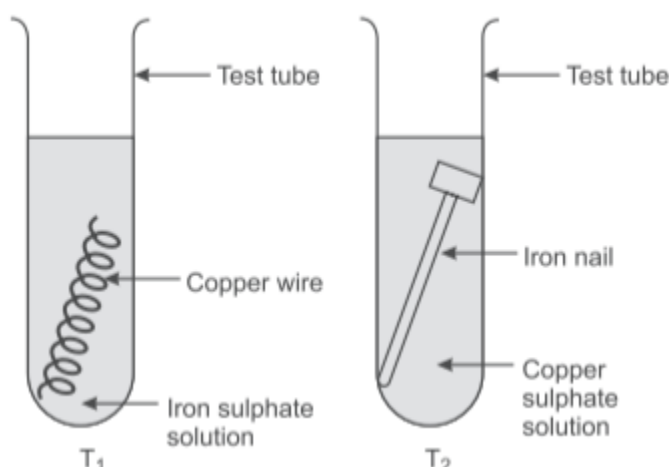


Chemical Reactions and Equations

Case Study Based Questions

Case Study 1

Rishabh wanted to study displacement reactions. He knows that he needs a metal and a salt solution of a different metal. So, he takes two tubes T₁ and T₂, out of which in T₁, he placed a copper wire in iron sulphate solution and in T₂, he placed an iron nail in copper sulphate solution as shown below:



Read the above passage carefully and give the answer of the following questions:

Q1. Based on the above passage which test tube will undergo displacement reaction?

- a. T₁
- b. T₂
- c. Both T₁ and T₂
- d. Neither T₁ nor T₂

Q2. Identify the balanced chemical equation for reaction taking place in T₂.

- a. $\text{Fe (s)} + \text{CuCl}_2 \text{ (aq)} \rightarrow \text{FeCl}_2 \text{ (aq)} + \text{Cu (s)}$
- b. $\text{Cu (s)} + \text{FeSO}_4 \text{ (aq)} \rightarrow$ -No reaction
- c. $\text{Fe (s)} + \text{CuSO}_4 \text{ (aq)} \rightarrow \text{FeSO}_4 \text{ (aq)} + \text{Cu (s)}$
- d. $\text{Pb (s)} + \text{CuSO}_4 \text{ (aq)} \rightarrow \text{PbSO}_4 \text{ (aq)} + \text{Cu (s)}$

Q3. State the change(s) that is/are observed in T₂.

- a. White precipitate of FeSO₄ is formed

- b. The blue colour of CuSO_4 changes to light green colour of FeSO_4
- c. Brown coating of copper is obtained on iron nail
- d. Both b. and c.

Q4. What will happen if zinc wire is used in place of copper wire in T_1 ?

- a. It will produce zinc sulphate solution and copper metal
- b. It will produce zinc sulphate solution and iron metal
- c. It will produce iron sulphate solution and zinc metal
- d. No reaction will take place

Q5. What will happen if silver nitrate is used in place of iron sulphate in T_1 ?

- a. No reaction will take place
- b. It will produce copper nitrate and iron metal
- c. It will produce copper nitrate and silver metal
- d. It will produce iron nitrate and silver metal

Answers

1. (b) T_2
 2. (c) $\text{Fe (s)} + \text{CuSO}_4 \text{ (aq)} \rightarrow \text{FeSO}_4 \text{ (aq)} + \text{Cu (s)}$
 3. (d) Both b. and c.
 4. (b) It will produce zinc sulphate solution and iron metal
 5. (c) It will produce copper nitrate and silver metal
- $\text{Cu} + 2\text{AgNO}_3 \rightarrow \text{Cu(NO}_3)_2 + 2\text{Ag}$

Case Study 2

Marble's popularity began in ancient Rome and Greece, where white and off-white marble were used to construct a variety of structures, from hand-held sculptures to massive pillars and buildings.



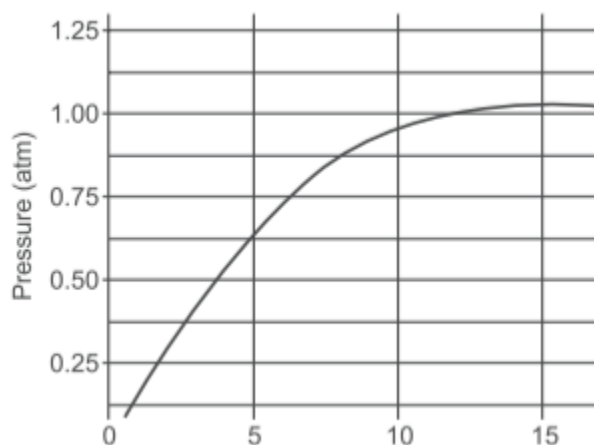
Read the above passage carefully and give the answer of the following questions:



Q1. The substance not likely to contain CaCO_3 is:

- a. dolomite
- b. a marble statue
- c. calcined gypsum
- d. sea shells

Q2. A student added 10 g of calcium carbonate in a rigid container, secured it tightly and started to heat it. After some time, an increase in pressure was observed, the pressure reading was then noted at intervals of 5 mins and plotted against time, in a graph as shown below. During which time interval did maximum decomposition took place?



- a. 15-20 min
- b. 10-15 min
- c. 5-10 min
- d. 0-5 min

Q3. Gas A, obtained above is a reactant for a very important biochemical process which occurs in the presence of sunlight. Identify the name of the process:

- a. respiration
- b. photosynthesis
- c. transpiration
- d. photolysis

Q4. Marble statues are corroded or stained when they repeatedly come into contact with polluted rain water. Identify the main reason.



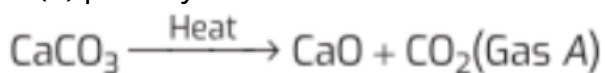
- a. Decomposition of calcium carbonate to calcium oxide
- b. Polluted water is basic in nature hence it reacts with calcium carbonate
- c. Polluted water is acidic in nature hence it reacts with calcium carbonate
- d. Calcium carbonate dissolves in water to give calcium hydroxide.

Q5. Calcium oxide can be reduced to calcium, by heating with sodium metal. Which compound would act as an oxidising agent in the above process?

- a. Sodium
- b. Sodium oxide
- c. Calcium
- d. Calcium oxide

Answers

- 1. (c) calcined gypsum
- 2. (d) 0-5 min
- 3. (b) photosynthesis



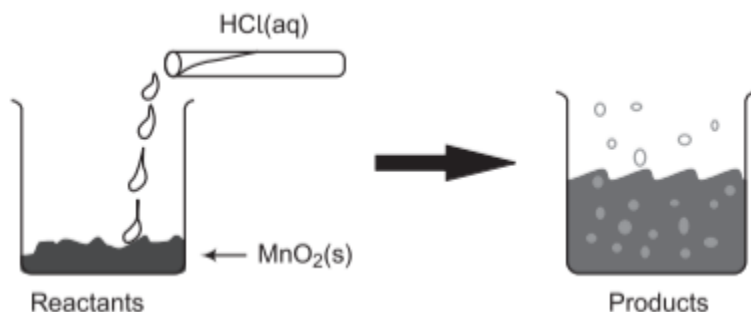
We know that CO₂ is a reactant of photosynthesis, which occurs in the presence of sunlight.

- 4. (c) Polluted water is acidic in nature hence it reacts with calcium carbonate
- 5. (d) Calcium oxide

In this reaction, calcium oxide is being reduced to calcium. Therefore, calcium oxide is the oxidising agent.

Case Study 3

The reaction between MnO_2 with HCl is depicted in the following diagram. It was observed that a gas with bleaching abilities was released.



Read the above passage carefully and give the answer of the following questions:

Q1. The chemical reaction between MnO_2 and HCl is an example of:

- a. displacement reaction
- b. combination reaction
- c. redox reaction
- d. decomposition reaction

Q2. In which of the following chemical equations, the abbreviations represent the correct states of reactants and products?

- a. $\text{MnO}_2 (\text{s}) + 4\text{HCl} (\text{aq}) \longrightarrow \text{MnCl}_2 (\text{aq}) + 2\text{H}_2\text{O} (\text{l}) + \text{Cl}_2 (\text{g})$
- b. $\text{MnO}_2 (\text{s}) + 4\text{HCl} (\text{aq}) \longrightarrow \text{MnCl}_2 (\text{s}) + 2\text{H}_2\text{O} (\text{aq}) + \text{Cl}_2 (\text{g})$
- c. $\text{MnO}_2 (\text{s}) + 4\text{HCl} (\text{l}) \longrightarrow \text{MnCl}_2 (\text{s}) + 2\text{H}_2\text{O} (\text{l}) + \text{Cl}_2 (\text{g})$
- d. $\text{MnO}_2 (\text{s}) + 4\text{HCl} (\text{aq}) \longrightarrow \text{MnCl}_2 (\text{aq}) + 2\text{H}_2\text{O} (\text{aq}) + \text{Cl}_2 (\text{g})$

Q3. Identify the correct statement from the following:

- a. MnO_2 is getting reduced whereas HCl is getting oxidised
- b. MnO_2 is getting oxidised whereas HCl is getting reduced
- c. MnO_2 and HCl both are getting reduced
- d. MnO_2 and HCl both are getting oxidised

Q4. In the above discussed reaction, name the reducing agent.

- a. MnCl_2



- b. HCL
- c. MnO₂
- d. H₂O

Q5. What will happen if we take dry HCL gas instead of aqueous solution of HCL?

- a. Reaction will occur faster
- b. Reaction will not occur
- c. Reaction rate will be slow
- d. Reaction rate will remain the same

Answers

- 1. (c) redox reaction
- 2. (a) $\text{MnO}_2 (\text{s}) + 4\text{HCL} (\text{aq}) \rightarrow \text{MnCl}_2 (\text{aq}) + 2\text{H}_2\text{O} (\text{l}) + \text{Cl}_2 (\text{g})$
- 3. (a) MnO₂ is getting reduced whereas HCL is getting oxidised
- 4. (b) HCL
- 5. (b) Reaction will not occur

Case Study 4

Rahul is a skilled painter. He mixed a white coloured powder, compound X with water. The compound X reacted vigorously with water to produce a compound Y and a large amount of heat. Then, Rahul used the compound Y for white washing the walls. Customer was not satisfied with the work of Rahul as walls were not shining. But Rahul guaranteed him that the walls would shine after 2-3 days and after 3 days of whitewash, the walls became shiny. Read the above passage carefully and give the answer of the following questions:

- Q1. Name the compound X, that Rahul mixed with water.
- Q2. Name the compound Y, that Rahul got after mixing X with water.
- Q3. What type of reaction has occurred here?
- Q4. Write the chemical reaction responsible for shiny finish of the walls.
- Q5. Write the common name of X and Y.

Answers



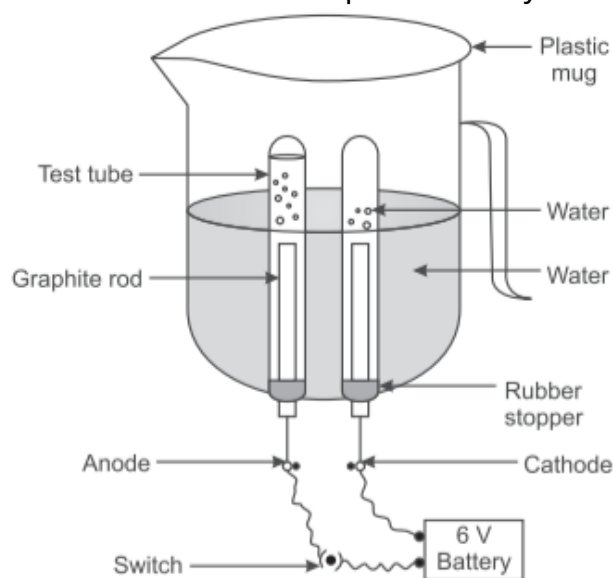
1. The compound X is calcium oxide (CaO).
2.
$$\underset{(X)}{\text{CaO}} + \text{H}_2\text{O} \longrightarrow \underset{(Y)}{\text{Ca(OH)}_2} + \text{Heat}$$

Thus, compound Y is calcium hydroxide.
3. Here, CaO combine with water to form a single product, Ca(OH)₂, thus it is a combination reaction.
4.
$$\underset{\substack{\text{(Calcium} \\ \text{Hydroxide)}}}{\text{Ca(OH)}_2(aq)} + \text{CO}_2(g) \longrightarrow \underset{\substack{\text{(Calcium} \\ \text{carbonate)}}}{\text{CaCO}_3(s)} + \text{H}_2\text{O}(l)$$
5. Common name of CaO (X) is quick lime and that of Ca(OH)₂ (Y) is slaked lime.

Case Study 5

Electrolysis of water is a popular method used for different applications in various industries. The electrolysis of water is mainly carried out to yield pure hydrogen and oxygen gases. It involves passing an electric current through the water which results in decomposition of water into hydrogen and oxygen. Pure water is a poor conductor of electricity. Sulphuric acid is added to the water so that the conductance of water increases which makes the

reaction faster. The setup for electrolysis of water is given below:



The number of hydrogen molecules produced in electrolysis is twice the number of oxygen molecules. Also, hydrogen is double in volume than oxygen.

Read the above passage carefully and give the answer of the following questions:

Q1. Name the gases evolved at cathode and anode respectively.

Q2. Why is volume of one gas collected at one electrode is double of anode?

Q3. Why are few drops of H_2SO_4 added to pure water?

Q4. How will you test the gas evolved at anode?

Q5. How will you test the gas evolved at cathode?

Answers

1. At cathode, hydrogen gas (H_2) is evolved and at anode, oxygen gas (O_2) is evolved.

2. During electrolysis, water splits into 2 molecules of hydrogen and 1 molecule of oxygen. Since, number of molecules of hydrogen released is double the number of molecules of oxygen released. Thus, volume occupied by hydrogen gas is double the volume occupied by oxygen gas.

3. Few drops of H_2SO_4 are added to make the water conduct electricity as distilled water is a poor conductor of electricity.

4. If we bring a glowing splinter close to the mouth of anode, it relights because oxygen supports combustion.

5. If we bring a burning splinter close to the mouth of cathode, it makes a popping sound in the presence of hydrogen gas.



Solutions for Questions 6 to 15 are Given Below

Case Study 6

Read the following and answer any four questions from 1(i) to 1(v).

Chemical equation is a method of representing a chemical reaction with the help of symbols and formulae of the substances involved in it. In a chemical equation, the substances which combine or react are called reactants and new substances produced are called products. A chemical equation is a short hand method of representing a chemical reaction. A balanced chemical equation has equal number of atoms of different elements in the reactants and products side. An unbalanced chemical equation has unequal number of atoms of one or more elements in reactants and products. Formulae of elements and compounds are not changed to balance an equation.

- (i) Consider the following reaction:
 $p\text{Mg}_3\text{N}_2 + q\text{H}_2\text{O} \longrightarrow r\text{Mg}(\text{OH})_2 + s\text{NH}_3$
 When the equation is balanced, the coefficients p, q, r, s respectively are
 (a) 1, 3, 3, 2 (b) 1, 6, 3, 2
 (c) 1, 2, 3, 2 (d) 2, 3, 6, 2
- (ii) Which of the following information is not conveyed by a balanced chemical equation?
 (a) Physical states of reactants and products
 (b) Symbols and formulae of all the substances involved in a particular reaction
 (c) Number of atoms/molecules of the reactants and products formed
 (d) Whether a particular reaction is actually feasible or not
- (iii) The balancing of chemical equations is in accordance with
 (a) law of combining volumes
 (b) law of constant proportions
 (c) law of conservation of mass
 (d) both (b) and (c).
- (iv) Which of the following chemical equations is an unbalanced one?
 (a) $2\text{NaHCO}_3 \longrightarrow \text{Na}_2\text{CO}_3 + \text{H}_2\text{O} + \text{CO}_2$
 (b) $2\text{C}_4\text{H}_{10} + 12\text{O}_2 \longrightarrow 8\text{CO}_2 + 10\text{H}_2\text{O}$
 (c) $2\text{Al} + 6\text{H}_2\text{O} \longrightarrow 2\text{Al}(\text{OH})_3 + 3\text{H}_2$
 (d) $4\text{NH}_3 + 5\text{O}_2 \longrightarrow 4\text{NO} + 6\text{H}_2\text{O}$

- (v) Which of the following statements is/are correct?
- A chemical equation tells us about the substances involved in a reaction.
 - A chemical equation informs us about the symbols and formulae of the substances involved in a reaction.
 - A chemical equation tells us about the atoms or molecules of the reactants and products involved in a reaction.
 - All the above.

Case Study 7

Read the following and answer any four questions from 2(i) to 2(v).

In decomposition reactions, a single reactant breaks down to form two or more products. Decomposition reaction is opposite to combination reaction. Thermal decomposition reactions use the energy in form of heat for decomposition of reactants. Electrolytic decomposition reactions involve the use of electrical energy for the decomposition of reactant molecules. Photolysis or photochemical decomposition involves the use of light energy for the purpose of decomposition.

- (i) Which of the following reactions is a decomposition reaction?
- $\text{NaOH} + \text{HCl} \longrightarrow \text{NaCl} + \text{H}_2\text{O}$
 - $\text{NH}_4\text{CNO} \longrightarrow \text{H}_2\text{NCONH}_2$
 - $2\text{KClO}_3 \longrightarrow 2\text{KCl} + 3\text{O}_2$
 - $\text{H}_2 + \text{I}_2 \longrightarrow 2\text{HI}$
- (ii) $2\text{Pb}(\text{NO}_3)_2 \longrightarrow 2\text{PbO} + n\text{A} + \text{O}_2$
What is $n\text{A}$ in the given reaction?
- 4NO
 - 4NO₂
 - 2PbNO₂
 - NO₂
- (iii) Amino acid is formed by the decomposition of which component of our diet?
- Carbohydrate
 - Starch
 - Protein
 - Fat
- (iv) Silver chloride on exposure to sunlight for a long duration turns grey due to
- the formation of silver by decomposition of silver chloride
 - sublimation of silver chloride
 - decomposition of chlorine gas from silver chloride
 - oxidation of silver chloride
- The correct statement(s) is/are
- Only (I)
 - Only (II) and (III)
 - Only (I) and (II)
 - Only (IV)
- (v) What type of chemical reaction takes place when electricity is passed through water?
- Thermal decomposition
 - Electrolytic decomposition
 - Photochemical decomposition
 - Displacement reaction

Case Study 8

Read the following and answer any four questions from 3(i) to 3(v).

Redox reactions are those reactions in which oxidation and reduction occur simultaneously. A redox reaction is made up of two half reactions. In the first half reaction, oxidation takes place and in second half reaction, reduction occurs. Oxidation is a process in which a substance loses electrons and in reduction, a substance gains electrons. The substance which gains electrons is reduced and acts as an oxidising agent. On the other hand, a substance which loses electrons is oxidised and acts as a reducing agent.

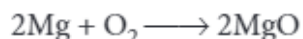


- (i) Which of the following is a redox reaction?
- (a) $\text{CaCO}_3 \rightarrow \text{CaO} + \text{CO}_2$ (b) $\text{H}_2 + \text{Cl}_2 \rightarrow 2\text{HCl}$
 (c) $\text{CaO} + 2\text{HCl} \rightarrow \text{CaCl}_2 + \text{H}_2\text{O}$ (d) $\text{NaOH} + \text{HCl} \rightarrow \text{NaCl} + \text{H}_2\text{O}$
- (ii) Identify the reaction in which H_2O_2 is acting as a reducing agent.
- (a) $\text{H}_2\text{SO}_3 + \text{H}_2\text{O}_2 \longrightarrow \text{H}_2\text{SO}_4 + \text{H}_2\text{O}$ (b) $2\text{HI} + \text{H}_2\text{O}_2 \longrightarrow 2\text{H}_2\text{O} + \text{I}_2$
 (c) $\text{Cl}_2 + \text{H}_2\text{O}_2 \longrightarrow 2\text{HCl} + \text{O}_2$ (d) $2\text{FeCl}_2 + 2\text{HCl} + \text{H}_2\text{O}_2 \longrightarrow 2\text{FeCl}_3 + 2\text{H}_2\text{O}$
- (iii) For the following reactions, identify the one in which H_2S acts as a reducing agent.
- (a) $\text{CuSO}_4 + \text{H}_2\text{S} \longrightarrow \text{CuS} + \text{H}_2\text{SO}_4$ (b) $\text{Cd}(\text{NO}_3)_2 + \text{H}_2\text{S} \longrightarrow \text{CdS} + 2\text{HNO}_3$
 (c) $2\text{FeCl}_3 + \text{H}_2\text{S} \longrightarrow 2\text{FeCl}_2 + 2\text{HCl} + \text{S}$ (d) None of these
- (iv) For the following reaction, identify the correct statement.
- $$\text{ZnO} + \text{CO} \longrightarrow \text{Zn} + \text{CO}_2$$
- (a) ZnO is being reduced. (b) CO_2 is being oxidised.
 (c) CO is being reduced. (d) ZnO is being oxidised.
- (v) In the following reaction, which substance is reduced?
- $$\text{PbS} + 4\text{H}_2\text{O}_2 \longrightarrow \text{PbSO}_4 + 4\text{H}_2\text{O}$$
- (a) H_2O (b) H_2O_2 (c) PbS (d) PbSO_4

Case Study 9

Read the following and answer any four questions from 4(i) to 4(v).

In a balanced chemical reaction, equal number of atoms are present on both sides of reaction. A balanced chemical reaction is based on law of conservation of mass which means that total mass of reactants and products participating in a reaction must be equal. For example, a balanced chemical equation of burning of magnesium in oxygen to form magnesium oxide is written as :



The mass of reactants ($2 \times 24 + 32 = 80$) is equal to the mass of products [$2 \times (24 + 16) = 80$].

- (i) In a reaction, 35 g of reactant, PQ breaks down into 20 g of product, P and an unknown amount of product, Q. Using the law of conservation of mass, weight of products, Q will be
- (a) 25 g (b) 35 g (c) 30 g (d) 15 g
- (ii) When solid mercury (II) oxide is heated, liquid mercury and oxygen gas are produced. Which of the following statements is true regarding the balanced chemical equation for this process?
- (a) 1 mole of mercury (II) oxide produces two moles of mercury and one mole of oxygen gas.
 (b) 2 moles of mercury (II) oxide produce one mole of mercury and one mole of oxygen gas.
 (c) 1 mole of mercury (II) oxide produces half mole of mercury and half mole of oxygen gas.
 (d) 2 moles of mercury (II) oxide produce 2 moles of mercury and one mole of oxygen gas.
- (iii) Which of the following laws is satisfied by a balanced chemical equation?
- (a) Law of multiple proportions (b) Law of conservation of mass
 (c) Law of conservation of motion (d) Law of conservation of magnetism
- (iv) In the given chemical reaction,
- $$2\text{C}_6\text{H}_{6(l)} + 15\text{O}_{2(g)} \longrightarrow m\text{CO}_{2(g)} + n\text{H}_2\text{O}_{(l)}$$
- The values of m and n are respectively
- (a) 14 and 8 (b) 12 and 6 (c) 8 and 10 (d) 12 and 10



- (v) Sulphur dioxide reacts with oxygen to form sulphur trioxide. What would be the molar ratio of sulphur dioxide to sulphur trioxide?
- (a) 2 : 3 (b) 1 : 1 (c) 1 : 2 (d) 3 : 2

Case Study 10

Read the following and answer any four questions from 5(i) to 5(v).

In a chemical reaction, reactants are converted into products. The conversion of reactants into products in a chemical reaction is often accompanied by some features which can be observed easily. These easily observed features which take place as a result of chemical reaction are known as characteristics of chemical reactions. Some important characteristics of chemical reactions are :

- (I) Evolution of heat (II) Formation of precipitate
(III) Change in colour (IV) Change in temperature
(V) Change in state

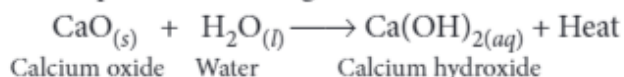
Any one of these general characteristics can tell us whether a chemical reaction has taken place or not.

- (i) Reaction of magnesium with air is a/an
- (a) exothermic reaction (b) endothermic reaction
(c) reversible reaction (d) substitution reaction.
- (ii) In the following reaction,
- $$\text{Ca}_{(aq)}^{2+} + 2\text{OH}_{(aq)}^{-} \longrightarrow \text{Ca}(\text{OH})_{2(s)}$$
- precipitate of calcium hydroxide will be of
- (a) green colour (b) blue colour (c) brown colour (d) white colour.
- (iii) In the given reaction,
- $$\text{S}_{(s)} + \text{O}_{2(g)} \longrightarrow \text{SO}_{2}$$
- the physical state of SO_2 is
- (a) liquid (b) solid (c) gaseous (d) all three.
- (iv) Which one of the following processes involve chemical reactions?
- (a) Storing of oxygen gas under pressure in a gas cylinder.
(b) Keeping petrol in a china dish in the open.
(c) Liquefaction of air.
(d) Heating copper wire in the presence of air at high temperature.
- (v) In which of the following reactions, high amount of heat energy will be evolved?
- (a) Electrolysis of water (b) Dissolution of NH_4Cl in water
(c) Burning of L.P.G. (d) Decomposition of AgBr in the presence of light

Case Study 11

Read the following and answer any four questions from 6(i) to 6(v).

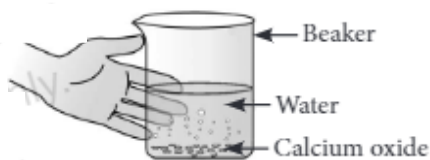
A reaction in which two or more reactants combine to form a single product is called a combination reaction. For example, calcium oxide reacts vigorously with water to form calcium hydroxide. The reaction is highly exothermic in nature, as lots of heat is produced during the reaction.



Solution of $\text{Ca}(\text{OH})_2$ is used for white wash the walls. Calcium hydroxide reacts slowly with carbon dioxide in air to form a thin layer of calcium carbonate on the wall which gives a shiny appearance to wall. Calcium carbonate will form after two or three days of white wash.



- (i) What is the chemical name of quick lime?
 (a) Calcium oxide (b) Calcium carbonate (c) Calcium hydroxide (d) Carbon dioxide
- (ii) When carbon dioxide is passed through lime water,
 (a) calcium hydroxide is formed (b) white precipitate of CaO is formed
 (c) lime water turns milky (d) colour of lime water becomes green.
- (iii) Following observations are observed when calcium oxide reacts vigorously with water.



Identify the incorrect observations.

- (I) It is an endothermic reaction. (II) Slaked lime is produced.
 (III) Quick lime is produced. (IV) It is an exothermic reaction.
 (V) It is a combination reaction.
- (a) (I) and (II) (b) (III) and (IV) (c) (I) and (III) (d) (II), (IV) and (V)
- (iv) Quick lime combines vigorously with water to form (A) which reacts slowly with the carbon dioxide in air to form (B).
 Identify the compounds (A) and (B).
- | (A) | (B) |
|-------------------------|---------------------|
| (a) Calcium carbonate | Calcium hydroxide |
| (b) Calcium hydroxide | Calcium carbonate |
| (c) Calcium | Calcium bicarbonate |
| (d) Calcium bicarbonate | Calcium |
- (v) Among the following, the endothermic reaction is
 (a) combination of carbon and oxygen to form carbon monoxide
 (b) combination of nitrogen and oxygen to form nitrogen monoxide
 (c) combination of glucose and oxygen to form carbon dioxide and water
 (d) combination of zinc and hydrochloric acid to form zinc chloride and hydrogen.

Case Study 12

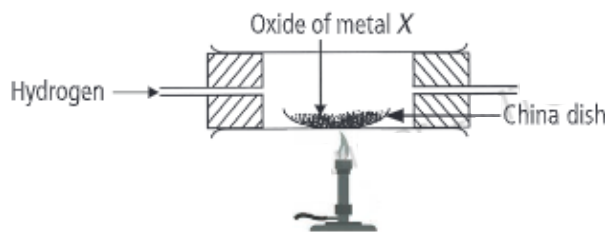
Read the following and answer any four questions from 7(i) to 7(v).

Reactions in which one element takes place of another element in a compound, are known as displacement reactions. In general, more reactive elements displaces a less reactive element from its compound. In all single displacement reactions, only one element displaces another element from its compound. The single displacement reactions are, however, written as just displacement reactions. The displacement reaction between iron (III) oxide and powdered aluminium produces so much heat that iron metal obtained is in molten form.

- (i) Copper displaces which of the following metals from its salt solution?
 (a) ZnSO_4 (b) FeSO_4 (c) AgNO_3 (d) NiSO_4
- (ii) When zinc reacts with dilute sulphuric acid, the gas evolved is
 (a) red in colour and have a sweet smelling.
 (b) green in colour and have a foul smell.
 (c) colourless, odourless and burns with a pop sound.
 (d) colourless, pungent smelling and burns with a pop sound.



- (iii) When dry hydrogen is passed over a heated oxide of metal X using the apparatus shown below, a reddish-brown residue is obtained.



The reddish-brown residue could be

- (a) copper (b) lead (c) silver (d) zinc.
- (iv) Which of the following reactions is a displacement reaction?
- (a) $\text{CaO} + \text{H}_2\text{O} \longrightarrow \text{Ca(OH)}_2$ (b) $\text{MgCO}_3 \longrightarrow \text{Mg} + \text{CO}_2$
 (c) $\text{Mg} + \text{CuSO}_4 \longrightarrow \text{MgSO}_4 + \text{Cu}$ (d) $\text{H}_2 + \text{Cl}_2 \longrightarrow 2\text{HCl}$
- (v) When dilute hydrochloric acid is added to granulated zinc placed in a test tube, the observation made is
- (a) the surface of the metal turns shining
 (b) the reaction mixture turns milky
 (c) greenish yellow gas is evolved
 (d) the colourless and odourless gas evolves with a pop sound.

Case Study 13

Read the following and answer any four questions from 8(i) to 8(v).

Those reactions in which two compounds react by an exchange of ions to form two new compounds are called double displacement reactions. A double displacement reaction usually occurs in solution and one of the products, being insoluble, precipitate out (separates as a solid). Any reaction in which an insoluble solid (called precipitate) is formed that separates from the solution is called a precipitation reaction. The reaction in which acid or acidic oxide reacts with base or basic oxide to form salt and water is called neutralisation reaction.

For example, $2\text{NaOH} + \text{H}_2\text{SO}_4 \longrightarrow \text{Na}_2\text{SO}_4 + \text{H}_2\text{O}$

- (i) When hydrogen sulphide gas is passed through a blue solution of copper sulphate, a black precipitate of copper sulphide is obtained and the sulphuric acid so formed remains in the solution. The reaction is an example of a
- (a) combination reaction (b) displacement reaction
 (c) decomposition reaction (d) double displacement reaction.
- (ii) Which of the following is not a double displacement reaction?
- (a) $\text{AgNO}_{3(aq)} + \text{NaCl}_{(aq)} \longrightarrow \text{AgCl}_{(s)} + \text{NaNO}_{3(aq)}$ (b) $\text{Zn}_{(s)} + \text{H}_2\text{SO}_{4(aq)} \longrightarrow \text{ZnSO}_{4(aq)} + \text{H}_{2(g)}$
 (c) $\text{CuSO}_{4(aq)} + \text{H}_2\text{S}_{(aq)} \longrightarrow \text{CuS}_{(s)} + \text{H}_2\text{SO}_{4(aq)}$ (d) $\text{Pb(NO}_3)_2(aq) + 2\text{KI}_{(aq)} \longrightarrow \text{PbI}_{2(s)} + 2\text{KNO}_{3(aq)}$
- (iii) Barium chloride on reaction with ammonium sulphate forms barium sulphate and ammonium chloride. Which of the following correctly represents the type of the reaction involved?
- (I) Displacement reaction (II) Precipitation reaction
 (III) Combination reaction (IV) Double displacement reaction
- (a) (I) only (b) (II) only (c) (III) and (IV) only (d) (II) and (IV) only
- (iv) Identify A in the following reaction.
- $\text{AlCl}_{3(aq)} + 3\text{NH}_4\text{OH}_{(aq)} \longrightarrow \text{A} + 3\text{NH}_4\text{Cl}_{(aq)}$
- (a) Al(OH)_3 (b) Al_2O_3 (c) AlH_3 (d) AlN

(v) Consider the following reaction,



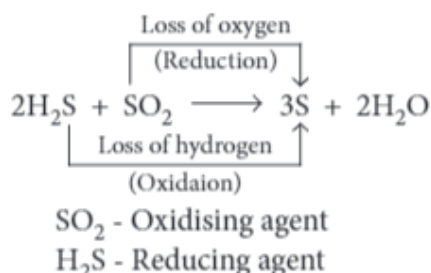
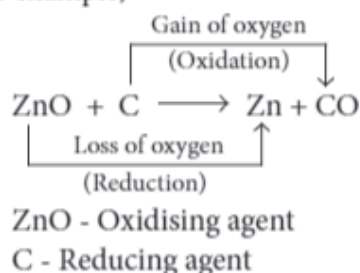
identify the precipitate in the reaction.

- (a) BaCl_2 (b) BaSO_4 (c) Na_2SO_4 (d) NaCl

Case Study 14

Read the following and answer any four questions from 9(i) to 9(v).

The earlier concept of oxidation and reduction is based on the addition or removal of oxygen or hydrogen elements so, in terms of oxygen and hydrogen, oxidation is addition of oxygen to a substance and removal of hydrogen from a substance. On the other hand, reduction is addition of hydrogen to a substance and removal of oxygen from a substance. The substance which gives oxygen to another substance or removes hydrogen from another substance in an oxidation reaction is known as oxidising agent, while the substance which gives hydrogen to another substance or removes oxygen from another substance in a reduction reaction is known as reducing agent. For example,



- (i) A redox reaction is one in which
- both the substances are reduced
 - both the substances are oxidised
 - an acid is neutralised by the base
 - one substance is oxidised while the other is reduced.
- (ii) In the reaction, $\text{H}_2\text{S} + \text{Cl}_2 \longrightarrow \text{S} + 2\text{HCl}$
- H_2S is the reducing agent.
 - HCl is the oxidising agent.
 - H_2S is the oxidising agent.
 - Cl_2 is the reducing agent.
- (iii) Which of the following processes does not involve either oxidation or reduction?
- Formation of slaked lime from quick lime.
 - Heating mercuric oxide.
 - Formation of manganese chloride from manganese oxide (MnO_2).
 - Formation of zinc from zinc blende.
- (iv) $\text{Mg} + \text{CuO} \longrightarrow \text{MgO} + \text{Cu}$
- Which of the following is wrong relating to the above reaction?
- CuO gets reduced.
 - Mg gets oxidised.
 - CuO gets oxidised.
 - It is a redox reaction.
- (v) Identify the correct oxidising agent and reducing agent in the following reaction.
- $$\text{Fe}_2\text{O}_3 + 2\text{Al} \longrightarrow 2\text{Fe} + \text{Al}_2\text{O}_3$$
- Al - Oxidising agent, Fe_2O_3 - Reducing agent
 - Fe_2O_3 - Oxidising agent, Al - Reducing agent
 - Fe - Oxidising agent, Al_2O_3 - Reducing agent
 - Fe_2O_3 - Oxidising agent, Al_2O_3 - Reducing agent

Case Study 15

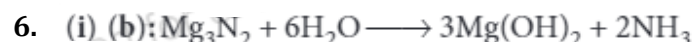
Read the following and answer any four questions from 10(i) to 10(v).

Oxidation has damaging effect on metals as well as on food. The damaging effect of oxidation on metal is studied as corrosion and that on food is studied as rancidity. The phenomenon due to which metals are slowly eaten away by the reaction of air, water and chemicals present in atmosphere, is called corrosion. For example, iron articles are shiny when new, but get coated with a reddish brown powder when left for sometime. This process is known as rusting of iron. Rancidity is the process of slow oxidation of oil and fat (which are volatile in nature) present in the food materials resulting in the change of smell and taste in them.

- (i) Rancidity can be prevented by
- (a) adding antioxidants (b) packaging oily food in nitrogen gas
(c) both (a) and (b) (d) none of these.
- (ii) Combination of phosphorus and oxygen is an example of
- (a) oxidation (b) reduction (c) rancidity (d) none of these.
- (iii) A science teacher wrote the following statements about rancidity :
- (I) When fats and oils are reduced, they become rancid.
(II) In chips packet, rancidity is prevented by oxygen.
(III) Rancidity is prevented by adding antioxidants.
Select the correct option.
- (a) (I) only (b) (II) and (III) only (c) (III) only (d) (I), (II) and (III)
- (iv) Two statements are given below regarding rusting of iron.
- (I) The rusting of iron is a redox reaction and reaction occurs as, $4\text{Fe} + 3\text{O}_2 \longrightarrow 4\text{Fe}^{3+} + 6\text{O}^{2-}$
(II) The metallic iron is oxidised to Fe^{2+} and O_2 is reduced to O^{2-} .
Select the correct statement(s).
- (a) I only (b) II only (c) Both I and II (d) None of these
- (v) Which of the following measures can be adopted to prevent or slow down rancidity?
- (I) Food materials should be packed in air tight container.
(II) Food should be refrigerated.
(III) Food materials and cooked food should be kept away from direct sunlight.
- (a) Only II and III (b) Only I and III (c) Only II and III (d) I, II and III



HINTS & EXPLANATIONS



(ii) (d)

(iii) (c): In a balanced chemical equation, total mass of reactants must be equal to the total mass of products. This is the statement of law of conservation of mass.

(iv) (b)

(v) (d)

7. (i) (c)



(iii) (c): Proteins in our diet get broken down into amino acids.

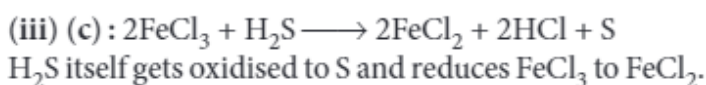


(v) (b): Electrolysis of water is electrolytic decomposition.



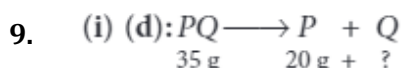
8. (i) (b): H_2 is oxidised to HCl while Cl_2 is reduced to HCl .

(ii) (c)



(iv) (a): ZnO is reduced to Zn and CO is oxidised to CO_2 .

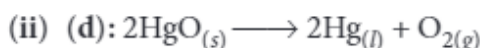
(v) (b): H_2O_2 is reduced to water by removal of oxygen.



According to law of conservation of mass,

Mass of PQ = Mass of P + Mass of Q

\therefore Mass of $\text{Q} = (35 - 20) \text{ g} = 15 \text{ g}$



(iii) (b)

(iv) (b)

(v) (b)

10. (i) (a)

(ii) (d): Calcium hydroxide is a white colour solid.

(iii) (c): SO_2 is gaseous in nature.

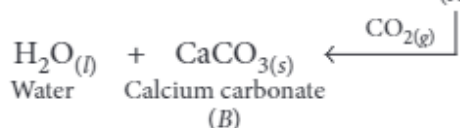
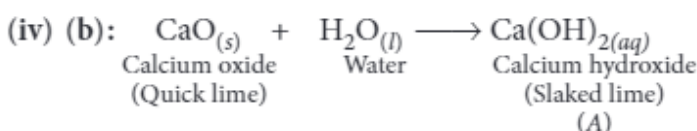
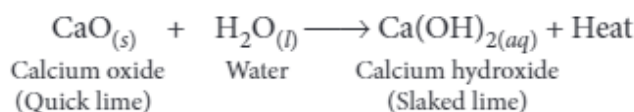
(iv) (d): When copper is heated in the presence of air in a very high temperature, a chemical reaction takes place. Copper reacts with oxygen of the air to form a thin layer of copper oxide on the surface of metallic copper.

(v) (c): On burning of L.P.G., heat is evolved.

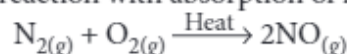
11. (i) (a): Calcium oxide (CaO) is quick lime.



(iii) (c): Calcium oxide (quick lime) reacts vigorously with water to produce calcium hydroxide (slaked lime) releasing a large amount of heat. It is a combination reaction.



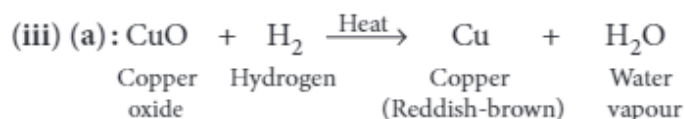
(v) (b): Combination of N_2 and O_2 to form NO is an endothermic reaction with absorption of heat.



12. (i) (c): $\text{Cu} + 2\text{AgNO}_3 \longrightarrow \text{Cu}(\text{NO}_3)_2 + 2\text{Ag}$
 Copper can displace silver from its salt solution since, copper is more reactive than silver.



H_2 is a colourless, odourless gas and burns with a pop sound.

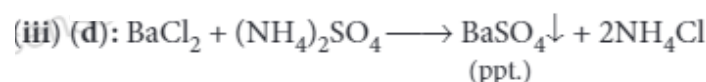


(iv) (c) : It is a single displacement reaction.

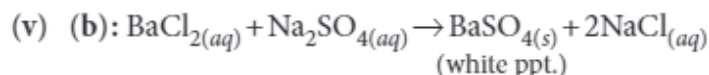


Both CuSO_4 and H_2S exchange their ions to give new compounds- CuS and H_2SO_4 . Hence, this is a double displacement reaction.

(ii) (b): It is an example of single displacement reaction.

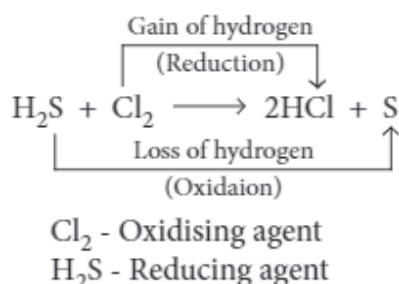


It is a precipitation reaction as well as double displacement reaction.

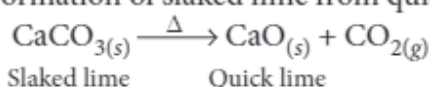


14. (i) (d) : In a redox reaction, one reactant is reduced while other reactant is oxidised.

(ii) (a) :



(iii) (a) : Formation of slaked lime from quick lime:



It is a decomposition reaction.

(iv) (c) : Addition of oxygen is called oxidation while removal of oxygen is called reduction.

Thus, Mg gets oxidised and CuO gets reduced and it is a redox reaction.

(v) (b)

15. (i) (c) : Antioxidants and nitrogen gas prevent oxidation of food.



(iii) (c) : The oils and fats are slowly oxidised to certain bad smelling compounds, which release foul smell. This is known as rancidity.

Rancidity is prevented by filling nitrogen gas in chips packets.

(iv) (a)

(v) (d)

