Class –X   PT - I

CHEMISTRY

Chapter 1: Chemical Reactions and Equations Science

In Text Questions

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1. Why should a magnesium ribbon be cleaned before it is burnt in air?

Answer

Magnesium is an very reactive metal. When stored, it reacts with oxygen to form a layer of magnesium oxide on its surface. This layer of magnesium oxide is quite stable and prevents further reaction of magnesium with oxygen. The magnesium ribbon is cleaned by sand paper for removing this layer so that the underlying metal can be exposed to air.

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

(i) Hydrogen + Chlorine → Hydrogen chloride
(ii) Barium chloride + Aluminium sulphate → Barium sulphate + Aluminium chloride
(iii) Sodium + Water → Sodium hydroxide + Hydrogen

Answer

(i) H_2 (g) + Cl_2 (g) → 2HCl (g)

(ii) $3BaCl_2$ (s) + $Al_2(SO_4)_3$ (s) → $3BaSO_4$ (s) + $2AlCl_3$ (s)
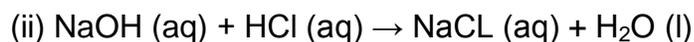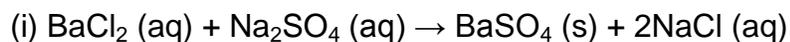
(iii) 2Na(s) + $2H_2O$ (l) → 2NaOH (aq) + H_2 (g)

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

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

to produce sodium chloride solution and water.

Answer

(i) $BaCl_2$ (aq) + Na_2SO_4 (aq) $\rightarrow$ $BaSO_4$ (s) + $2NaCl$ (aq)

(ii) NaOH (aq) + HCl (aq) $\rightarrow$ NaCL (aq) + H_2O (l)

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1. A solution of a substance 'X' is used for white washing.
(i) Name the substance 'X' and write its formula.
(ii) Write the reaction of the substance 'X' named in (i) above with water.

Answer

(i) The substance 'X' is calcium oxide. Its chemical formula is CaO.

(ii) Calcium oxide reacts vigorously with water to form calcium hydroxide (slaked lime).
CaO (s)   + H_2O (l) $\rightarrow$ $Ca(OH)_2$ (aq)
Calcium Oxide (Quick Lime) + Water $\rightarrow$ Calcium Hydroxide (Slaked Lime)

2. Why is the amount of gas collected in one of the test tubes in Activity 1.7 double of the amount collected in the other? Name this gas.

Answer

Water contains two parts of hydrogen and one part oxygen. Therefore, during the electrolysis of water the amount of hydrogen gas collected in one of the test tubes is double than that of the oxygen produced and collected in the other test tube.

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

Answer

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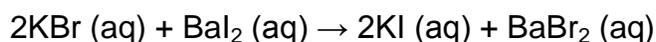
from the copper sulphate because iron is more reactive than copper. Therefore the colour of the copper sulphate solution changes.
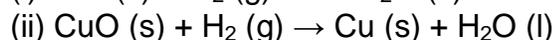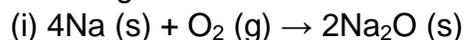
The reaction involved here is:

$Fe\ (s) + CuSO_4\ (aq) \rightarrow FeSO_4\ (aq) + Cu\ (s)$
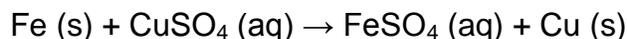
2. Give an example of a double displacement reaction other than the one given in Activity 1.10.

Answer

$2KBr\ (aq) + BaI_2\ (aq) \rightarrow 2KI\ (aq) + BaBr_2\ (aq)$

3. Identify the substances that are oxidised and the substances that are reduced in the following reactions.
(i) $4Na\ (s) + O_2\ (g) \rightarrow 2Na_2O\ (s)$
(ii) $CuO\ (s) + H_2\ (g) \rightarrow Cu\ (s) + H_2O\ (l)$
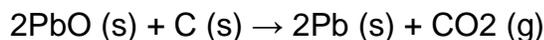
Answer

(i) Sodium (Na) is oxidised as it gains oxygen and oxygen gets reduced.

(ii) Copper oxide (CuO) is reduced to copper (Cu) while hydrogen (H_2) gets oxidised to water (H_2O).

Excercise

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1. Which of the statements about the reaction below are incorrect?
$2PbO\ (s) + C\ (s) \rightarrow 2Pb\ (s) + CO2\ (g)$
(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
► (i) (a) and (b)
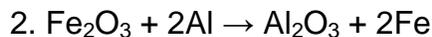
2. $Fe_2O_3 + 2Al \rightarrow Al_2O_3 + 2Fe$
The above reaction is an example of a
(a) combination reaction.
(b) double displacement reaction.
(c) decomposition reaction.
(d) displacement reaction.
► (d) displacement reaction.

3. What happens when dilute hydrochloric acid is added to iron filings? 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.
► (a) Hydrogen gas and iron chloride are produced.

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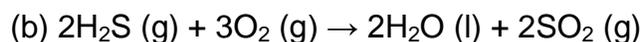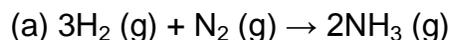
Answer

A reaction which has an equal number of atoms of all the elements on both sides of the chemical equation is called a balanced chemical equation.Chemical reaction should be balanced to follow law of conservation of mass.

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.

Answer

(a) $3H_2$ (g) + N_2 (g) $\rightarrow$ $2NH_3$ (g)

(b) $2H_2S$ (g) + $3O_2$ (g) $\rightarrow$ $2H_2O$ (l) + $2SO_2$ (g)

(c) $3BaCl_2$ (aq) + $Al_2(SO_4)_3$ (aq) $\rightarrow$ $2AlCl_3$ (aq) + $3BaSO_4$ (s)

(d) $2K$ (s) + $2H_2O$ (l) $\rightarrow$ $2KOH$ (aq) + H_2 (g)
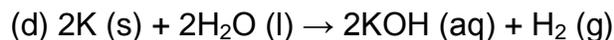
6. Balance the following chemical equations.

(i) HNO_3 + $Ca(OH)_2$ $\rightarrow$ $Ca(NO_3)_2$ + H_2O
(ii) $NaOH$ + H_2SO_4 $\rightarrow$ Na_2SO_4 + H_2O
(iii) $NaCl$ + $AgNO_3$ $\rightarrow$ $AgCl$ + $NaNO_3$
(iv) $BaCl_2$ + H_2SO_4 $\rightarrow$ $BaSO_4$ + HCl

Answer

(i) $2HNO_3$ + $Ca(OH)_2$ $\rightarrow$ $Ca(NO_3)_2$ + $2H_2O$
(ii) $2NaOH$ + H_2SO_4 $\rightarrow$ Na_2SO_4 + $2H_2O$
(iii) $NaCl$ + $AgNO_3$ $\rightarrow$ $AgCl$ + $NaNO_3$
(iv) $BaCl_2$ + H_2SO_4 $\rightarrow$ $BaSO_4$ + $2HCl$
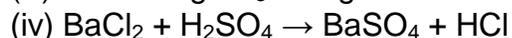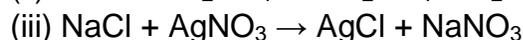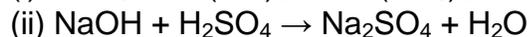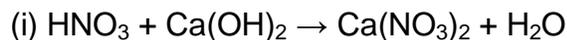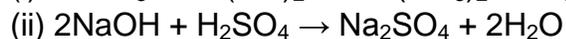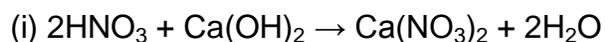
7. Write the balanced chemical equations for the following reactions.

(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
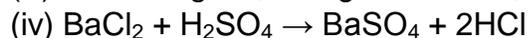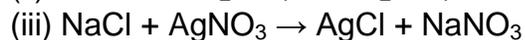
Answer

(a) $Ca(OH)2$ + CO_2 $\rightarrow$ $CaCO_3$ + H_2O

(b) Zn + $2AgNO_3$ $\rightarrow$ $Zn(NO_3)_2$ + $2Ag$

(c) $2Al$ + $3CuCl_2$ $\rightarrow$ $2AlCl_3$ + $3Cu$

(d) $BaCl2$ + K_2SO_4 $\rightarrow$ $BaSO_4$ + $2KCl$
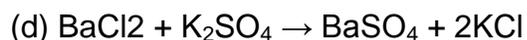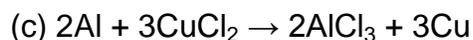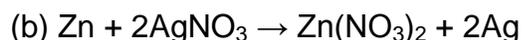
8. Write the balanced chemical equation for the following and identify the type of reaction in each case.

(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)
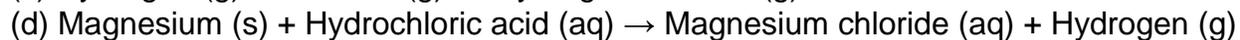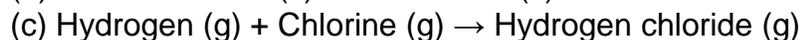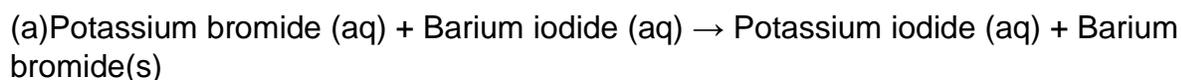
Answer

(a) 2KBr (aq) + BaI_2 (aq) → 2KI (aq) + $BaBr_2$ (s): Double displacement reaction

(b) $ZnCO_3$ (s) → ZnO (s) + CO_2 (g): Decomposition reaction

(c) H_2 (g) + Cl_2 (g) → 2HCl (g): Combination reaction

(d) Mg (s) + 2HCl (aq) → $MgCl_2$ (aq) + H_2 (g) : Displacement Reaction

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

Answer

Chemical reactions that release energy in the form of heat, light, or sound are called exothermic reactions.

Example: C (g) + O_2 (g) → CO_2 + Heat Energy

Reactions that absorb energy or require energy in order to proceed are called endothermic reactions.

Example:

$$N_2\,(g) + O_2\,(g) \xrightarrow{\text{Heat}} 2NO$$
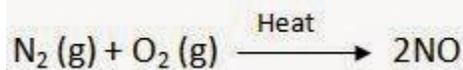
10. Why is respiration considered an exothermic reaction? Explain.

Answer

Respiration is considered as an exothermic reaction because in respiration oxidation of glucose takes place which produces large amount of heat energy.

$C_6H_{12}O_6$ (aq) + $6O_2$ (g) → $6CO_2$ (g) + $6H_2O$ (l) + Energy

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

Answer

Decomposition reactions are those in which a compound breaks down to form two or more substances. These reactions require a source of energy to proceed. Thus, they are the exact opposite of combination reactions in which two or more substances combine to give a new substance with the release of energy.For Example:
Decomposition Reaction:

$$CaCO_3 \text{ (s)} \xrightarrow{\text{Heat}} CaO \text{ (s)} + CO_2 \text{ (g)}$$
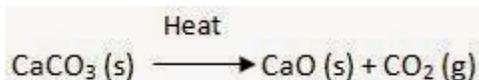
Combination Reaction:
CaO (s) + H_2O (l) → $Ca(OH)_2$ (aq)
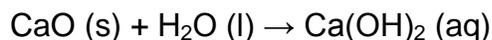
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12. Write one equation each for decomposition reactions where energy is supplied in the form of heat, light or electricity.

Answer

$$CaCO_3 \text{ (s)} \xrightarrow{\text{Heat}} CaO \text{ (s)} + CO_2 \text{ (g)}$$

$$2AgCl \text{ (s)} \xrightarrow{\text{Sunlight}} 2Ag \text{ (s)} + Cl_2 \text{ (g)}$$

$$2H_2O \text{ (l)} \xrightarrow{\text{Electricity}} 2H_2 \text{ (g)} + O_2 \text{ (g)}$$
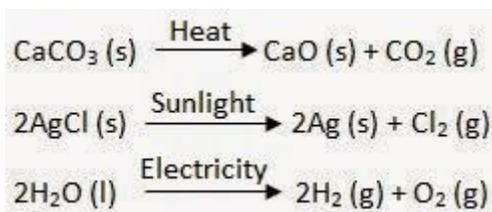
13. What is the difference between displacement and double displacement reactions? Write equations for these reactions.

Answer

In a displacement reaction, a more reactive element replaces a less reactive element from a compound.
For Example: $CuSo_4$ (aq) + Zn (s) → $ZnSO_4$ (aq) + Cu (s)
In a double displacement reaction, two atoms or a group of atoms switch places to form new compounds.

For Example: Na_2SO_4 (aq) + $BaCl_2$ (aq) → $BaSO_4$ (s) + 2NaCl (aq)

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

Answer
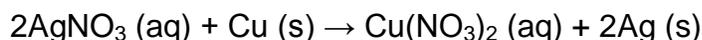
$2AgNO_3$ (aq) + Cu (s) → $Cu(NO_3)_2$ (aq) + 2Ag (s)
Silver Nitrate + Copper → Copper Nitrate + Silver

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

Answer

A reaction in which an insoluble solid (called precipitate) is formed is called a precipitation reaction.For Example:
Na_2CO_3 (aq) + $CaCl_2$ (aq) → $CaCO_3$ (s) + 2NaCl (aq)
Sodium Carbonate + Calcium Chloride → Calcium Carbonate + Sodium Chloride
In this reaction, calcium carbonate is obtained as a precipitate. Hence, it is a precipitation reaction.
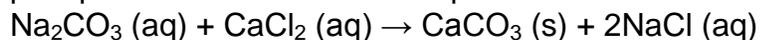
16. Explain the following in terms of gain or loss of oxygen with two examples each.
(a) Oxidation
(b) Reduction

Answer

Oxidation Reaction: It is a chemical reaction in which gain of oxygen or loss of hydrogen takes place.

(i) $2Mg\,(s) + O_2\,(g) \xrightarrow{\text{Heat}} 2\,MgO\,(s)$
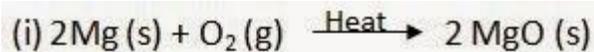
Here, Magnesium is oxidised to become Magnesium Oxide.

(ii) $2Cu\,(s) + O_2\,(g) \xrightarrow{\text{Heat}} 2CuO\,(s)$
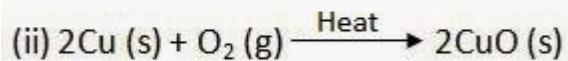
Here, Copper is oxidised to become Copper Oxide.

Reduction Reaction: It is a chemical reaction in which loss of oxygen or gain of hydrogen takes place.

(i) $CuO + H_2 \xrightarrow{\text{Heat}} Cu + H_2O$

Here, Copper Oxide is reduced to become Copper.

(ii) $ZnO + C \xrightarrow{\text{Heat}} Zn + CO$

Here, Zinc Oxide is reduced to become Zinc.

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

Answer

'X' is copper (Cu) and the black-coloured compound formed is copper oxide (CuO). The equation of the reaction involved on heating copper is given below.

$$2Cu + O_2 \xrightarrow{\text{Heat}} 2CuO$$
(Shiny Brown in Colour)   (Black in Colour)
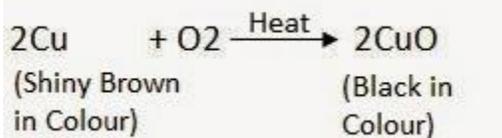
18. Why do we apply paint on iron articles?

Answer

Iron articles are painted because it prevents them from rusting. When painted, the contact of iron articles from moisture and air is cut off. Hence, rusting is prevented.

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

Answer

Oil and fat containing food items flushed with nitrogen because nitrogen acts as an antioxidant and it prevent them from being oxidised.

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

Answer

Corrosion is defined as a process where materials, usually metals, deteriorate as a result of a chemical reaction with air, moisture, chemicals, etc.
For example, iron, in the presence of moisture, reacts with oxygen to form hydrated iron oxide.
$4Fe + 3O_2 + nH_2O \rightarrow 2Fe_2O_3.nH_2O$

Rancidity is the process of oxidation of fats and oils that can be easily noticed by the change in taste and smell is known as rancidity.
For example, the taste and smell of butter changes when kept for long.

Chapter 2: Acids, Bases and Salts Science

In Text Questions

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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?

Answer

If the colour of red litmus does not change then it is acid. If the colour of red litmus changes to blue then it is base. If there is slight change in the colour of red litmus (such as purple) then it is distilled water.

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

Answer

Curd and other sour substances contain acids. Therefore, when they are kept in brass and copper vessels, the metal reacts with the acid to liberate hydrogen gas and harmful products, thereby spoiling the food.

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?

Answer

Hydrogen gas is usually liberated when an acid reacts with a metal.
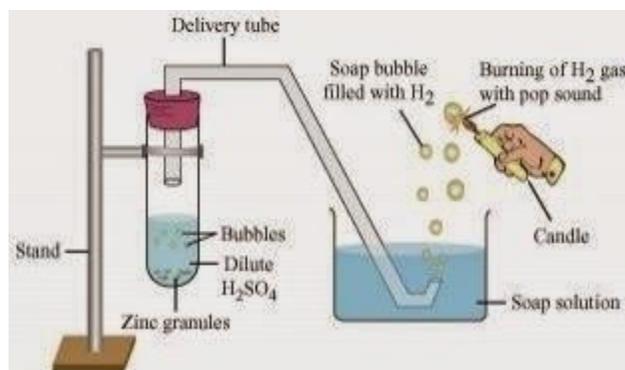
Take few pieces of zinc granules and add 5 ml of dilute H2SO4. Shake it and pass the gas produced into a soap solution. The bubbles of the soap solution are formed. These soap bubbles contain hydrogen gas.

$H_2SO_4 + Zn \rightarrow ZnSO_4 + H_2 \uparrow$
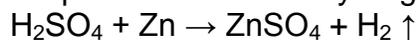
We can test the evolved hydrogen gas by its burning with a pop sound when a candle is brought near the soap bubbles.

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.

Answer

$CaCO_3 \text{ (s)} + 2HCl \text{ (aq)} \rightarrow CaCl_2 \text{ (aq)} + CO_2 \text{ (g)} + H_2O \text{ (l)}$
Calcium Carbonate + Hydrochloric acid → Calcium Chloride + Carbon dioxide + Water

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

Answer

When HCl or HNO_3 are mixed with water then they dissolve in water to form H^+ or H_3O^+ ions which shows their acidic character. For example just see the following reactions

$HCl \text{ (aq)} \rightarrow H^+ + Cl^-$

$H^+ + H_2O \rightarrow H_3O^+$
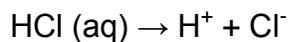
When alcohols and glucose are mixed with water then they do not dissolve to form ions. Hence they do not show acidic character.

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

Answer

The presence of hydrogen (H^+) or hydronium (H_3O^+) ions in the aqueous solution of an acid are responsible for conducting electricity.

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

Answer

Dry HCl gas not change the colour of the dry litmus paper because it has no Hydrogen ions (H^+) in it.

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

Answer

Since the process of dissolving an acid in water is exothermic, it is always recommended that acid should be added to water. If it is done the other way, then it is possible that because of the large amount of heat generated, the mixture splashes out and causes burns.

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

Answer

When an acid is diluted, the concentration of hydronium ions (H_3O^+) per unit volume decreases. This means that the strength of the acid decreases.

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

Answer

The concentration of hydroxide ions (OH^-) would increase when excess base is dissolved in a solution of sodium hydroxide.

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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?

Answer

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.

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

Answer

If the concentration of H^+ (aq) ions is increased (>10-7) then the solution become acidic and if the concentration of H^+ (aq) ions is decreased (<10-7) then the solution become basic in nature.

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

Answer

Yes, basic solution also has H^+ ions. However, their concentration is less as compared to the concentration of OH^- ions that makes the solution basic.

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)?

Answer

If the soil is acidic and improper for cultivation, then to increase the basicity of soil, the farmer would treat the soil with quick lime or slaked lime or chalk.

Page No: 33

1. What is the common name of the compound $CaOCl_2$?
► Bleaching Powder.

2. Name the substance which on treatment with chlorine yields bleaching powder?
► Calcium hydroxide [$Ca(OH)_2$]

3. Name the sodium compound which is used for softening hard water.
► Washing soda ($Na_2CO_3.10H_2O$)

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

Answer

When sodium hydrogen carbonate is heated then sodium carbonate and water is formed along with the evolution of carbon dioxide gas.

$$2NaHCO_3 \xrightarrow{Heat} Na_2CO_3 + H_2O + CO_2$$
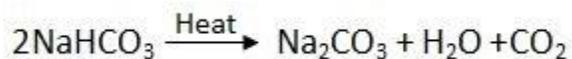
5. Write an equation to show the reaction between Plaster of Paris and water.

Answer

$$\underset{\text{(Plaster of Paris)}}{CaSO_4.\frac{1}{2}H_2O} + \underset{\text{(Water)}}{1\frac{1}{2}H_2O} \xrightarrow{Heat} \underset{\text{(Gypsum)}}{CaSO_4.2H_2O}$$
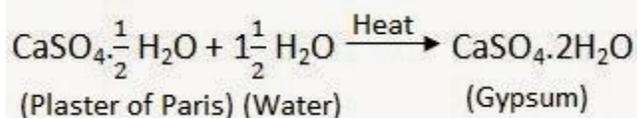
Excercise

1. A solution turns red litmus blue, its pH is likely to be
(a) 1
(b) 4
(c) 5
(d) 10
► (d) 10

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

► (b) HCl

3. 10 mL of a solution of NaOH is found to be completely neutralised by 8 mL of a given

solution of HCl. If we take 20 mL of the same solution of NaOH, the amount of HCl solution (the same solution as before) required to neutralise it will be
(a) 4 mL

(b) 8mL

(c) 12 mL

(d) 16 mL

► (d) 16 mL

4. Which one of the following types of medicines is used for treating indigestion?
(a) Antibiotic
(b) Analgesic
(c) Antacid
(d) Antiseptic
► (c) Antacid

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.

Answer

(a) H_2SO_4 (aq) + Zn (s) → $ZnSO_4$ (aq) + H_2 (g)

(b) 2HCl (aq) + Mg (s) → $MgCl$ (aq) + H_2 (g)

(c) $3H_2SO_4$ (aq) + 2Al (s) → Al_2SO_4 (aq) + $3H_2$ (g)

(d) 6HCl (aq) + 2Fe (s) → $2FeCl_3$ (aq) + $3H_2$ (g)
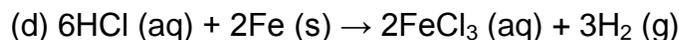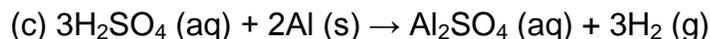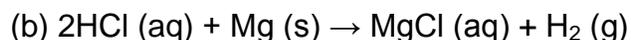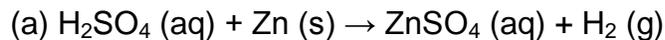
6. Compounds such as alcohols and glucose also contain hydrogen but are not categorized as acids. Describe an activity to prove it.

Answer

Two nails are fitted on a cork and are kept it in a 100 mL beaker. The nails are then connected to the two terminals of a 6-volt battery through a bulb and a switch. Some dilute HCl is poured in the beaker and the current is switched on. The same experiment is then performed with glucose solution and alcohol solution.

Observations:
It will be observed that the bulb glows in the HCl solution and does not glow in the glucose solution.
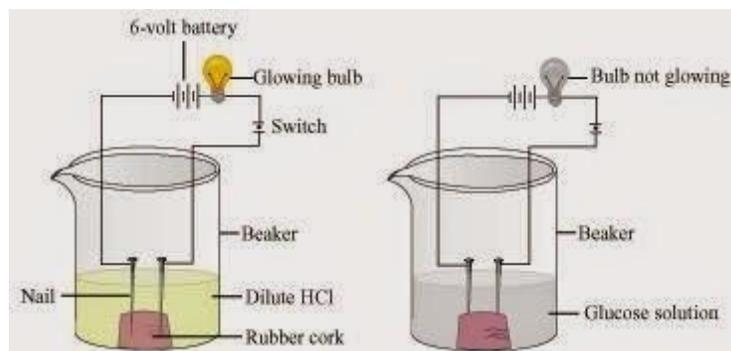
Result:
HCl dissociates into H^+ and Cl^- ions. These ions conduct electricity in the solution resulting in the glowing of the bulb. On the other hand, the glucose solution does not dissociate into ions. Therefore, it does not conduct electricity.

Conclusion:
From this activity, it can be concluded that all acids contain hydrogen but not all compounds containing hydrogen are acids.
That is why, though alcohols and glucose contain hydrogen, they are not categorised as acids.

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

Answer

Distilled water cannot conduct electricity because it does not contain ions while rain water conducts electricity as it contains ions due presence of dissolved salts in it.

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

Answer

Acids do not show acidic behaviour in the absence of water because the dissociation of hydrogen ions from an acid occurs in the presence of water only.

9. Five solutions A, B, C, D and E when tested with 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.

Answer

(a) Neutral →Solution D with pH 7
(b) Strongly alkaline →Solution C with pH 11
(c) Strongly acidic →Solution B with pH 1
(d) Weakly acidic →Solution A with pH 4
(e) Weakly alkaline →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.

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?

Answer

The fizzing will occur strongly in test tube A, in which hydrochloric acid (HCl) is added. This is because HCl is a stronger acid than CH_3COOH and therefore produces hydrogen gas at a faster speed due to which fizzing occurs.

11. Fresh milk has a pH of 6. How do you think the pH will change as it turns into curd? Explain your answer.

Answer

The pH of milk is 6. As it changes to curd, the pH will reduce because curd is acidic in nature. The acids present in it decrease the pH.

12.A milkman adds a very small amount of baking soda to fresh milk.

(a) Why does he shift the pH of the fresh milk from 6 to slightly alkaline?
(b) Why does this milk take a long time to set as curd?

Answer

(a) The milkman shifts the pH of the fresh milk from 6 to slightly alkaline because in alkaline condition, milk does not set as curd easily.

(b) Since this milk is slightly basic than usual milk, acids produced to set the curd are neutralized by the base. Therefore, it takes a longer time for the curd to set.

13. Plaster of Paris should be stored in a moisture-proof container. Explain why?

Answer

The Plaster of Paris should be stored in a moisture-proof container as it absorbs water from moisture and turn into hard substance (Gypsum) as shown in following chemical equation.

$$CaSO_4.\frac{1}{2} H_2O + 1\frac{1}{2} H_2O \xrightarrow{Heat} CaSO_4.2H_2O$$
(Plaster of Paris) (Water)   (Gypsum)
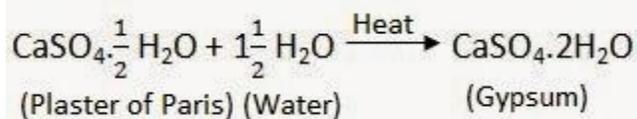
14. What is a neutralization reaction? Give two examples.

Answer

A reaction in which an acid and base react with each other to give a salt and water is termed as neutralization reaction. For Example:
(i) $NaOH + HCl \rightarrow NaCl + H_2O$
(ii) $HNO_3 + KOH \rightarrow KNO_3 + H_2O$

15. Give two important uses of washing soda and baking soda.

Answer

Two important uses of washing soda are:
→ It is used in glass, soap, and paper industries.
→ It is used to remove permanent hardness of water.

Two important uses of baking soda are:
→ It is used as baking powder. Baking powder is a mixture of baking soda and a mild acid known as tartaric acid. When it is heated or mixed in water, it releases CO_2 that makes bread or cake fluffy.
→ It is used in soda-acid fire extinguishers.

BIOLOGY

Chapter 6: Life Processes Science

In Text Questions

Page No: 95

1. Why is diffusion insufficient to meet the oxygen requirementsof multi-cellular organisms like humans?

Answer

Unlike the unicellular organisms, the multi-cellular organisms have complex body structures with specialized cells and tissues to perform various necessary functions of the body. Since these cells are not in direct contact with surrounding environment so, simple diffusion cannot meet the oxygen requirement of all these cells.

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

Answer

Any visible movement such as walking, breathing, or growing is generally used to decide whether something is alive or not. However, a living organism can also have movements, which are not visible to the naked eye. Therefore, the presence of life processes is a fundamental criterion that can be used to decide whether something is alive or not.

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

Answer

Various outside raw materials used by an organism are as follows:
→ Food as source of supplying energy and materials.
→ Oxygen for breakdown of food to obtain energy.
→ Water for proper digestion of food and other functions inside the body.
The raw materials required by an organism will vary depending on the complexity of the organism and its environment.

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

Answer

Life processes such as nutrition, respiration, transportation, excretion, etc. are essential for maintaining life.

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

Answer

Autotrophic Nutrition	Heterotrophic Nutrition
Food is synthesised from simple inorganic raw materials such as CO_2 and water.	Food is obtained directly or indirectly from autotrophs. This food is broken down with the help of enzymes.
Chlorophyll is required.	Chlorophyll is not required.
Food is generally prepared during day time.	Food can be obtained at all time.
All green plants and some bacteria have this type of nutrition.	All animals and fungi have this type of nutrition.

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

Answer

The following raw materials are required for photosynthesis:
→ Carbon Dioxide: Plants get CO2 from atmosphere through stomata.
→ Water: Plants absorb water from soil through roots and transport to leaves.
→ Sunlight: Sunlight, which is absorbed by the chlorophyll and other green parts of the plant.

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

Answer

Following are the roles of acid in our stomach:→ The hydrochloric acid present in our stomach dissolves bits of food and creates an acidic medium. In this acidic medium, enzyme pepsinogen is converted to pepsin, which is a protein-digesting enzyme.
→ It also kills many bacteria and other microorganisms that enter alongwith the food.

4. What is the function of digestive enzymes?

Answer

Digestive enzymes such as amylase, lipase, pepsin, trypsin, etc. help in the breaking down of complex food particles into simple ones. These simple particles can be easily absorbed by the blood and thus transported to all the cells of the body.

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

Answer

The small intestine has millions of tiny finger-like projections called villi. These villi increase the surface area for more efficient food absorption. Within these villi, many blood vessels are present that absorb the digested food and carry it to the blood stream. From the blood stream, the absorbed food is delivered to each and every cell of the body.

A villus in the small intestine
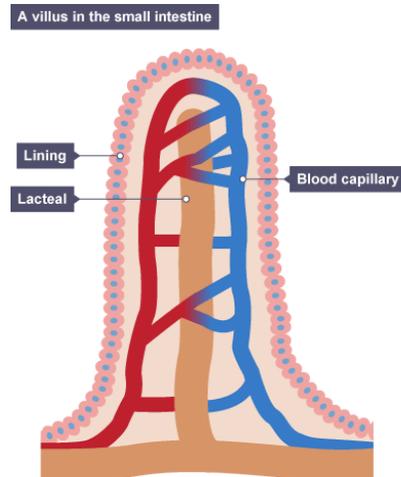
Page No: 105

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

Answer

Terrestrial organisms take up oxygen from the atmosphere whereas aquatic animals obtain oxygen from water. Air contains more O_2 as compared to water. Since the content of O_2 in air is high, the terrestrial animals do not have to breathe faster to get more oxygen. Therefore, unlike aquatic animals, terrestrial animals do not need adaptations for gaseous exchange.

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

Answer

At first glucose (6 carbon molecules) is broken in the cytoplasm of cells of all organisms. This process yields a 3 carbon molecule compound called pyruvate.
Further break down of pyruvate takes place in different manners in different organisms.
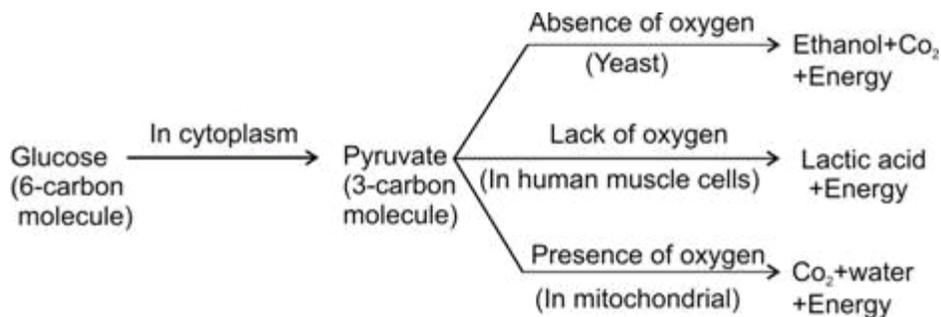
(Break down of glucose by various pathways)

→ Anaerobic Respiration: This process takes place in absence of oxygen, e.g. in yeast during fermentation. In this case pyruvate is converted into ethanol and carbon dioxide.
→ Aerobic Respiration: In aerobic respiration, breakdown of pyruvate takes place in presence of oxygen to give rise 3 molecules of carbon dioxide and water. The release of energy in aerobic respiration is much more than anaerobic respiration.
→ Lack of Oxygen: Sometimes, when there is lack of oxygen, especially during vigorous activity, in our muscles, pyruvate is converted into lactic acid (3 carbon molecule compounds). Formation of lactic acid in muscles causes cramp.

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

Answer

→ Transport of Oxygen: The respiratory pigments (haemoglobin) present in red blood

cells takes up the oxygen from the air to the lungs. They carry the oxygen to tissues which are deficient in oxygen.

→ Transport of carbon dioxide: Carbon Dioxide is more soluble in water. Hence, it is mostly transported from body tissues in the dissolved form in our blood plasma to lungs where it diffuses from blood to air in the lungs and then expelled out through nostrils.

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

Answer

Lungs contain millions of alveoli which provide a surface for the exchange of gases. An extensive network of blood vessels is present in the wall of the alveoli. By lifting our ribs and flatten the diaphragm, the chest cavity becomes spacious. Air is sucked into the lungs and alveoli. The oxygen from the breath, diffuses into the blood and CO_2 from the blood brought from the body, diffuses out into the air.

Page No: 110

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

Answer

The main components of the transport system in human beings are the heart, blood, and blood vessels.
→ Heart pumps oxygenated blood throughout the body. It receives deoxygenated blood from the various body parts and sends this impure blood to the lungs for oxygenation.
→ Blood helps in the transport of oxygen, nutrients, CO_2, and nitrogenous wastes.
→ The blood vessels (arteries, veins, and capillaries) carry blood either away from the heart to various organs or from various organs back to the heart.

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

Answer

It is necessary to separate oxygenated and deoxygenated blood to maintain efficient supply of oxygen into the body. This system is essential in animals that have high energy need. For example, animals like mammals and birds which constantly use this energy to maintain their body temperature.

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

Answer

In highly organised plants, there are two different types of conducting tissues - xylem and phloem. Xylem conducts water and minerals obtained from the soil (via roots) to the rest of the plant. Phloem transports food materials from the leaves to different parts of the plant body.

4. How are water and minerals transported in plants?

Answer

Water and minerals are transported through xylem cells from soil to the leaves. The xylem cells of roots stem and leaves are interconnected to form a conducting channel that reaches all parts of the plant. The root cells take ions from the soil. This creates a difference between the concentration of ions of roots and soil. Therefore, there is a steady movement of water into xylem. An osmotic pressure is formed and water and minerals are transported from one cell to the other cell due to osmosis. The continuous loss of water takes place due to transpiration. Because of transpiration, a suction pressure is created as a result of which water is forced into the xylem cells of roots. The effect of root pressure for transportation in plants is more important in night while during day time transpiration pull becomes the major driving force.

5. How is food transported in plants?

Answer

Phloem transports food materials from the leaves to different parts of the plant. The transportation of food in phloem is achieved by utilizing energy from ATP which helps in creating osmotic pressure that transport food from the area of high concentration to low concentration.

Page No: 112

1. Describe the structure and functioning of nephrons.

Answer

Nephrons are the basic filtering units of kidneys. Each kidney possesses large number

of nephrons, approximately 1-1.5 million. The main components of the nephron are glomerulus, Bowman's capsule, and a long renal tubule.
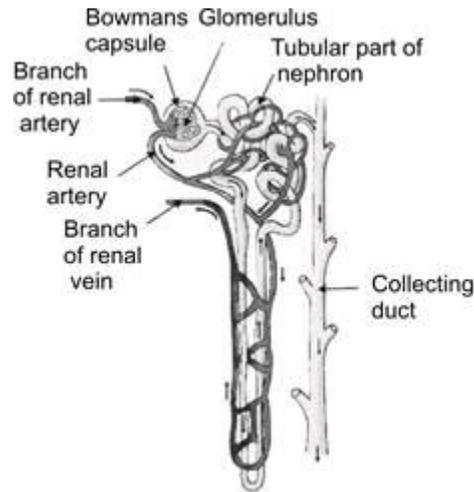
Functioning of a nephron:
→ The blood enters the kidney through the renal artery, which branches into many capillaries associated with glomerulus.
→ The water and solute are transferred to the nephron at Bowman's capsule.
→ In the proximal tubule, some substances such as amino acids, glucose, and salts are selectively reabsorbed and unwanted molecules are added in the urine.
→ The filtrate then moves down into the loop of Henle, where more water is absorbed.
→ From here, the filtrate moves upwards into the distal tubule and finally to the collecting duct. Collecting duct collects urine from many nephrons.
→ The urine formed in each kidney enters a long tube called ureter. From ureter, it gets transported to the urinary bladder and then into the urethra.

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

Answer

Plants can get rid of excess of water by transpiration. Waste materials may be stored in the cell vacuoles or as gum and resin, especially in old xylem. It is also stored in the leaves that later fall off.

3. How is the amount of urine produced regulated?

Answer

The amount of urine produced depends on the amount of excess water and dissolved wastes present in the body. Some other factors such as habitat of an organism and hormone such as Anti-diuretic hormone (ADH) also regulates the amount of urine produced.

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Excercise

1. The kidneys in human beings are a part of the system for
(a) nutrition.

(b) respiration.

(c) excretion.

(d) transportation.

► (c) excretion.

2. The xylem in plants are responsible for
(a) transport of water.
(b) transport of food.
(c) transport of amino acids.
(d) transport of oxygen.
► (a) transport of water.

3. The autotrophic mode of nutrition requires
(a) carbon dioxide and water.
(b) chlorophyll.
(c) sunlight.
(d) all of the above.
► (d) all of the above.

4. The breakdown of pyruvate to give carbon dioxide, water and energy takes place in
(a) cytoplasm.
(b) mitochondria.
(c) chloroplast.
(d) nucleus.
► (b) mitochondria.

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

Answer

Fats are present in the form of large globules in the small intestine. The small intestine receives the secretions from the liver and the pancreas. The bile salts (from the liver) break down the large fat globules into smaller globules so that the pancreatic enzyme lipase can easily act on them. This is referred to as emulsification of fats. This process takes place in the small intestine.

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

Answer

The role of saliva in the digestion of food:
→ It moistens the food for easy swallowing.
→ It contains a digestive enzyme called salivary amylase, which breaks down starch into sugar.

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

Answer

Autotrophic nutrition takes place through the process of photosynthesis. Carbon dioxide, water, chlorophyll pigment, and sunlight are the necessary conditions required for autotrophic nutrition. Carbohydrates (food) and O_2 are the by-products of photosynthesis.

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

Answer

Aerobic respiration	Anaerobic respiration
It occurs in the presence of O_2.	It occurs in the absence of O_2.
It involves the exchange of gases between the organism and the outside environment.	Exchange of gases is absent.
It occurs in cytoplasm and mitochondria.	It occurs only in cytoplasm.

It always releases CO_2 and H_2O.	End products vary.
It always releases CO_2 and H_2O.	End products vary.

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

Answer

Alveoli provide a surface for the exchange of gases. An extensive network of blood vessels is present in the wall of the alveoli. By lifting our ribs and flatten the diaphragm, the chest cavity becomes spacious. Air is sucked into the lungs and alveoli. The oxygen from the breath, diffuses into the blood and CO_2 from the blood brought from the body, diffuses out into the air.

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

Answer

Haemoglobin is the respiratory pigment that transports oxygen to the body cells for cellular respiration. Therefore, deficiency of haemoglobin in blood can affect the oxygen supplying capacity of blood. This can lead to deficiency of oxygen in the body cells. It can also lead to a disease called anaemia.

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

Answer

During a single cycle blood goes twice in the heart which is known as double circulation. It is necessary in human being to separate oxygenated and de-oxygenated blood because this makes their circulatory system is more efficient and helps in maintaining constant body temperature.

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

Answer

Aerobic respiration	Anaerobic respiration
Xylem tissue helps in the transport of water and minerals.	Phloem tissue helps in the transport of food.
Water is transported upwards from roots to all	Food is transported in both upward

other plant parts.	and downward directions.
Transport in xylem occurs with the help of simple physical forces such as transpiration pull.	Transport of food in phloem requires energy in the form of ATP.

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

Answer

Alveoli	Nephrons
Structure	**Structure**
Alveoli are tiny balloon-like structures present inside the lungs.	Nephrons are tubular structures present inside the kidneys.
The walls of the alveoli are one cell thick and it contains an extensive network of blood capillaries.	Nephrons are made of glomerulus, bowman's capsule, and a long renal tube.
Function	**Function**
The exchange of O2 and CO2 takes place between the blood of the capillaries that surround the alveoli and the gases present in the alveoli.	The blood enters the kidneys through the renal artery. The blood is entered here and the nitrogenous waste in the form of urine is collected by collecting duct.
Alveoli are the site of gaseous exchange.	Nephrons are the basic filtration unit.

Chapter 7: Control and Coordination Science

In Text Questions

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

Answer

A reflex action is voluntary action which is a rapid and automatic response to stimuli while walking is a voluntary action which requires our thinking and in our control.

2. What happens at the synapse between two neurons?

Answer

A synapse is the gap between the two neurons. At synapse the electrical signals converted into chemicals that can easily cross over the gap and pass on to the next neurons where it again converted into electrical signals.

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

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

Answer

When the smell of the incense stick reaches to our nose then the olfactory receptors present in our nose detects it send this information in fore brain in the form of electrical signals. Fore brain interprets this information as the smell of incense stick where it is already stored.

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

Answer

Brain has no direct involvement in reflex action. It is mainly controlled by Spinal Cord as these action not requires thinking and are very quick action.

1. What are plant hormones?

Answer

Plant hormones are the fluids which are secreted within the plant also known as phytohormones. Plant hormones regulate the growth and development of the plant. Examples of plant hormones are auxin, gibberellins etc.

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

Answer

The movements of the leaves of the sensitive plant are touch sensitive and independent of growth while the movement of the shoot towards light is growth related and known as phototropism.

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

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

Answer

When tendrils come in contact with any support, the part of the tendril in contact with the object does not grow as rapidly as the part of the tendril away from the object. This is caused by the action of auxin hormone. Less auxin occurs on the side of contact as compared to the free side as a result, auxin promotes growth on the free side and the tendrils coil around the support.

5. Design an experiment to demonstrate hydrotropism.

Answer

Take two small beakers and label them as A and B. Fill beaker A with water. Now make a cylindrical-shaped roll from a filter paper and keep it as a bridge between beaker A and beaker B, as shown in the figure. Attach few germinating seeds in the middle of the filter paper bridge. Now, cover the entire set-up with a transparent plastic container so that the moisture is retained.
Observation:
The roots of the germinating seeds will grow towards beaker A.
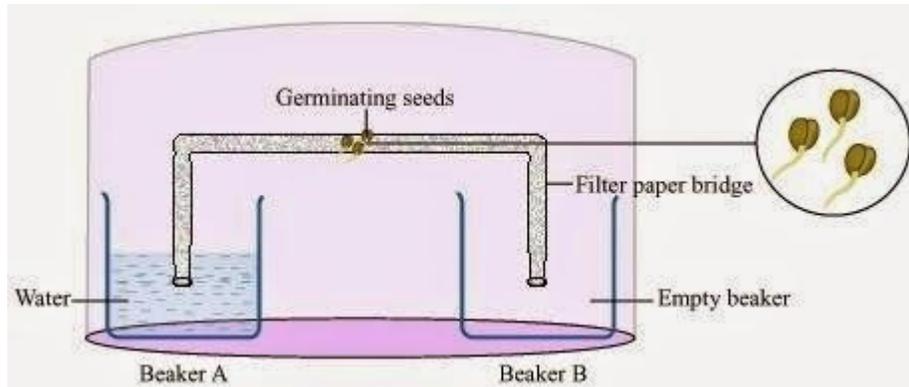
This experiment demonstrates the phenomenon of hydrotropism.

1. How does chemical coordination take place in animals?

Answer

Chemical coordination takes place in animals with the help of hormones. Hormones are the chemical fluids that are secreted by the glands of the endocrine system. Hormones regulate the overall growth and development of the animals.

2. Why is the use of iodised salt advisable?

Answer

Iodine stimulates the thyroid gland to produce thyroxin hormone. It regulates carbohydrate, fat, and protein metabolism in our body. Deficiency of this hormone results in the enlargement of the thyroid gland. This can lead to goitre, a disease characterized by swollen neck. Therefore, iodised salt is advised for normal functioning of the thyroid gland.

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

Answer

When someone is in danger or in emergency then adrenal gland secrete adrenaline hormone. It is secreted directly into the blood and is transported to different parts of the body. It speeds up the heartbeat and hence supplies more oxygen to the muscles. This results in increasing breathing rate and blood pressure which enable them to fight with such urgent situation.

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

Answer

Diabetes is caused due to less or no secretion of hormone insulin by pancreas. In such a person, blood sugar level is high. Insulin converts extra sugar present in blood into glycogen. Thus, patients suffering from diabetes are given insulin injection to control their blood sugar level.

Excercise

1. Which of the following is a plant hormone?
(a) Insulin
(b) Thyroxin
(c) Oestrogen
(d) Cytokinin
► (d) Cytokinin

2. The gap between two neurons is called a
(a) dendrite.
(b) synapse.
(c) axon.
(d) impulse.
► (b) synapse.

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3. The brain is responsible for
(a) thinking.
(b) regulating the heart beat.
(c) balancing the body.
(d) all of the above.
► (d) all of the above.

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?

Answer

Functions of receptors:
→ They sense the external stimuli such as heat or pain.
→ They also trigger an impulse in the sensory neuron which sends message to the spinal cord.

When the receptors are damaged, the external stimuli transferring signals to the brain are not felt. For example, in the case of damaged receptors, if we accidentally touch any

hot object, then our hands might get burnt as damaged receptors cannot perceive the external stimuli of heat and pain.

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

Answer
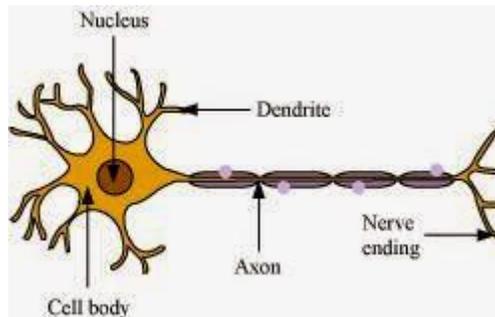
Functions of the three parts of a neuron:
→ Axon: It conducts messages away from the cell body.
→ Dendrite: It receives information from axon of another cell and conducts the messages towards the cell body.
→ Cell body: It contains nucleus, mitochondria, and other organelles. It is mainly concerned with the maintenance and growth.

6. How does phototropism occur in plants?

Answer

The growth movement in plants in response to light stimulus is known as phototropism.The shoots show positive phototropism and the roots show negative phototropism. This means that the shoots bend towards the source of light whereas the roots bend away from the light source.
For Example: The flower head of sunflower is positively phototropic and hence it moves from east to west along with the sun.

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

Answer

In case of the spinal cord injury, the signals coming from the nerves as well as the signals coming to the receptors will be disrupted. As both these signals meet in a bundle in spinal cord so there is any spinal cord injury then both these signals are

disrupted.

8. How does chemical coordination occur in plants?

Answer

Chemical coordination occurs in plants with the help of plant hormones. Different plant hormones help to coordinate growth, development, and responses to the environment. They are synthesized at places away from where they act and diffuse to the area for action, For example, auxin promotes cell growth, gibberellins promote stem growth, cytokinins promote cell division and abscisic acid inhibits growth and its effects include wilting of leaves.

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

Answer

There are various organs in an organism. These organs must be carefully controlled and coordinated for the survival of an organisms. In the body of an organism various fluids are secreted from the glands of the endocrine system. These hormones are responsible for the overall growth and development of an organism. All others daily decision that includes voluntary and involuntary action are controlled by central nervous system(CNS).

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

Answer

Involuntary action is the set of muscle movement which do not require thinking. But it is controlled by brain for example beating of heart beat while on the other hand, the reflex action is rapid and spontaneous action in response to any stimulus. For example closing of eyes immediately when bright light is focused.

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

Answer

Nervous System Mechanism	Hormonal System Mechanism
It is consist of nerve impulses between PNS, CNS and Brain.	It consists of endocrine system which secretes hormones directly into blood.

The axons and dendrites transmit the information through a coordinated effort.	The information is transmitted or transported through blood.
The flow of information is rapid and the response is quick.	The information travels slowly and the response is slow.
Nerve impulses are not specific in their action.	Each hormone has specific actions.
Effects are short lived.	It has prolonged effects.

12. What is the difference between the manner in which movement takes place in a sensitive plant and the movement in our legs?

Answer

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

PHYSICS

Chapter 12: Electricity

In Text Questions

Page No: 200

1. What does an electric circuit mean?

Answer

A continuous and closed path of an electric current is called an electric circuit. An electric circuit consists of electric devices, source of electricity and wires that are connected with the help of a switch.

2. Define the unit of current.

Answer

The unit of electric current is ampere (A). 1 A is defined as the flow of 1 C of charge through a wire in 1 s.

3. Calculate the number of electrons constituting one coulomb of charge.

Answer

One electron possesses a charge of 1.6×10^{-19}C, i.e., 1.6×10^{-19}C of charge is contained in 1 electron.

∴ 1 C of charge is contained in $1/1.6 \times 10^{-19} = 6.25 \times 10^{18} = 6 \times 10^{18}$

Therefore, 6×10^{18} electrons constitute one coulomb of charge.

Page No: 202

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

Answer

Any source of electricity like battery, cell, power supply, etc. helps to maintain a potential difference across a conductor.

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

Answer

If 1 J of work is required to move a charge of amount 1 C from one point to another, then it is said that the potential difference between the two points is 1 *V*.

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

Answer

The energy given to each coulomb of charge is equal to the amount of work which is done in moving it.
Now we know that,
Potential difference = Work Done/Charge
∴ Work done = Potential difference × charge
Where, Charge = 1 C and Potential difference = 6 *V*
∴ Work done = 6×1
= 6 Joule.

Page No: 209

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

Answer

The resistance of a conductor depends upon the following factors:
→ Length of the conductor
→ Cross-sectional area of the conductor
→ Material of the conductor
→ Temperature of the conductor

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

Answer

The current will flow more easily through thick wire. It is because the resistance of a conductor is inversely proportional to its area of cross - section. If thicker the wire, less is resistance and hence more easily the current flows.

3. Let the resistance of an electrical component 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?

Answer

According to Ohm's law
$V = IR$
$\Rightarrow I = V/R \ldots$ (1)
Now Potential difference is decreased to half
$\therefore$ New potential difference $V' = V/2$
Resistance remains constant
So the new current $I' = V'/R$
$= (V/2)/R$
$= (1/2) (V/R)$
$= (1/2) I = I/2$

Therefore, the amount of current flowing through the electrical component is reduced by half.

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

Answer

The resistivity of an alloy is higher than the pure metal. Moreover, at high temperatures, the alloys do not melt readily. Hence, the coils of heating appliances such as electric toasters and electric irons are made of an alloy rather than a pure metal.

5. Use the data in Table 12.2 to answer the following -
Table 12.2 Electrical resistivity of some substances at 20°C

–	**Material**	**Resistivity (Ω m)**
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^{-6}
	Constantan (alloy of Cu and Ni)	49×10^{-6}
Alloys	Manganin (alloy of Cu, Mn and Ni)	44×10^{-6}
	Nichrome (alloy of Ni, Cr, Mn and Fe)	100×10^{-6}
	Glass	$10^{10} - 10^{14}$
Insulators	Hard rubber	$10^{13} - 10^{16}$
	Ebonite	$10^{15} - 10^{17}$
	Diamond	$10^{12} - 10^{13}$
	Paper (dry)	10^{12}

Answer

(a) Resistivity of iron = $10.0 \times 10^{-8}\ \Omega$

Resistivity of mercury = 94.0×10^{-8} Ω
Resistivity of mercury is more than that of iron. This implies that iron is a better conductor than mercury.

(b) It can be observed from Table 12.2 that the resistivity of silver is the lowest among the listed materials. Hence, it is the best conductor.

Page No: 213

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

Answer

Three cells of potential 2 V, each connected in series therefore the potential difference of the battery will be 2 V + 2 V + 2 V = 6V. The following circuit diagram shows three resistors of resistances 5 Ω, 8 Ω and 12 Ω respectively connected in series and a battery of potential 6 V and a plug key which is closed means the current is flowing in the circuit.
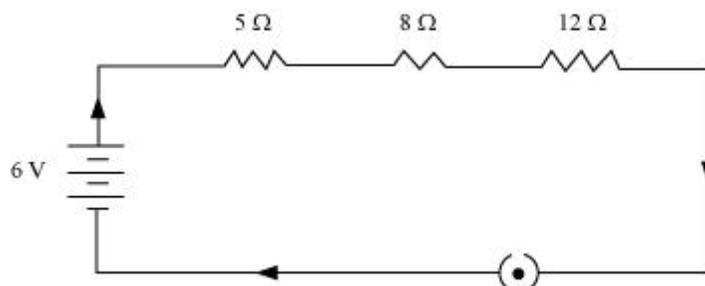
2. Redraw the circuit of question 1, putting in an ammeter to measure the current through the resistors and a voltmeter to measure potential difference across the 12 Ω resistor. What would be the readings in the ammeter and the voltmeter?

Answer

An ammeter should be connected in the circuit in series with the resistors. To measure the potential difference across the resistor it should be connected in parallel, as shown in the following figure.
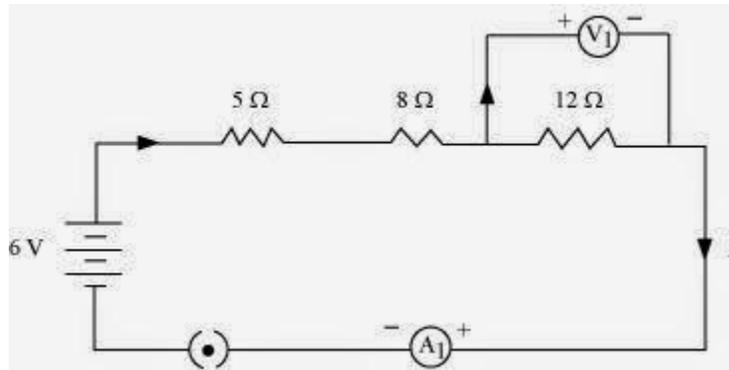
The resistances are connected in series.
Ohm's law can be used to obtain the readings of ammeter and voltmeter. According to Ohm's law,
$V = IR$,
Where,
Potential difference, $V = 6$ V
Current flowing through the circuit/resistors $= I$
Resistance of the circuit, $R = 5 + 8 + 12 = 25\Omega$
$I = V/R = 6/25 = 0.24$ A
Potential difference across 12 Ω resistor $= V_1$
Current flowing through the 12 Ω resistor, $I = 0.24$ A
Therefore, using Ohm's law, we obtain
$V_1 = IR = 0.24 \times 12 = 2.88$ V
Therefore, the reading of the ammeter will be 0.24 A.
The reading of the voltmeter will be 2.88 V.

Page No: 216

1. Judge the equivalent resistance when the following are connected in parallel − (a) 1 Ω and $10^6\Omega$, (b) 1 Ω and $10^3\Omega$ and $10^6\Omega$.

Answer

(a) When 1 Ω and 10^6 Ω are connected in parallel:
Let R be the equivalent resistance.

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

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

Therefore, equivalent resistance ≈ 1 Ω

(b) When 1Ω, 103 Ω and 106 Ω are connected in parallel:

Let *R* be the equivalent resistance.

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

$$R = \frac{1000000}{1001001} = 0.999 \ \Omega$$

Therefore, equivalent resistance = 0.999 Ω

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?
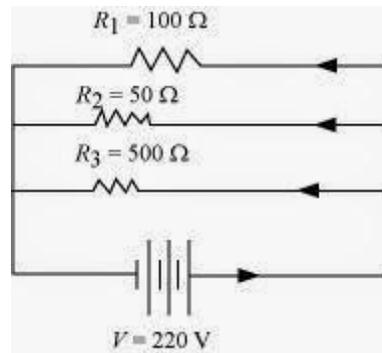
Answer

Resistance of electric lamp, R_1 = 100 Ω
Resistance of toaster, R_2 = 50 Ω
Resistance of water filter, R_3 = 500 Ω
Potential difference of the source, V = 220 *V*
These are connected in parallel, as shown in the following figure.

Let R be the equivalent resistance of the circuit.

$$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} = \frac{1}{100} + \frac{1}{50} + \frac{1}{500}$$

According to Ohm's law,

$V = IR$

$I = \dfrac{V}{R}$

Where,

Current flowing through the circuit = I

$I = \dfrac{220}{\frac{500}{16}} = \dfrac{220/16}{50} = 7.04 \text{ A}$

7.04 A of current is drawn by all the three given appliances.

Therefore, current drawn by an electric iron connected to the same source of potential 220 V = 7.04 A

Let R' be the resistance of the electric iron. According to Ohm's law,

$V = IR'$

$R' = \dfrac{V}{I} = \dfrac{220}{7.04} = 31.25\,\Omega$

Therefore, the resistance of the electric iron is 31.25 Ω and the current flowing through it is 7.04 A.

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

Answer

There is no division of voltage among the appliances when connected in parallel. The potential difference across each appliance is equal to the supplied voltage.
The total effective resistance of the circuit can be reduced by connecting electrical appliances in parallel.

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

Answer

There are three resistors of resistances 2 Ω, 3 Ω, and 6 Ω respectively.

(a) The following circuit diagram shows the connection of the three resistors.
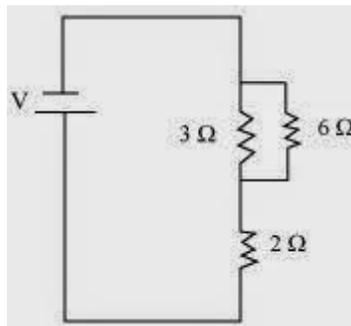
Here, 6 Ω and 3 Ω resistors are connected in parallel.
Therefore, their equivalent resistance will be given by

$$\frac{1}{\frac{1}{6} + \frac{1}{3}} = \frac{6 \times 3}{6 + 3} = 2 \ \Omega$$

This equivalent resistor of resistance 2 Ω is connected to a 2 Ω resistor in series.
Therefore, the equivalent resistance of the circuit = 2 Ω + 2 Ω = 4 Ω
Hence the total resistance of the circuit is 4 Ω.

(b) The following circuit diagram shows the connection of the three resistors.
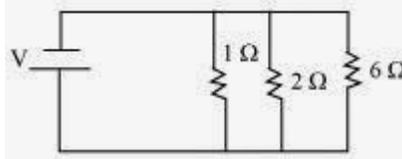
All the resistors are connected in series. Therefore, their equivalent resistance will be given as

$$\frac{1}{\frac{1}{2}+\frac{1}{3}+\frac{1}{6}} = \frac{1}{\frac{3+2+1}{6}} = \frac{6}{6} = 1\,\Omega$$

Therefore, the total resistance of the circuit is 1 Ω.

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

Answer

There are four coils of resistances 4 Ω, 8 Ω, 12 Ω and 24 Ω respectively.

(a) If these coils are connected in series, then the equivalent resistance will be the highest, given by the sum 4 + 8 + 12 + 24 = 48 Ω

(b) If these coils are connected in parallel, then the equivalent resistance will be the lowest, given by

$$\frac{1}{\frac{1}{4}+\frac{1}{8}+\frac{1}{12}+\frac{1}{24}} = \frac{1}{\frac{6+3+2+1}{24}} = \frac{24}{12} = 2\,\Omega$$

Therefore, 2 Ω is the lowest total resistance.

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

Answer

The heating element of the heater is made up of alloy which has very high resistance so when current flows through the heating element, it becomes too hot and glows red. But the resistance of cord which is usually of copper or aluminium is very law so it does not glow.

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

Answer

Given Charge, Q = 96000C
Time, t= 1hr = 60 x 60= 3600s
Potential difference, V= 50volts
Now we know that H= VIt
So we have to calculate I first
As I= Q/t
∴ I = 96000/3600 = 80/3 A

$$H= 50 \times \frac{80}{3} \times 60 \times 60 = 4.8 \times 10^6 \text{ J}$$

Therefore, the heat generated is 4.8 x 10^6 J.

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

Answer

The amount of heat (H) produced is given by the joule's law of heating as H= VIt
Where,
Current, I = 5 A
Time, t = 30 s
Voltage, V = Current x Resistance = 5 x 20 = 100 V

$H= 100 \times 5 \times 30 = 1.5 \times 10^4$ J.

Therefore, the amount of heat developed in the electric iron is 1.5×10^4 J.

Page No: 220

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

Answer

The rate of consumption of electric energy in an electric appliance is called electric power. Hence, the rate at which energy is delivered by a current is the power of the appliance.

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

Answer

Power (*P*) is given by the expression, $P = VI$
Where,
Voltage, $V = 220$ V
Current, $I = 5$ A
$P= 220 \times 5 = 1100$ W
Energy consumed by the motor = Pt
Where,
Time, $t = 2$ h $= 2 \times 60 \times 60 = 7200$ s
∴ $P = 1100 \times 7200 = 7.92 \times 10^6$ J
Therefore, power of the motor = 1100 W
Energy consumed by the motor = 7.92×10^6 J

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Excercise

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
► (d) 25

2. Which of the following terms does not represent electrical power in a circuit?
(a) I^2R
(b) IR^2
(c) VI
(d) V^2/R
► (b) IR^2

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
► (d) 25 W

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

(a) 1:2

(b) 2:1

(c) 1:4

(d) 4:1

► (c) 1:4

5. How is a voltmeter connected in the circuit to measure the potential difference between two points?

Answer

To measure the potential difference between two points, a voltmeter should be connected in parallel to the points.

6. A copper wire has diameter 0.5 mm and resistivity of $1.6 \times 10^{-8}\Omega$ m. What will be the length of this wire to make its resistance 10 Ω? How much does the resistance change if the diameter is doubled?

Answer

Area of cross-section of the wire, $A = \pi (d/2)^2$

Diameter= 0.5 mm = 0.0005 m

Resistance, R = 10 Ω

We know that

$$R = \rho \frac{l}{A}$$

$$l = \frac{RA}{\rho}$$

$$= \frac{10 \times 3.14 \times (\frac{0.0005}{2})^2}{1.6 \times 10^{-8}}$$

$$= \frac{10 \times 3.14 \times 25}{4 \times 1.6} = 122.72 \text{ m}$$

∴ length of the wire = 122.72m

If the diameter of the wire is doubled, new diameter=2×0.5=1mm=0.001m

Let new resistance be R'

$$R' = \rho \frac{l}{A}$$

$$= \frac{1.6 \times 10^{-8} \times 122.72}{\pi(\frac{1}{2} \times 10^{-3})^2}$$

$$= \frac{1.6 \times 10^{-8} \times 122.72 \times 4}{3.14 \times 10^{-6}}$$

$$= 250.2 \times 10^{-2} = 2.5 \text{ Ω}$$

Therefore, the length of the wire is 122.7 m and the new resistance is 2.5 Ω.

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 that resistor.

Answer

The plot between voltage and current is called IV characteristic. The voltage is plotted on x-axis and current is plotted on y-axis. The values of the current for different values of the voltage are shown in the given table.

V (volts)	1.6	3.4	6.7	10.2	13.2
I (amperes)	0.5	1.0	2.0	3.0	4.0

The IV characteristic of the given resistor is plotted in the following figure.
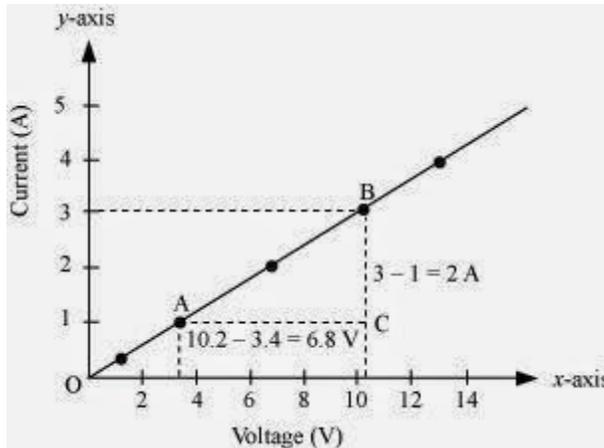
The slope of the line gives the value of resistance (R) as,

Slope = $1/R$ = BC/AC = 2/6.8

R= 6.8/2 = 3.4 Ω

Therefore, the resistance of the resistor is 3.4 Ω.

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 resistance of the resistor.

Answer

Resistance (R) of a resistor is given by Ohm's law as, V= IR
R= V/I
Where,
Potential difference, V= 12 V
Current in the circuit, I= 2.5 mA = 2.5 x 10^{-3} A

$$R= \frac{12}{2.5 \; x \; 10^{-3}} = 4.8 \; x \; 10^3 \; Ω = 4.8 \; kΩ$$

Therefore, the resistance of the resistor is 4.8 kΩ

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?

Answer

There is no current division occurring in a series circuit. Current flow through the component is the same, given by Ohm's law as

V= IR

I= V/R

Where,

R is the equivalent resistance of resistances 0.2 Ω, 0.3 Ω, 0.4 Ω, 0.5 Ω and 12 Ω. These are connected in series. Hence, the sum of the resistances will give the value of R.

R= 0.2 + 0.3 + 0.4 + 0.5 + 12 = 13.4 Ω

Potential difference, V= 9 V

I= 9/13.4 = 0.671 A
Therefore, the current that would flow through the 12 Ω resistor is 0.671 A.

10. How many 176 Ω resistors (in parallel) are required to carry 5 A on a 220 V line?

Answer

For x number of resistors of resistance 176 Ω, the equivalent resistance of the resistors connected in parallel is given by Ohm's law as V= IR
R= V/I
Where,
Supply voltage, V= 220 V
Current, I = 5 A
Equivalent resistance of the combination = R,given as

$$\frac{1}{R} = x \times \left(\frac{1}{176}\right)$$

$$R = \frac{176}{x}$$

From Ohm's law,

$$\frac{V}{I} = \frac{176}{x}$$

$$x = \frac{176 \, x \, I}{V} = \frac{176 \, x \, 5}{220} = 4$$

Therefore, four resistors of 176 Ω are required to draw the given amount of current.

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.

Answer

If we connect the resistors in series, then the equivalent resistance will be the sum of the resistors, i.e., 6 Ω + 6 Ω + 6 Ω = 18 Ω, which is not desired. If we connect the resistors in parallel, then the equivalent resistance will be 6/2 = 3 Ω is also not desired. Hence, we should either connect the two resistors in series or parallel.
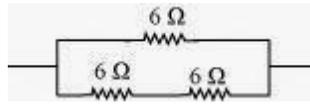(a) Two resistor in parallel
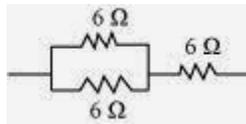
Two 6 Ω resistors are connected in parallel. Their equivalent resistance will be

$$\frac{1}{\frac{1}{6}+\frac{1}{6}} = \frac{6 \times 6}{6+6} = 3 \ \Omega$$

The third 6 Ω resistor is in series with 3 Ω. Hence, the equivalent resistance of the circuit is 6 Ω+ 3 Ω = 9 Ω.
(b) Two resistor in series

Two 6 Ω resistors are in series. Their equivalent resistance will be the sum 6 + 6 = 12 Ω.

The third 6 Ω resistor is in parallel with 12 Ω. Hence, equivalent resistance will be

$$\frac{1}{\frac{1}{12}+\frac{1}{6}} = \frac{12 \times 6}{12+6} = 4 \ \Omega$$

Therefore, the total resistance is 4 Ω.

12. Several electric bulbs designed to be used on a 220 V electric supply line, are rated 10 W. 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?

Answer

Resistance R_1 of the bulb is given by the expression,
Supply voltage, $V = 220$ V
Maximum allowable current, $I = 5$ A
Rating of an electric bulb P=10watts
Because $R=V^2/P$

$R1 = \dfrac{(220)^2}{10} = 4840\ \Omega$

According to Ohm's law,

$V = IR$

Let R is the total resistance of the circuit for x number of electric bulbs

$R = V/I$

$= \dfrac{220}{5} = 44\ \Omega$

Resistance of each electric bulb, $R_1 = 4840\ \Omega$

$\dfrac{1}{R} = \dfrac{1}{R_1} + \dfrac{1}{R_2} + \dots\dots$ upto x times.

$\dfrac{1}{R} = \dfrac{1}{R_1} \times x$

$x = \dfrac{R_1}{R} = \dfrac{4840}{44} = 110$

∴ Number of electric bulbs connected in parallel are 110.

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 resistances, which may be used separately, in series, or in parallel. What are the currents in the three cases?

Answer

Supply voltage, V= 220 V
Resistance of one coil, R= 24 Ω

(i) Coils are used separately

According to Ohm's law,
$V = I_1 R_1$
Where,

I_1 is the current flowing through the coil

$I_1 = V/R_1 = 220/24 = 9.166$ A
Therefore, 9.16 A current will flow through the coil when used separately.

(ii) Coils are connected in series

Total resistance, R_2 = 24 Ω + 24 Ω = 48 Ω

According to Ohm's law, $V = I_2 R_2$
Where,

I_2 is the current flowing through the series circuit

$I_2 = V/R_2 = 220/48 = 4.58$ A
Therefore, 4.58 A current will flow through the circuit when the coils are connected in series.
(iii) Coils are connected in parallel

Total resistance, R_3 is given as =

$$\frac{1}{\frac{1}{24}+\frac{1}{24}} = \frac{24}{2} = 12 \text{ Ω}$$

According to Ohm's law,

$V = I_3 R_3$
Where,
I_3 is the current flowing through the circuit $I_3 = V/R_3 = 220/12 = 18.33$ A
Therefore, 18.33 A current will flow through the circuit when coils are connected in parallel.

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.

Answer

(i) Potential difference, $V = 6$ V
1 Ω and 2 Ω resistors are connected in series. Therefore, equivalent resistance of the circuit, $R = 1 + 2 = 3$ Ω
According to Ohm's law,
$V = IR$
Where,
I is the current through the circuit
$I = 6/3 = 2$ A
This current will flow through each component of the circuit because there is no division of current in series circuits. Hence, current flowing through the 2 Ω resistor is 2 A.
Power is given by the expression,
$P = (I)^2 R = (2)^2 \times 2 = 8$ W

(ii) Potential difference, $V = 4$ V
12 Ω and 2 Ω resistors are connected in parallel. The voltage across each component of a parallel circuit remains the same. Hence, the voltage across 2 Ω resistor will be 4 V.
Power consumed by 2 Ω resistor is given by
$P = V^2/R = 4^2/2 = 8$ W
Therefore, the power used by 2 Ω resistor is 8 W.

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?

Answer

Both the bulbs are connected in parallel. Therefore, potential difference across each of them will be 220 V, because no division of voltage occurs in a parallel circuit.
Current drawn by the bulb of rating 100 W is given by,Power = Voltage x Current
Current = Power/Voltage = 60/220 A

Hence, current drawn from the line = 100/220 + 60/220 = 0.727 A

16. Which uses more energy, a 250 W TV set in 1 hr, or a 1200 W toaster in 10 minutes?

Answer

Energy consumed by an electrical appliance is given by the expression, H= Pt
Where,
Power of the appliance = P
Time = t
Energy consumed by a TV set of power 250 W in 1 h = 250 ×3600 = 9 ×10^5 J
Energy consumed by a toaster of power 1200 W in 10 minutes = 1200 ×600
Energy consumed by a toaster of power 1200 W in 10 minutes = 1200 ×600
= 7.2×10^5 J
Therefore, the energy consumed by a 250 W TV set in 1 h is more than the energy consumed by a toaster of power 1200 W in 10 minutes.

17. An electric heater of resistance 8 Ω draws 15 A from the service mains 2 hours. Calculate the rate at which heat is developed in the heater.

Answer

Rate of heat produced by a device is given by the expression for power as, $P= I^2R$
Where,
Resistance of the electric heater, R= 8 Ω
Current drawn, I = 15 A
P= $(15)^2$ x 8 = 1800 J/s

Therefore, heat is produced by the heater at the rate of 1800 J/s.

18. Explain the following.
(a) Why is the 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 are copper and aluminium wires usually employed for electricity transmission?

Answer

(a) The melting point and of Tungsten is an alloy which has very high melting point and very high resistivity so does not burn easily at a high temperature.

(b) The conductors of electric heating devices such as bread toasters and electric irons

are made of alloy because resistivity of an alloy is more than that of metals which produces large amount of heat.

(c) In series circuits voltage is divided. Each component of a series circuit receives a small voltage so the amount of current decreases and the device becomes hot and does not work properly. Hence, series arrangement is not used in domestic circuits.

(d) Resistance (R) of a wire is inversely proportional to its area of cross-section (A), i.e. when area of cross section increases the resistance decreases or vice versa.

(e) Copper and aluminium are good conductors of electricity also they have low resistivity. So they are usually used for electricity transmission.

Chapter 13: Magnetic Effects of Electric Current Science

In Text Questions

Page No: 224

1. Why does a compass needle get deflected when brought near a bar magnet?
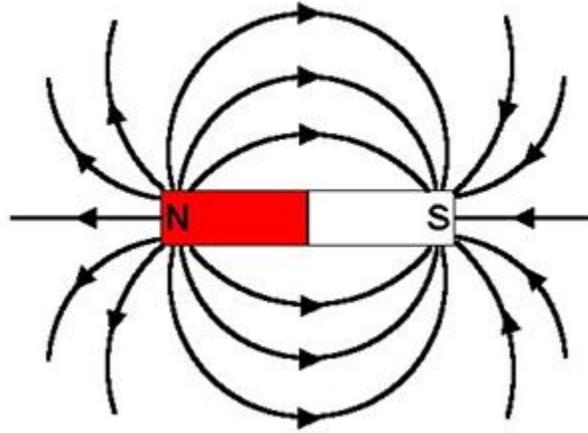
Answer

The needle of a compass is a small magnet. That's why when a compass needle is brought near a bar magnet, its magnetic field lines interact with that of the bar magnet. Hence, a compass needle gets deflected.

Page No: 228

1. Draw magnetic field lines around a bar magnet.

Answer

Magnetic field lines of a bar magnet emerge from the north pole and terminate at the south pole. Inside the magnet, the field lines emerge from the south pole and terminate at the north pole, as shown in the given figure.

2. List the properties of magnetic lines of force.

Answer

The properties of magnetic lines of force are as follows.
→ Magnetic field lines emerge from the north pole.
→ They merge at the south pole.
→ The direction of field lines inside the magnet is from the south pole to the north pole.
→ Magnetic lines do not intersect with each other.

3. Why don't two magnetic lines of force intersect each other?

Answer

The two magnetic field lines do not intersect each other because if they do it means at the point of intersect the compass needle is showing two different directions which is not possible.
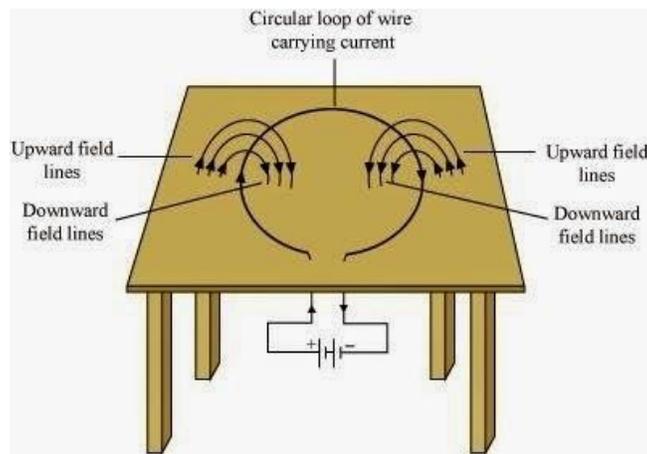
Page No: 229

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.

Answer

Inside the loop = Pierce inside the table
Outside the loop = Appear to emerge out from the table
For downward direction of current flowing in the circular loop, the direction of magnetic field lines will be as if they are emerging from the table outside the loop and merging in the table inside the loop. Similarly, for upward direction of current flowing in the circular loop, the direction of magnetic field lines will be as if they are emerging from the table outside the loop and merging in the table inside the loop, as shown in the given figure.

2. The magnetic field in a given region is uniform. Draw a diagram to represent it.

Answer
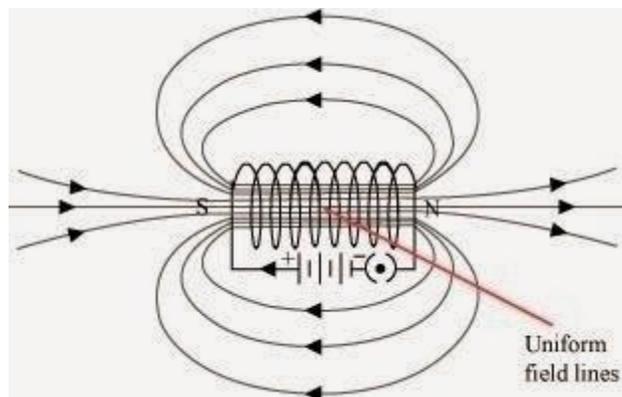
The magnetic field lines inside a current-carrying long straight solenoid are uniform.

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

► (d) is the same at all points

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

► (c) velocity and (d) momentum

2. In Activity 13.7 (page: 230), 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?

Answer

(i) If the current in the rod is increased then rod will be deflected with greater force.

(ii) If a stronger horse-shoe magnet is used then also rod will be deflected with greater

force due to the increase in magnetic field.

(iii) If the length of the rod AB is increased.

3. A positively-charged particle (alpha-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

► (d) upward

Page No: 233

1. State Fleming's left-hand rule.

Answer

Fleming's left hand rule states that if we arrange the thumb, the centre finger, and the forefinger of the left hand at right angles to each other, then the thumb points towards the direction of the magnetic force, the centre finger gives the direction of current, and the forefinger points in the direction of magnetic field.

2. What is the principle of an electric motor?

Answer

The principle of an electric motor is based on the magnetic effect of electric current. A current-carrying loop experiences a force and rotates when placed in a magnetic field. The direction of rotation of the loop is according to the Fleming's left-hand rule.

3. What is the role of the split ring in an electric motor?

Answer

The split ring in the electric motor also known as a commutator reverses the direction of current flowing through the coil after every half rotation of the coil. Due to this the coil continues to rotate in the same direction.

Page No: 236

1. Explain different ways to induce current in a coil.

Answer

The different ways to induce current in a coil are as follows:
→ If a coil is moved rapidly between the two poles of a horse-shoe magnet, then an electric current is induced in the coil.
→ If a magnet is moved relative to a coil, then an electric current is induced in the coil.

Page No: 237

1. State the principle of an electric generator.

Answer

Electric generator works on the principle of electromagnetic induction. Electricity is generated by rotating a coil inside magnetic field.

2. Name some sources of direct current.

Answer

Some sources of direct current are cell, DC generator, etc.

3. Which sources produce alternating current?

Answer

AC generators, power plants, etc., produce alternating current.

4. Choose the correct option.

A rectangular coil of copper wires is rotated in a magnetic field. The direction of the induced current changes once in each

(a) two revolutions
(b) one revolution
(c) half revolution

(d) one-fourth revolution
► (c) half revolution

1. Name two safety measures commonly used in electric circuits and appliances.

Answer

Two safety measures commonly used in electric circuits and appliances are
→ Electric Fuse: An electric fuse is connected in series it protects the circuit from overloading and prevents it from short circuiting.
→ Proper earthing of all electric circuit in which any leakage of current in an electric appliance is transferred to the ground and people using the appliance do not get the shock.

2. An electric oven of 2 kW is operated in a domestic electric circuit (220 *V*) that has a current rating of 5 A. What result do you expect? Explain.

Answer

Current drawn by the electric oven can be obtained by the expression,
$P = VI$

Where,
Current = I
Power of the oven, P = 2 kW = 2000 W
Voltage supplied, V = 220 *V*

I = 2000/220 *V* = 9.09 A
Hence, the current drawn by the electric oven is 9.09 A, which exceeds the safe limit of the circuit. Fuse element of the electric fuse will melt and break the circuit.

3. What precaution should be taken to avoid the overloading of domestic electric circuits?

Answer

The precautions that should be taken to avoid the overloading of domestic circuits are as follows:

→ Too many appliances should not be connected to a single socket.
→ Too many appliances should not be used at the same time.
→ Faulty appliances should not be connected in the circuit.
→ Fuse should be connected in the circuit.

Page No: 240

Excercise

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 centred on the wire
► (d) The field consists of concentric circles centred on the wire

2. The phenomenon of electromagnetic induction is
(a) the process of charging a body
(b) the process of generating magnetic field due to a current passing through a coil
(c) producing induced current in a coil due to relative motion between a magnet and the coil
(d) the process of rotating a coil of an electric motor
► (c) producing induced current in a coil due to relative motion between a magnet and the coil

3. The device used for producing electric current is called a
(a) generator
(b) galvanometer
(c) ammeter
(d) motor
► (a) generator

4. The essential difference between an AC generator and a DC generator is that
(a) AC generator has an electromagnet while a DC generator has permanent magnet.
(b) DC generator will generate a higher voltage.
(c) AC generator will generate a higher voltage.
(d) AC generator has slip rings while the DC generator has a commutator.
► (d) AC generator has slip rings while the DC generator has a commutator.

5. At the time of short circuit, the current in the circuit
(a) reduces substantially
(b) does not change
(c) increases heavily
(d) vary continuously
► (c) increases heavily

6. State whether the following statements are true or false.

(a) An electric motor converts mechanical energy into electrical energy.
► False

An electric motor converts electrical energy into mechanical energy.

(b) An electric generator works on the principle of electromagnetic induction.

► True

(c) The field at the centre of a long circular coil carrying current will be parallel straight lines.

► True

(d) A wire with a green insulation is usually the live wire of an electric supply.

► False
Live wire has red insulation cover, whereas earth wire has green insulation colour in the domestic circuits.

7. List three sources of magnetic fields.

Answer

Three sources of magnetic fields are as follows:
→ Current-carrying conductors
→ Permanent magnets
→ Electromagnets

Page No: 241

8. How does a solenoid behave like a magnet? Can you determine the north and south poles of a current-carrying solenoid with the help of a bar magnet? Explain.

Answer

A solenoid is a long coil of circular loops of insulated copper wire. Magnetic field lines are produced around the solenoid when a current is allowed to flow through it. The magnetic field produced by it is similar to the magnetic field of a bar magnet. The field lines produced in a current-carrying solenoid is shown in the following figure.
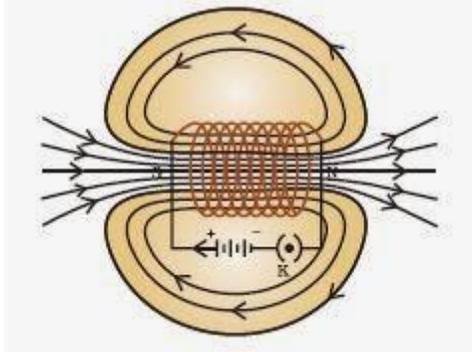
In the above figure, when the north pole of a bar magnet is brought near the end connected to the negative terminal of the battery, the solenoid repels the bar magnet. Since like poles repel each other, the end connected to the negative terminal of the battery behaves as the north pole of the solenoid and the other end behaves as a south pole. Hence, one end of the solenoid behaves as a north pole and the other end behaves as a south pole.

9. When is the force experienced by a current-carrying conductor placed in a magnetic field largest?

Answer

The force experienced by a current-currying conductor is the maximum when the direction of current is perpendicular to the direction of the magnetic field.

10. Imagine that 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 magnetic field?

Answer

The direction of the magnetic field is vertically downwards. The direction of current is from the front wall to the back wall because negatively charged electrons are moving from back wall to the front wall. The direction of magnetic force is rightward. Hence, using Fleming's left hand rule, it can be concluded that the direction of magnetic field inside the chamber is downward.

11. Draw a labelled diagram of an electric motor. Explain its principle and working. What is the function of a split ring in an electric motor?

Answer
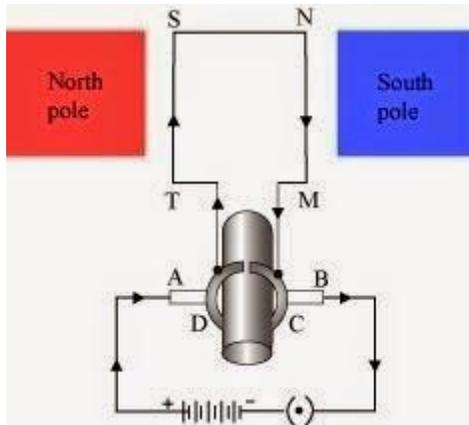
<u>Principle:</u> It works on the principle of the magnetic effect of current. A current-carrying coil rotates in a magnetic field.

<u>Working:</u> When a current is allowed to flow through the coil MNST by closing the switch, the coil starts rotating anti-clockwise. This happens because a downward force acts on length MN and at the same time, an upward force acts on length ST. As a result, the coil rotates anti-clockwise.

Current in the length MN flows from M to N and the magnetic field acts from left to right, normal to length MN. Therefore, according to Fleming's left hand rule, a downward force acts on the length MN. Similarly, current in the length ST flows from S to T and the magnetic field acts from left to right, normal to the flow of current. Therefore, an upward force acts on the length ST. These two forces cause the coil to rotate anti-clockwise. After half a rotation, the position of MN and ST interchange. The half-ring D comes in contact with brush A and half-ring C comes in contact with brush B. Hence, the direction of current in the coil MNST gets reversed.
The current flows through the coil in the direction TSNM. The reversal of current through the coil MNST repeats after each half rotation. As a result, the coil rotates unidirectional.

The split rings help to reverse the direction of current in the circuit. These are called the commutator.

12. Name some devices in which electric motors are used?

Answer

Some devices in which electric motors are Water pumps, Electric fans, Electric mixers

and Washing machines.

13. A coil of insulated copper wire is connected to a galvanometer. What will happen if a bar magnet is (i) pushed into the coil, (ii) withdrawn from inside the coil, (iii) held stationary inside the coil?

Answer

(i) The needle of the galvanometer shows a momentary deflection in a particular direction.

(ii) The needle of the galvanometer shows a momentarily in the opposite direction.

(iii) The needle of the galvanometer shows no deflection.

14. Two circular coils A and B are placed closed to each other. If the current in the coil A is changed, will some current be induced in the coil B? Give reason.

Answer

Two circular coils A and B are placed close to each other. When the current in coil A is changed, the magnetic field associated with it also changes. As a result, the magnetic field around coil B also changes. This change in magnetic field lines around coil B induces an electric current in it. This is called electromagnetic induction.

15. 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 due to its rotation in a magnetic field.

Answer

(i) Maxwell's right hand thumb rule

(ii) Fleming's left hand rule

(iii) Fleming's right hand rule

16. Explain the underlying principle and working of an electric generator by drawing a labelled diagram. What is the function of brushes?

Answer

Principle: An electric generator works on the principle of electromagnetic induction phenomenon. According to it, whenever a coil is rotated between the poles of a magnet,

an induced current is set up in the coil, whose direction is given by Fleming's right hand rule.
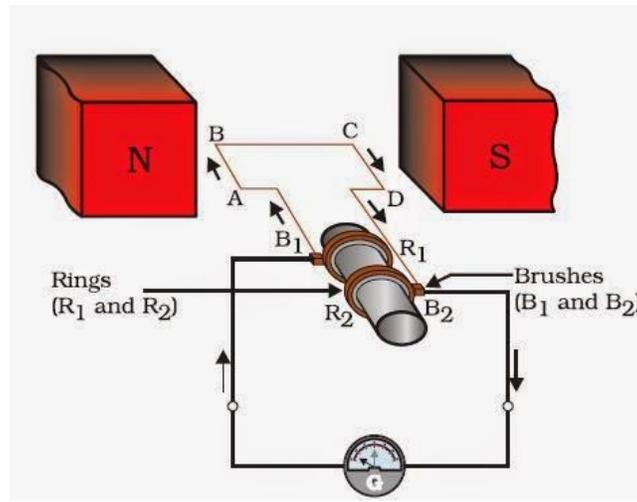
Working: Let in the beginning, as shown in Fig. brushes B_1 and $B_2$are kept pressed separately on rings R_1 and R_2 respectively. Let the axle attached to the rings is rotated such that arm AB of the coil moves up and arm CD moves down in the magnetic field. Due to rotation of arms AB and CD induced currents are set up in them. As per Fleming's right hand rule induced currents in these arms are along the directions AB and CD. Thus an induced current flows along ABCD and current in the external circuit flows from B_2 to B_1.

After half a rotation, arm AB starts moving down and the arm CD upward. Therefore, directions of induced currents in these arms change. Thus net induced current now becomes in the direction DCBA. In the external circuit now current flows from B_1 to B_2. Thus after every half rotation current changes its direction and an alternating current is obtained from the generator.

Function of Brushes: Brushes are kept pressed on the two slip tings separately. Outer ends of the brushes are connected to the galvanometer (or the external load). Thus brushes help in transferring current from the coil ABCD to the external circuit.

17. When does an electric short circuit occur?

Answer

If the insulation of the wires used in the circuit is damaged or the appliance used is faulty due to which the live wire and the neutral wire comes in direct contact as a result current in the circuit rises and the short circuit occurs.

18. What is the function of an earth wire? Why is it necessary to earth metallic

appliances?

Answer

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.