3 = \frac{6V}{25\Omega} = 0.24 \text{ A}$$

So, the reading in ammeter will be 0.24 A. Now, potential difference across 12 ohm resistance

$$= 12 \times 0.24 = 2.88 \text{ V}$$

Reading of voltmeter will be 2.88 volt.

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Q.1. Judge the equivalent resistance when the following are connected in parallel –

(a) 1 Ω and $10^6 \Omega$, (b) 1 Ω , $10^3 \Omega$, and $10^6 \Omega$.

Ans. (a) When 1 Ω and $10^6 \Omega$ are connected in parallel, the equivalent resistance is given by

$$\begin{aligned} \frac{1}{R} &= \frac{1}{1} + \frac{1}{10^6} \\ R &= \frac{10^6}{1 + 10^6} \approx \frac{10^6}{10^6} = 1 \Omega \end{aligned}$$

Therefore, the equivalent resistance is 1 Ω .

(b) When 1 Ω , $10^3 \Omega$, and $10^6 \Omega$ are connected in parallel, the equivalent resistance is given by

$$\frac{1}{R} = \frac{1}{1} + \frac{1}{10^3} + \frac{1}{10^6}$$

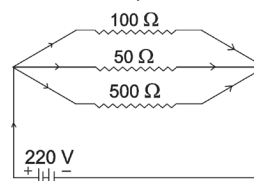
Solving we get

$$R = \frac{10^6 + 10^3 + 1}{10^6} = \frac{1000000}{1000001} = 0.999 \Omega$$

Therefore, the equivalent resistance is 0.999 Ω .

Q.2. An electric lamp of 100 Ω , a toaster of resistance 50 Ω , and a water filter of resistance 500 Ω are connected in parallel to a 220 V source. What is the resistance of an electric iron connected to the same source that takes as much current as all three appliances, and what is the current through it?

Ans. In parallel combination resistance of electric iron will be equal to the resultant of these three appliances connected in parallel.



$$\therefore \frac{1}{R_p} = \frac{1}{100} + \frac{1}{50} + \frac{1}{500}$$

$$\frac{1}{R_p} = \frac{5 + 10 + 1}{500}$$

$$\Rightarrow R_p = \frac{500}{16} = 31.25 \Omega$$

Now, current through it

$$I = \frac{V}{R_p} = \frac{220}{31.25} = 7.04 \text{ A}$$

Q.3. What are the advantages of connecting electrical devices in parallel with the battery instead of connecting them in series?

Ans. (i) In parallel combination the potential difference across each device remains the same whereas in series connections it is distributed.

(ii) If any appliance is switched 'ON' or 'OFF' it does not affect the working of other devices.

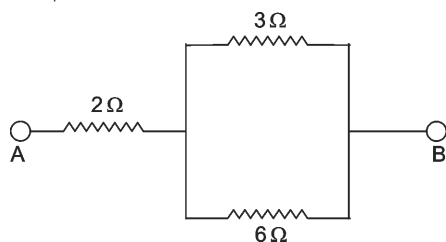
Q.4. How can three resistors of resistances 2Ω , 3Ω , and 6Ω be connected to give a total resistance of (a) 4Ω , (b) 1Ω ?

Ans. (a) To get a total resistance of 4Ω from three resistors 2Ω , 3Ω and 6Ω , then resistors 3Ω and 6Ω should be connected in parallel with 2Ω in series with them. Now, equivalent resistance of 3Ω and 6Ω is

Now, 2Ω resistance is in series with $R_{eq} = 2 \Omega$, then total resistance becomes R , total $= 2 + 2 = 4 \Omega$

$$\frac{1}{R_{eq}} = \frac{1}{3} + \frac{1}{6}$$

$$\frac{1}{R_{eq}} = \frac{6+3}{18} + \frac{9}{18} = \frac{1}{2} \Rightarrow R_{eq} = 2 \Omega$$



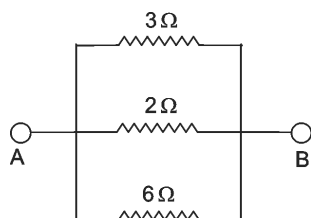
(b) The resistances should be connected in parallel.

$$\frac{1}{R} = \frac{1}{3} + \frac{1}{2} + \frac{1}{6}$$

$$\frac{1}{R} = \frac{3+2+1}{6} = \frac{1}{R} = \frac{6}{6}$$

$\Rightarrow$

$$R = 1 \Omega$$



Q.5. What is (a) the highest, (b) the lowest total resistance that can be secured by combinations of four coils of resistance 4Ω , 8Ω , 12Ω , 24Ω ?

Ans. (a) The highest total resistance obtained when resistance are connected in series.

$$R = R_1 + R_2 + R_3 + R_4$$

$$= 4 + 8 + 12 + 24$$

$$= 48 \Omega$$

(b) The lowest total resistance obtained when resistances are connected in parallel.

$$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \frac{1}{R_4}$$

$$\frac{1}{R} = \frac{1}{4} + \frac{1}{8} + \frac{1}{12} + \frac{1}{24}$$

$$\frac{1}{R} = \frac{6+3+2+1}{24} = \frac{24}{12} = 2 \Omega$$

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Q.1. Why does the cord of an electric heater not glow while the heating element does?

Ans. Element of electric heater has higher resistance than the cord and we know that $H = I^2 R t$, so heat produced is directly proportional to the resistance of the conductor. So due to high resistance, element glow but cord does not.

Q.2. Compute the heat generated while transferring 96000 Coulomb of charge in one hour through a potential difference of 50 V.

Ans. Given, $Q = 96000 \text{ C}$
 $V = 50 \text{ volt}$

$$\text{As, } W = VQ = 50 \times 96000$$

$$= 4800000 \text{ J} = 4800 \text{ kJ}$$

Q.3. An electric iron of resistance 20Ω takes a current of 5 A. Calculate the heat developed in 30 s.

Ans. Given, $R = 20 \Omega$
 $I = 5 \text{ A}$

$$t = 30 \text{ s}$$

$$\text{By } H = I^2 R t = (5)^2 \times 20 \times 30$$

$$= 15000 \text{ Joule}$$

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Q.1. What determines the rate at which energy is delivered by a current?

Ans. Electric power determines the rate at which energy is delivered by a current.

Q.2. An electric motor takes 5 A from 220 V line. Determine the power of the motor and the energy consumed in 2 h.

Ans. Given, $I = 5 \text{ A}$

$$V = 220 \text{ V}$$

$$\text{as, } P = VI = 220 \times 5 \text{ A} = 1100 \text{ W}$$

Energy consumed in 2 hours
 $= 1100 \text{ W} \times 2 \text{ h} = 2200 \text{ Wh}$
 $= 2.2 \text{ kWh}$

NCERT Exercise

Q.1. A piece of wire of resistance R is cut into five equal parts. These parts are then connected in parallel. If the equivalent resistance of this combination is R' , then the ratio R/R' is:

- (a) $1/25$ (b) $1/5$ (c) 5 (d) 25

Ans. (d) As the resistance is cut into five equal pieces, so the resistance of individual resistance $= R/5$. Now resistance of five equal parts connected in parallel is

$$\frac{1}{R'} = \frac{1}{R/5} + \frac{1}{R/5} + \frac{1}{R/5} + \frac{1}{R/5} + \frac{1}{R/5}$$

$$\Rightarrow \frac{1}{R'} = \frac{5}{R} + \frac{5}{R} + \frac{5}{R} + \frac{5}{R} + \frac{5}{R} = \frac{25}{R}$$

$$\Rightarrow R/R' = 25$$

Q.2. Which of the following does not represent electrical power in a circuit?

- (a) $I^2 R$ (b) IR^2 (c) VI (d) V^2/R

Ans. (b) Electrical Power,

$$P = VI = (IR)I = I^2 R$$

$$= \left(\frac{V}{R}\right)^2 R = \frac{V^2}{R}$$

$\Rightarrow IR^2$ does not represent electrical power in a circuit.

Q.3. An electric bulb is rated 220 V and 100 W. When it is operated on 110 V, the power consumed will be:

- (a) 100 W (b) 75 W (c) 50 W (d) 25 W

Ans. (d) Resistance of electric bulb,

$$R = \frac{V^2}{P} \Rightarrow R = \frac{(220)^2}{100} = 484 \Omega$$

Power consumed

$$R = \frac{V^2}{P} = \frac{(110)^2}{484} = \frac{110 \times 110}{484}$$

$$\Rightarrow P' = 25 \text{ W}$$

Q.4. Two conducting wires of the same material and of equal lengths and equal diameters are first connected in series and then in parallel in an electric circuit across the same potential difference. The ratio of the heat produced in series and parallel combinations would be:

- (a) $1:2$ (b) $2:1$ (c) $1:4$ (d) $4:1$

Ans. (c) As both the conducting wires are of same material and they have equal lengths and equal diameters, these have the same resistance. Let we consider that the resistance is R . When these wires connected in series, the equivalent resistance is $R_s = R + R = 2R$

When these wires connected in parallel, the equivalent resistance is

$$\frac{1}{R_p} = \frac{1}{R} + \frac{1}{R} = \frac{2}{R} \Rightarrow R_p = \frac{R}{2}$$

Now electrical power in series

$$P_s = \frac{V^2}{R_s} = \frac{V^2}{2R}$$

and electrical power in parallel

$$P_p = \frac{V^2}{R_p} = \frac{V^2}{R/2}$$

$$\therefore \frac{P_s}{P_p} = \frac{V^2/2R}{V^2/(R/2)} = \frac{1}{4}$$

$$\Rightarrow P_s : P_p = 1 : 4$$

Q.5. How is voltmeter connected in the circuit to measure potential difference between two points?

Ans. A voltmeter is always connected in parallel to measure the potential difference between two points.

Q.6. A copper wire has a diameter of 0.5 mm and a resistivity of $1.6 \times 10^{-6} \Omega\text{-cm}$. How much length of this wire would be required to make a 10Ω coil? How much does the resistance change if the diameter is doubled?

Ans. Given, diameter of the wire

$$D = 0.5 \text{ mm} = 0.5 \times 10^{-3} \text{ m}$$

Resistivity of copper,

$$\rho = 1.6 \times 10^{-6} \Omega\text{-cm} = 1.6 \times 10^{-8} \Omega\text{-m}$$

Resistance required, $R = 10 \Omega$

$$\text{As, } R = \rho \frac{l}{A}$$

$$\Rightarrow l = \frac{RA}{\rho} = \frac{R(\pi D^2/4)}{\rho} = \frac{\pi R D^2}{4\rho}$$

$$[\because A = \pi r^2 = \pi(D/2)^2 = \pi D^2/4]$$

$$\Rightarrow l = \frac{RA}{\rho} = \frac{3.14 \times 10 \times (0.5 \times 10^{-3})^2}{4 \times 1.6 \times 10^{-8}} \text{ m}$$

$$= 122.7 \text{ m}$$

Now, when diameter is doubled, then resistance,

$$\therefore R = \frac{\rho l}{\pi D^2/4} = \frac{4\rho l}{\pi D^2}$$

$$\Rightarrow R \propto \frac{1}{D^2}$$

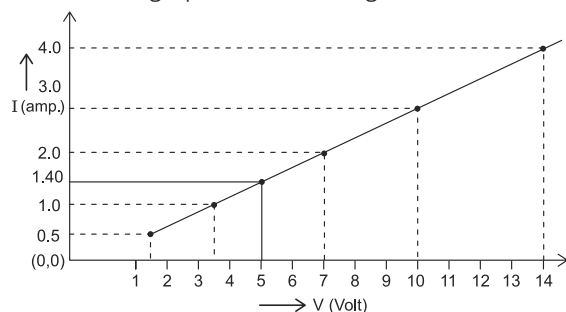
So, when D is doubled, then resistance becomes 1/4th of original size.

Q.7. The values of current I flowing in a given resistor for the corresponding values of potential difference V across the resistor are given below:

I (amperes)	0.5	1.0	2.0	3.0	4.0
V (volts)	1.6	3.4	6.7	10.2	13.2

Plot a graph between V and I and calculate the resistance of the resistor.

Ans. The V-I graph is shown in figure



Now, for
Current,

$$V = 5V$$

$$I = 1.40 A$$

$\therefore$

$$R = \frac{V}{I} = \frac{5}{1.4} = 3.5 \Omega$$

Q.8. When a 12 V battery is connected across an unknown resistor, there is a current of 2.5 mA in the circuit, find the value of the resistor.

Ans. Given, $V = 12 \text{ volt}$

$$I = 2.5 \text{ mA} = 2.5 \times 10^{-3} \text{ A}$$

$\therefore$

$$R = \frac{V}{I} = \frac{12V}{2.5 \times 10^{-3} \text{ A}} = 4800 \Omega$$

$$= 4.8 \text{ k}\Omega$$

Q.9. A battery of 9 V is connected in series with resistors of 0.2 Ω , 0.3 Ω , 0.4 Ω , 0.5 Ω and 12 Ω , respectively. How much current would flow through the 12 Ω resistor?

Ans. In series connection, there is no division of current. The current flowing across all the resistors is the same.

Let us find out the equivalent resistance as follows:

$$R = 0.2 \Omega + 0.3 \Omega + 0.4 \Omega + 0.5 \Omega + 12 \Omega = 13.4 \Omega$$

Now, using Ohm's law,

$$I = \frac{V}{R} = \frac{9V}{13.4 \Omega} = 0.671 \text{ A}$$

The current flowing across the 12 Ω is 0.671 A.

Q.10. How many 176 Ω resistors (in parallel) are required to carry 5 A on a 220 V line?

Ans. Let us consider the number of resistors required as 'X'.

The equivalent resistance of the parallel combination of resistor R is given by

$$\frac{1}{R} = X \times \frac{1}{176} = R = \frac{176}{X}$$

Now, using Ohm's law, the number of resistors can be calculated as follows:

$$R = \frac{V}{I}$$

Substituting the values, we get $\frac{176}{X} = \frac{220}{5}$

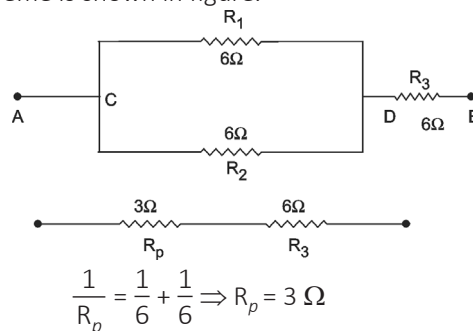
$$\frac{176}{X} = \frac{220}{5}$$

$$X = \frac{176 \times 5}{220} = 4$$

The number of resistors required is 4.

Q.11. Show how you would connect three resistors, each of resistance 6 Ω , so that the combination has a resistance of (i) 9 Ω , (ii) 4 Ω .

Ans. (i) We connect two resistors (i.e., of 6 Ω each) in parallel and the third resistor in series. This scheme is shown in figure.

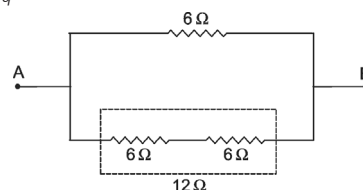


Now 3 Ω resistance is in series with 6 Ω resistance.

$$\therefore R_{eq} = 3 \Omega + 6 \Omega = 9 \Omega$$

(ii) We connect two resistance of 6 Ω in series to get a resistance of 12 Ω . Now 12 Ω and 6 Ω resistances are connected in parallel. The scheme is shown in figure.

$$\frac{1}{R_{eq}} = \frac{1}{12} + \frac{1}{6}$$



$$\Rightarrow R_{eq} = \frac{12\Omega}{3} = 4\Omega$$

Q.12. Several electric bulbs designed to be used on a 220 V electric supply line, are rated 10 Ω . How many lamps can be connected in parallel with each other across the two wires of 220 V line if the maximum allowable current is 5 A?

Ans. Total resistance of the circuit

$$R = \frac{V}{I} = \frac{220 \text{ V}}{5 \text{ A}} = 44 \Omega$$

Now, resistance of each bulb

$$r = \frac{V^2}{P} = \frac{(220)^2}{10} = 4840 \Omega$$

If n be the number of bulbs each of resistance r to be connected in parallel to obtain a resistance R .

$$\text{As, } R = \frac{r}{n}$$

$$\Rightarrow n = \frac{r}{R} = \frac{4840 \Omega}{44 \Omega} = 110$$

So, there is requirement of 110 lamps.

Q.13. A hot plate of an electric oven connected to a 220 V line has two resistance coils A and B, each of 24 Ω resistance, which may be used separately, in series, or in parallel, what are the currents in the three cases?

Ans. Given, Potential difference = 220 V, Resistance of each coil = 24 Ω

(i) When each of the coils A or B is connected separately, current through each coil, i.e.

$$I = \frac{220 \text{ V}}{24 \Omega} = 9.2 \text{ A}$$

(ii) When coils A and B are connected in series, equivalent resistance in the circuits,

$$R_s = 24 \Omega + 24 \Omega = 48 \Omega$$

$\therefore$ Current through the series combination,

$$I_s = \frac{V}{R_s} = \frac{220 \text{ V}}{48 \Omega} = 4.6 \text{ A}$$

(iii) When coils are connected in parallel equivalent resistance,

$$\frac{1}{R_p} = \frac{1}{24} + \frac{1}{24} = \frac{1+1}{24} = \frac{2}{24} \Rightarrow R_p = \frac{24}{2} = 12 \Omega$$

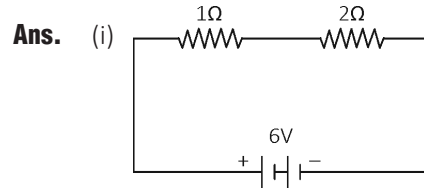
$\therefore$ Current through the parallel combination

$$I_p = \frac{V}{R_p} = \frac{220 \text{ V}}{12 \Omega} = 18.3 \text{ A}$$

Q.14. Compare the power used in the 2 Ω resistor in each of the following circuits:

(i) a 6 V battery in series with 1 Ω and 2 Ω resistors, and

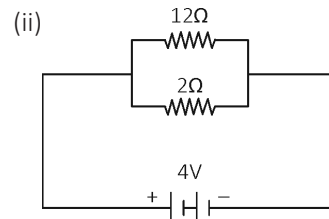
(ii) a 4 V battery in parallel with 12 Ω and 2 Ω resistors.



$$\text{Current in circuit, } I = \frac{V}{R_1 + R_2} = \frac{6}{3} = 2 \text{ A}$$

$\therefore$ Power used, $P = I^2 R$

$$P = 2^2 \times 2 = 8 \text{ W}$$



Potential across 2 Ω resistor, $V = 4 \text{ V}$

$$P = \frac{V^2}{R} = \frac{4^2}{2} = 8 \text{ W}$$

Power consumed by both the cases is same.

Q.15. Two lamps, one rated 100 W at 220 V, and the other 60 W at 220 V, are connected in parallel to electric mains supply. What current is drawn from the line if the supply voltage is 220 V?

Ans. Resistance of first lamp

$$R_1 = \frac{V^2}{P} = \frac{(220)^2}{100} = 484 \Omega$$

Resistance of the second lamp

$$R_2 = \frac{V^2}{P} = \frac{(220)^2}{60} = 806.7 \Omega$$

As the two lamps are connected in parallel, the equivalent resistance

$$\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2}$$

$$\text{or } \frac{1}{R_p} = \frac{1}{484} + \frac{1}{806.7} = \frac{806.7 + 484}{484 \times 806.7}$$

$$\Rightarrow R_p = \frac{484 \times 806.7}{484 + 806.7} = \frac{390442.8}{1290.7} = 302.6 \Omega$$

Current drawn from the line

$$I = \frac{V}{R_p} = \frac{220 \text{ V}}{302.6 \Omega} = 0.73 \text{ A}$$

Q.16. Which uses more energy, a 250 W TV set in 1h, or a 1200 W toaster in 10 minutes?

Ans. Energy used by 250 W TV set in 1h
 $= 250 \text{ W} \times 1 \text{ h} = 250 \text{ Wh}$

Energy used by 1200 W toaster in 10 minutes

$$= 1200 \text{ W} \times 10 \text{ minutes}$$

$$= 1200 \text{ W} \times \left(10 \times \frac{1}{60} \text{ h}\right)$$

$$= 200 \text{ Wh}$$

Thus, TV set uses more energy.

Q.17. An electric heater of resistance 8Ω draws 15 A from the service mains for 2 hours. Calculate the rate at which heat is developed in the heater.

Ans. Given, $I = 15 \text{ A}$, $R = 8 \Omega$, $t = 2 \text{ h} = 7200 \text{ s}$

Rate at which heat is developed

$$H = I^2 R t = (15)^2 \times 8 \times 7200$$

$$P = \frac{H}{t} = \frac{15 \times 15 \times 8 \times 7200}{7200} = 1800 \text{ J/s}$$

Q.18. Explain the following.

(a) Why is tungsten used almost exclusively for filament of electric lamps? (b) Why are the conductors of electric heating devices, such as bread-toasters and electric irons, made of an alloy rather than a pure metal? (c) Why is the series

arrangement not used for domestic circuits? (d) How does the resistance of a wire vary with its area of cross-section? (e) Why copper and aluminium wires are usually employed for electricity transmission?

Ans. (a) Due to high melting point of tungsten ($\approx 3380^\circ\text{C}$), it becomes incandescent at 2400 K.

(b) The resistivity of alloys are generally higher than that of pure metals of which they are made of. (c) In series circuits, same current flows then if any one of the electric appliance fails or in off position, then all the other appliances stop working because same electric current is flowing through all of them. (d) The resistance of a wire (R) varies inversely as its cross-sectional area (A) i.e., $R \propto \frac{1}{A}$.

(e) Due to very low resistivity, copper and aluminium wires are generally used for electricity transmission.



12

Magnetic Effects of Electric Current

Intext Questions

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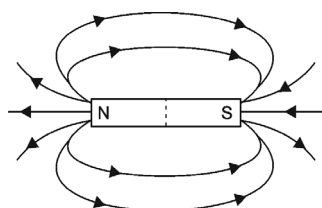
Q.1. Why does a compass needle get deflected when brought near a bar magnet?

Ans. The compass needle is made of very small magnet which has both north and south pole. When compass needle is brought near a bar magnet, the same poles of compass needle and bar magnet repel and opposite poles attract to each other hence needle gets deflected.

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Q.1. Draw magnetic field lines around a bar magnet.

Ans



Q.2. List the properties of magnetic field lines.

Ans. Some characteristic properties of the magnetic field lines are listed below: (a) Magnetic field lines start at the North Pole and end at the South Pole. (b) Magnetic field lines do not intersect each other because there can't be two directions of the magnetic field at any one point.

(c) The degree of closeness of the field lines depends upon the strength of the magnetic field. Stronger the field, closer are the field lines.

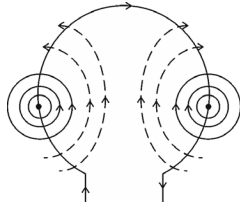
Q.3. Why don't two magnetic field lines intersect each other?

Ans. Two magnetic field lines do not intersect each other because if they intersect, then there would be two directions of magnetic field at one point, which is not possible.

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Q.1. Consider a circular loop of wire lying in the plane of the table. Let the current pass through the loop clockwise. Apply the right-hand rule to find out the direction of the magnetic field inside and outside the loop.

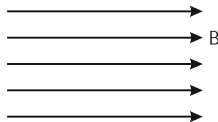
Ans. The diagram of the magnetic field inside and outside the circular loop (by applying right hand thumb rule) is shown below.



In the figure, the magnetic field lines are shown dotted and they are perpendicular to the plane of paper. The face of loop (front-side) is the South Pole and back face (on the table) is a north pole.

Q.2. The magnetic field in a given region is uniform. Draw a diagram to represent it.

Ans. In uniform magnetic field the magnetic field lines are parallel and equidistant, as shown in figure below.



Q.3. Choose the correct option: The magnetic field inside a long straight solenoid-carrying current:

- (a) is zero.
- (b) decreases as we move towards its end.
- (c) increases as we move towards its end.
- (d) is the same at all points.

Ans. (b) decreases as we move towards its end.

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Q.1. Which of the following property of a proton can change while it moves freely in a magnetic field? (There may be more than one correct answer.)

- (a) mass
- (b) speed
- (c) velocity
- (d) momentum.

Ans. (c) and (d)

Q.2. In Activity 12.7, how do we think the displacement of rod AB will be affected if

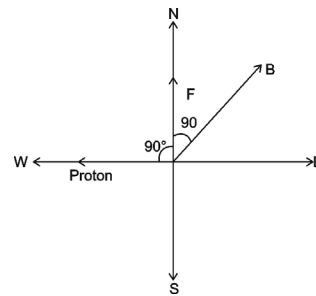
- (i) current in rod AB is increased,
- (ii) a stronger horse-shoe magnet is used; and
- (iii) length of the rod AB is increased?

Ans. According to equation $F = BIL$ (i) If the current (I) in the rod AB is increased, force F also increases. (ii) When a stronger horse-shoe magnet is used, magnetic field B increases, thus force F also increases. (iii) If the length (L) of the rod is increased, force F also increases.

Q.3. A positively-charged particle (α -particle) projected towards west is deflected towards north by a magnetic field. The direction of magnetic field is:

- (a) towards south
- (b) towards east
- (c) downward
- (d) upward.

Ans. (d) The schematic picture is shown in figure below.



Applying Fleming's left hand rule, the direction of magnetic field is upward. Here we consider the current in the direction of motion of proton.

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Q.1. Name two safety measures commonly used in electric circuits and appliances.

Ans. (i) Fuse (ii) Earth wire

Q.2. An electric oven of 2 kW power rating is operated in a domestic electric circuit (220V) that has a current rating of 5A. What result do you expect? Explain.

Ans. Given, $P = 2 \text{ kW} = 2000 \text{ W}$, $V = 220 \text{ V}$

$$\text{Thus } I = \frac{2000 \text{ V}}{220 \text{ V}} = 9.09 \text{ A}$$

As the current rating of the circuit is given 5A and the current flowing through it is more (9.09A), the fuse in the circuit melts and circuit is broken.

Q.3. What precautions should be taken to avoid the overloading of domestic electric circuits?

Ans. The precautions that should be taken to avoid overloading of household electric circuits are as follows: (i) An excess number of devices should not be connected to the same socket. (ii) The appliances that are malfunctioning should not be connected to the socket. (iii) Multiple high power consumption devices should not be connected at the same time.

NCERT Exercise

Q.1. Which of the following correctly describes the magnetic field near a long straight wire?

- (a) The field consists of straight lines perpendicular to the wire.

- (b) The field consists of straight lines parallel to the wire.
- (c) The field consists of radial lines originating from the wire.
- (d) The field consists of concentric circles centre on the wire.

Ans. (d) The field consists of concentric circles centre on the wire.

Q.2. At the time of short-circuit, the current in the circuit:

- (a) Reduces substantially
- (b) Does not change
- (c) Increases heavily
- (d) Varies continuously.

Ans. (c) Increases heavily

Q.3. State whether the following statements are true or false:

- (a) An electric motor converts mechanical energy into electrical energy.
- (b) An electric generator works on the principle of electromagnetic induction.
- (c) The field at the centre of a long circular coil carrying current will be parallel straight lines
- (d) A wire with a green insulation is usually the live wire of an electric supply.

Ans. (a) True (b) False (c) True (d) False

Q.4. List two methods of producing magnetic fields.

Ans. The three main sources to produce a magnetic field are: 1. Electromagnet 2. A wire carrying current produces a field around.

Q.5. When is the force experienced by a current-carrying conductor placed in a magnetic field largest?

Or

What is the maximum force experienced by a current-carrying straight conductor placed in a magnetic field.

Ans. According to Fleming's left hand rule, the force experienced by a current carrying conductor placed in a magnetic field is the largest when the direction of the current is perpendicular to the direction of the magnetic field.

Q.6. Imagine you are sitting in a chamber with your back to one wall. An electron beam, moving horizontally from back wall towards the front wall, is deflected by a strong magnetic field to your right side. What is the direction of the magnetic field?

Ans. As the electron is moving towards front wall, so direction of current will be towards the back wall. Also, the beam is deflected to the right side,

the force will be on lower side. Applying Fleming's left hand rule, it is clear that magnetic field (B) is acting vertically downwards or we can say that magnetic field is perpendicular to the plane of the paper and directed inwards.

Q.7. State the rule to determine the direction of a: (i) magnetic field produced around a straight conductor-carrying current. (ii) Force experienced by a current carrying-straight conductor placed in a magnetic field which is perpendicular to it, and (iii) Current induced in a coil to its rotation in a magnetic field.

Ans. (i) Right hand thumb rule to find the direction of magnetic field

The direction of magnetic field produced due to straight current carrying-conductor can be found by using Maxwell's Right Hand Thumb Rule, which states that "if we hold a conductor in such a way that the stretched right hand thumb is along the direction of current then the direction of curl of fingers around the conductor gives the direction of the magnetic field as shown in figure below (a) and (b).

(ii) Fleming's Left-Hand Rule

Stretch your thumb, middle finger and forefinger of left hand such that they are mutually perpendicular, then thumb gives direction of force (F), forefinger gives direction of magnetic field (B) and middle finger would give direction of current.

(iii) Fleming's Right-Hand Rule

Direction of induced current in a conductor can be found by using Fleming's right hand rule. This rule is applied when we are given the direction of magnetic field, direction of motion of the conductor and we are to find the direction of current.

Q.8. When does an electric short circuit occur?

Ans. Electric short-circuit occurs when both live wire and neutral wire come in contact to each other. The phenomenon of short-circuit occurs when either the wire is not properly insulated or there is a fault in the electric appliance.

Q.9. What is the function of an earth wire? Why is it necessary to earth metallic appliances?

Ans. The metallic body of electric appliances is connected to the earth by means of earth wire so that any leakage of electric current is transferred to the ground. This prevents any electric shock to the user. That is why earthing of the electrical appliances is necessary.



13

Our Environment

Intext Questions

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Q.1. What are trophic levels? Give an example of a food chain and state the different trophic levels in it.

Ans. Each step of a food chain is called as trophic level. Energy transfer takes place at each trophic level.

Food Chain :

Grass	→	Deer	→	Tiger
I. Trophic		II. Trophic		III. Trophic
level		level		level

Q.2. What is the role of decomposers in the ecosystem?

Ans. Decomposers are very important component of any ecosystem. Green plants make their food with the help of simple inorganic substances absorbed from their environment. Plants convert them into complex organic substances. These complex substances reach the body of animals through food chain. After the death of plants and animal these locked substances are returned back to the environment by decomposers. Therefore, decomposer play a major role in degradation and mineralization of substances. From soil they can be reused by the plants. It means decomposers are essential for bio-geochemical cycles.

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Q.1. Why are some substances biodegradable and some non-biodegradable?

Ans. Substances which can be degraded or digested externally by microbes, like bacteria and fungi are called biodegradable. Whereas substances which cannot be degraded by the action of enzymes are called non biodegradable substance. e.g., plastic.

Q.2. Give any two ways in which biodegradable substances would affect the environment.

Ans. Biodegradable substance affect the environment in following manner—(i) It forms the breeding place for many germs and pests. (ii) These wastes release methane and hence add to global warming.

Q.3. Give any two ways in which non-biodegradable substances would affect the environment.

Ans. (i) Some non-biodegradable substances, like pesticides enter the food chains. Their biological magnification affects human being and other animals of ecosystem. (ii) Disposal of non-biodegradable substances, like plastic, polythene etc., has become a serious problem. They choke the drains, create many problems in environment.

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Q.1. What is ozone and how does it affect any ecosystem?

Ans. Ozone is a gas with molecular formula O_3 . Though, it is made from oxygen but on earth surface it is deadly poisonous for the living beings. But at a height of 18- 50 km above the earth surface in atmosphere it forms a protective shield. This protective layer of ozone in the stratosphere part of atmosphere protects the living organisms of the earth from the dangerous effect of ultraviolet rays. Ultraviolet rays affect DNA and cause mutations (change in genetic material) of living organisms. In human beings these rays may cause skin cancer and eye diseases. These rays also affect plants life adversely. Hence, ultraviolet rays can affect the biotic components of any ecosystem. Ozone layer is depleted by chlorine releasing chemicals, like Chlorofluoro carbons (CFCs).

Q.2. How can you help in reducing the problem of waste disposal? Give any two methods.

Ans. In towns and big cities very large amount of waste is generated. Disposal of waste is really a big challenge. Its disposal should be environment friendly, because each and every individual generate waste, therefore, it is duty of all to do something for its disposal. Two methods in which students can help in waste disposal are as follows:
(i) Generate less waste can be done by reducing

the amount of resources used. For recycling of waste, students can make compost at domestic level (judicious and genuine use of resources.)

(ii) By making people aware of the problem and also encouraging them to reduce, reuse, recycle as much as possible. By keeping separate dustbins of biodegradable and non biodegradable wastes so that they can be recycled easily.

NCERT Exercise

Q.1. Which of the following groups contain only biodegradable items?

- (a) Grass, flowers and leather
- (b) Grass, wood and plastic
- (c) Fruit peel, cake and lime juice
- (d) Cake, wood, grass.

Ans. (c) Fruit peel, cake and lime juice

Q.2. Which of the following constitute a food chain?

- (a) Grass, wheat and mango
- (b) Grass, goat and human
- (c) Goat, cow and elephant
- (d) Grass, fish and goat.

Ans. (b) Grass, goat and human

Q.3. Which of the following are environmental friendly practices?

- (a) Carrying cloth bags to put purchases in while shopping
- (b) Switching off unnecessary light and fans
- (c) Walking to school instead of getting your mother to drop you on her scooter.
- (d) All of these.

Ans. (d) All of these.

Q.4. What will happen if we kill all the organisms in one trophic level?

Ans. Each step of a food chain forms a trophic level. Energy is transferred from one trophic level to the other level. Elimination of one trophic level would stop the flow of energy in a food chain. Other trophic levels which depends on it would also be affected. On the other hand, the population of the previous trophic level would expand enormously.

Ultimately, the balance of the ecosystem would be disturbed.

Q.5. Will the impact of removing all the organisms in a trophic level be different for different trophic levels? Can the organisms of any trophic level be removed without causing any damage to the ecosystem?

Ans. Initially, the impact will be different for different trophic levels. For example, if all the carnivores are killed then initially the population of herbivores would increase. They will eat all the plant material and ultimately in the absence of vegetation would die. Therefore, if the natural balance is disturbed all the organisms are affected adversely sooner or later. No, organism of any trophic level cannot be removed without causing any damage to the ecosystem. All producers and consumers of all categories together weave a web of life. Any harm to this web affect all, including human beings.

Q.6. What is biological magnification? Will the level of this magnification be different at different levels of the ecosystem?

Ans. Progressive increase in the concentration of harmful non-biodegradable substances at successive trophic levels of a food chain is called biological magnification. Yes, the level gradually increases. It is lowest at producer level but highest in top consumers, like human.

Q.7. What are the problems caused by non-biodegradable waste that we generate?

Ans. Many problems are caused by non biodegradable waste, like— (i) Its volume cannot be reduced.

(ii) Very large area is required for its disposal.

(iii) Land fill sites or other dumping sites of non-biodegradable waste become unfit for use.

(iv) Many toxic and persistent materials, like DDT enter food chain and lead to biological magnification.

(v) Heavy metals when enter food chain cause serious diseases in human being.

Q.8. If all the waste generate is biodegradable, will this have no impact on the environment?

Ans. Excess of any waste is not good for the environment. Decomposition is a slow process and requires optimum moisture and temperature. Excess biodegradable waste would require decomposers at all the places. Decomposition of organic matter especially proteins emits foul odour. It forms the breeding place of germs and pests. If all the waste becomes biodegradable then the demand on natural resources would increase. Biodegradable waste generates methane also which is a greenhouse gas and adds to global warming.

Q.9. Why is damage to the ozone layer a cause for concern? What steps are being taken to limit this damage?

Ans: (i) The ozone layer's depletion is a reason for concern because it will be unable to filter

out ultra-violet radiation effectively, resulting in a variety of skin issues such as skin discoloration and skin cancer.

The ozone layer keeps the planet's temperature constant. Damage to the layer could lead to the death of a large number of phytoplankton, resulting in increased global warming.

(ii) CFCs (chlorofluorocarbons) are chemicals that deplete the ozone layer. The release of CFCs into the atmosphere must be curtailed to limit the harm to the ozone layer. CFCs should be replaced with environmentally friendly replacements in refrigerants and fire extinguishers. In addition, the release of CFCs from industrial processes should be regulated.



