

Chemical Reactions And Equations

TOPICS COVERED

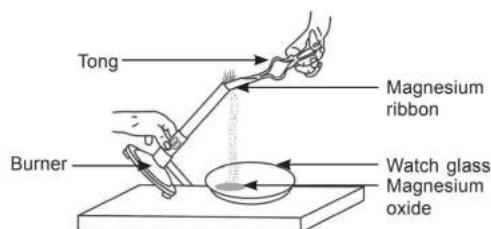
Chemical equations and Types of chemical reactions



Multiple Choice Questions

1 Mark

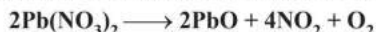
1.



Which of the following is correct observation of the reaction shown in above set up?

[CBSE Sample Paper 2023]

- (a) Brown powder of magnesium oxide is formed.
 - (b) Colourless gas which turns lime water milky is evolved.
 - (c) Magnesium ribbon burns with brilliant white light.
 - (d) Reddish brown gas with a smell of burning sulphur has evolved.
2. Which of the following is an example of simple displacement? [CFPQ, CBSE]
- (a) The electrolysis of water
 - (b) The burning of methane
 - (c) The reaction of a metal with an acid
 - (d) The reaction of two salt solutions to form a precipitate
3. Which of the following is a NECESSARY condition for ALL chemical reactions? [CFPQ, CBSE]
- (a) The reactants should be in the same state.
 - (b) Energy should be supplied to the reactants.
 - (c) The reactants should be at the same temperature.
 - (d) There should be physical contact between the reactants.
4. Given below is the balanced chemical equation for the thermal decomposition of lead nitrate.



Which of the following information does the coefficients of PbO and NO₂ in the equation (2 and 4 respectively) tell us? [CFPQ, CBSE]

- (a) The ratio of the number of moles produced of the two substances.
- (b) The ratio of the number of atoms in the two substances.

- (c) The ratio of the mass produced of the two substances.
- (d) The ratio of the densities of the two substances.

5. Reema took 5 mL of lead nitrate solution in a beaker and added approximately 4 mL of KI solution to it. What would she observe?

[CBSE Sample Paper 2022]

- (a) The solution turned red.
 - (b) Yellow precipitate was formed.
 - (c) White precipitate was formed.
 - (d) The reaction mixture becomes hot.
6. A student took sodium sulphate solution in a test tube and added barium chloride solution to it. He observed that an insoluble substance has formed. The colour and molecular formula of the insoluble substance is: [CBSE 2021]
- (a) Grey, Ba₂SO₄
 - (b) Yellow, Ba(SO₄)₂
 - (c) White, BaSO₄
 - (d) Pink, BaSO₄
7. $\text{C}_6\text{H}_{12}\text{O}_6(\text{aq}) + 6\text{O}_2(\text{aq}) \longrightarrow 6\text{CO}_2(\text{aq}) + 6\text{H}_2\text{O}(\text{l})$
The above reaction is a/an [CBSE 2021]
- (a) displacement reaction
 - (b) endothermic reaction
 - (c) exothermic reaction
 - (d) neutralisation reaction
8. It is important to balance the chemical equations to satisfy the law of conservation of mass. Which of the following statements of the law is incorrect? [CBSE 2021]
- (a) Total total mass of the elements present in the reactants is equal to the total mass of the elements presents in the products.
 - (b) The number of atoms of each element remains the same, before and after a chemical reaction.
 - (c) The chemical composition of the reactants is the same before and after the reaction.
 - (d) Mass can neither be created nor can it be destroyed in a chemical reaction.
9. Which one of the following reactions is categorised as thermal decomposition reaction? [CBSE 2021]
- (a) $2\text{H}_2\text{O}(\text{l}) \longrightarrow 2\text{H}_2(\text{g}) + \text{O}_2(\text{g})$
 - (b) $2\text{AgBr}(\text{s}) \longrightarrow 2\text{Ag}(\text{s}) + \text{Br}_2(\text{g})$
 - (c) $2\text{AgCl}(\text{s}) \longrightarrow 2\text{Ag}(\text{s}) + \text{Cl}_2(\text{g})$
 - (d) $\text{CaCO}_3(\text{s}) \longrightarrow \text{CaO}(\text{s}) + \text{CO}_2(\text{g})$
10. $2\text{HNO}_3 + \text{Ca}(\text{OH})_2 \longrightarrow \text{Ca}(\text{NO}_3)_2 + 2\text{H}_2\text{O}$; is an example of [KVS]
- (i) displacement reaction

- (ii) double displacement reaction
(iii) neutralisation reaction
(iv) combination reaction.
- (a) (i) and (ii) (b) (ii) and (iii)
(c) (iii) and (iv) (d) (i) and (iv)
11. Burning magnesium ribbon is brought in the gas jar of carbon dioxide. Which of the following is correct ?
(i) It keeps on burning
(ii) It gets extinguished
(iii) Although CO_2 is non-supporter of combustion but burning magnesium breaks CO_2 into carbon and oxygen, oxygen helps in burning.
(iv) Carbon dioxide is supporter of combustion.
(a) (i) and (iv) (b) (i) and (iii)
(c) (i) and (ii) (d) (iii) and (iv)
12. What is observed when a solution of potassium iodide is added to silver nitrate solution? [KVS]
(a) No reaction takes place
(b) White precipitate of silver iodide is formed
(c) Yellow precipitate of AgI is formed
(d) AgI is soluble in water.
13. Identify 'x', 'y' and 'z' in the following balanced reaction [CBSE 2023] [KVS]

$$x\text{Pb}(\text{NO}_3)_2(\text{s}) \xrightarrow{\text{Heat}} y\text{PbO}(\text{s}) + z\text{NO}_2(\text{g}) + \text{O}_2(\text{g})$$
 (a) 2, 4, 2 (b) 2, 2, 4
(c) 2, 4, 4 (d) 4, 2, 2
14. Which of the following is precipitation as well as double displacement reaction ?
(a) $\text{NaOH}(\text{aq}) + \text{HNO}_3(\text{aq}) \longrightarrow \text{NaNO}_3(\text{aq}) + \text{H}_2\text{O}(\text{l})$
(b) $\text{Cu}(\text{s}) + 2\text{AgNO}_3(\text{aq}) \longrightarrow \text{Cu}(\text{NO}_3)_2(\text{aq}) + 2\text{Ag}(\text{s})$
(c) $2\text{Hg}(\text{s}) + \text{O}_2(\text{g}) \xrightarrow{\text{Heat}} 2\text{HgO}(\text{s})$
(d) $\text{FeCl}_3(\text{aq}) + 3\text{NH}_4\text{OH}(\text{aq}) \longrightarrow \text{Fe}(\text{OH})_3(\text{s}) + 3\text{NH}_4\text{Cl}(\text{aq})$
15. Which of the following reactions will not take place?
(a) $\text{Zn} + \text{CuSO}_4 \longrightarrow \text{ZnSO}_4 + \text{Cu}$
(b) $2\text{KBr} + \text{Cl}_2 \longrightarrow 2\text{KCl} + \text{Br}_2$
(c) $\text{Zn} + \text{MgSO}_4 \longrightarrow \text{ZnSO}_4 + \text{Mg}$
(d) $\text{Mg} + \text{FeSO}_4 \longrightarrow \text{MgSO}_4 + \text{Fe}$
16. 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: [CBSE 2020]
(a) Combination reaction
(b) Displacement reaction
(c) Decomposition reaction
(d) Double displacement reaction
17. Which of the following is a thermal decomposition reaction ?
(a) $2\text{H}_2\text{O} \longrightarrow 2\text{H}_2 + \text{O}_2$
(b) $2\text{AgCl} \longrightarrow 2\text{Ag} + \text{Cl}_2$
(c) $\text{ZnCO}_3 \longrightarrow \text{ZnO} + \text{CO}_2$
(d) $\text{H}_2(\text{g}) + \text{Cl}_2(\text{g}) \longrightarrow 2\text{HCl}(\text{g})$
18. Calcium oxide reacts vigorously with water to produce slaked lime.

$$\text{CaO}(\text{s}) + \text{H}_2\text{O}(\text{l}) \longrightarrow \text{Ca}(\text{OH})_2(\text{aq})$$
 This reaction can be classified as:
(A) Combination reaction
(B) Exothermic reaction
(C) Endothermic reaction
(D) Oxidation reaction
Which of the following is a correct option? [CBSE 2020]
(a) (A) and (C) (b) (C) and (D)
(c) (A), (C) and (D) (d) (A) and (B)
19. In a double displacement reaction such as the reaction between sodium sulphate solution and barium chloride solution:
(A) exchange of atoms takes place
(B) exchange of ions takes place
(C) a precipitate is produced
(D) an insoluble salt is produced
The correct option is: [CBSE 2020]
(a) (B) and (D) (b) (A) and (C)
(c) only (B) (d) (B), (C) and (D)
20. The brown gas evolved on heating of copper nitrate is [KVS]
(a) O_2 (b) NO_2 (c) N_2 (d) NO
21. Zinc reacts with silver nitrate to form which compounds? [KVS]
(a) $\text{Zn}(\text{NO}_3)_2 + \text{Ag}$ (b) $\text{ZnNO}_3 + \text{Ag}$
(c) $\text{AgNO}_3 + \text{Zn}(\text{NO}_3)_2$ (d) $\text{Ag} + \text{Zn}(\text{NO}_3)_3$
22. $2\text{AgI}(\text{s}) \xrightarrow{\text{Sunlight}} 2\text{Ag}(\text{s}) + \text{I}_2(\text{g})$
The colour of iodine is
(a) green (b) purple (c) brown (d) pink
23. On heating solid lead nitrate in a test tube, we observe [DoE Pre-Board 2023]
(a) fumes of yellow colour
(b) melting of lead nitrate
(c) formation of black solid
(d) fumes of brown colour

Answers

- (c) $2\text{Mg}(\text{s}) + \text{O}_2(\text{g}) \longrightarrow 2\text{MgO}(\text{s}) + \text{heat} + \text{light}$
- (c) Metals react with acid to form salt and $\text{H}_2(\text{g})$.
- (d) Reactants must be in contact so as to react.
- (a) 2 moles of lead nitrate on decomposition gives 4 moles of nitrogen dioxide (NO_2).

5. (b) $\text{Pb}(\text{NO}_3)_2(\text{aq}) + 2\text{KI}(\text{aq}) \rightarrow \text{PbI}_2(\text{s}) + 2\text{KNO}_3(\text{aq})$
6. (c) $\text{BaCl}_2(\text{aq}) + \text{Na}_2\text{SO}_4(\text{aq}) \rightarrow \text{BaSO}_4(\text{s}) + 2\text{NaCl}(\text{aq})$
7. (c) Heat is evolved.
8. (c) Chemical composition of the reactants changes.
9. (d); (a) is electrical, (b) and (c) are photochemical decomposition.
10. (b) HNO_3 is acid and $\text{Ca}(\text{OH})_2$ is base.
11. (b) $2\text{Mg} + \text{CO}_2 \rightarrow 2\text{MgO} + \text{C}$
12. (c) $\text{AgNO}_3(\text{aq}) + \text{KI}(\text{aq}) \rightarrow \text{AgI}(\text{s}) + \text{KNO}_3(\text{aq})$
(Yellow)
13. (b) $2\text{Pb}(\text{NO}_3)_2(\text{s}) \xrightarrow{\text{Heat}} 2\text{PbO}(\text{s}) + 4\text{NO}_2(\text{g}) + \text{O}_2(\text{g})$
14. (d) $\text{Fe}(\text{OH})_3$ is reddish brown ppt.
15. (c) Because Zn is less reactive than Mg.
16. (d) It is double displacement reaction.
17. (c)
18. (d) It is exothermic as well as combination reaction.
19. (d) Exchange of ions takes place, an insoluble salt i.e precipitate is formed.
20. (b) $2\text{Cu}(\text{NO}_3)_2(\text{s}) \xrightarrow{\Delta} 2\text{CuO}(\text{s}) + 4\text{NO}_2(\text{g}) + \text{O}_2(\text{g})$
(Brown)
21. (a) $\text{Zn}(\text{s}) + 2\text{AgNO}_3(\text{aq}) \rightarrow \text{Zn}(\text{NO}_3)_2(\text{aq}) + 2\text{Ag}(\text{s})$
22. (b) Iodine is purple in colour.
23. (d) Brown fumes of NO_2 are formed.



Very Short Answer Type Questions 2 Marks



24. Trupti mixes an aqueous solution of sodium sulphate (Na_2SO_4) and an aqueous solution of copper chloride (CuCl_2).

Will this lead to a double displacement reaction? Justify your answer. [CFPQ, CBSE]

Ans. There will be no reaction.
Sodium sulphate and CuCl_2 will ionise in aqueous solution and will remain as ions.

Direction: Match Column I with Column II.

25. Column I	Column II
(i) $\text{AgNO}_3(\text{aq}) + \text{NaCl}(\text{aq}) \rightarrow \text{AgCl}(\text{s}) + \text{NaNO}_3(\text{aq})$	(A) Neutralisation reaction
(ii) $\text{H}_2(\text{g}) + \text{Cl}_2(\text{g}) \rightarrow 2\text{HCl}(\text{g})$	(B) Decomposition reaction
(iii) $2\text{NaOH} + \text{H}_2\text{SO}_4 \rightarrow \text{Na}_2\text{SO}_4 + 2\text{H}_2\text{O}$	(C) Precipitation reaction
(iv) $2\text{Cu}(\text{NO}_3)_2 \rightarrow 2\text{CuO} + 4\text{NO}_2 + \text{O}_2$	(D) Redox and combination reaction

Ans. (i) (C) (ii) (D) (iii) (A) (iv) (B)

26. What is a balanced chemical equation?

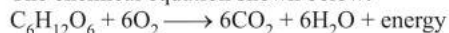
[CBSE 2021 (C)]

Ans. The equation in which the number of atoms of all the molecules is equal on both sides of the equation (Reactants as well as products side) is called balanced chemical equation.

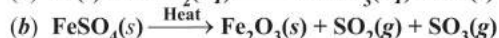
27. Why is respiration considered an exothermic reaction? [CBSE 2021 (C)]

Ans. Respiration is considered an exothermic reaction because, in respiration process, oxidation of glucose takes place which produces a large amount of heat energy, which is stored in the form of ATP.

The chemical equation shown below:

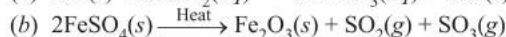


28. Balance the given chemical equations:

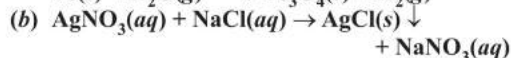


[KVS]

Ans. (a) $2\text{Al}(\text{s}) + 3\text{CuCl}_2(\text{aq}) \rightarrow 2\text{AlCl}_3(\text{aq}) + 3\text{Cu}(\text{s})$



29. (a) Balance the given chemical equation:



Consider the above mentioned two chemical equations with two different kinds of arrows (\uparrow and \downarrow) along with product. What do these two different arrows indicate? [KVS]

Ans. (a) $3\text{Fe}(\text{s}) + 4\text{H}_2\text{O}(\text{g}) \rightarrow \text{Fe}_3\text{O}_4(\text{s}) + 4\text{H}_2(\text{g})$

(b) \uparrow shows the gas evolved whereas \downarrow shows insoluble substance (precipitate) formed.

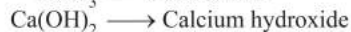
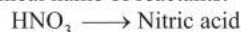
30. Hydrogen being a highly inflammable gas and oxygen being a supporter of combustion, yet water which is a compound made up of hydrogen and oxygen is used to extinguish fire. Why?

Ans. It is because properties of compound (H_2O) are different from properties of its constituting elements i.e. H_2 and O_2 .

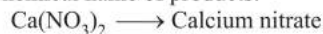
31. Give the chemical name of the reactants as well as the products of the following chemical equation:
 $2\text{HNO}_3 + \text{Ca}(\text{OH})_2 \rightarrow \text{Ca}(\text{NO}_3)_2 + 2\text{H}_2\text{O}$

[CBSE 2021 (C)]

Ans. Chemical name of reactants:



Chemical name of products:



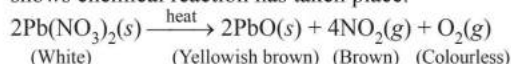
32. Write any two observations in an activity which may suggest that a chemical reaction has taken place. Give an example in support of your answer.

[KVS]

Ans. Any two of these observations will suggest chemical reaction has taken place.

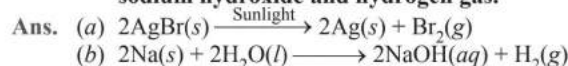
- Change in state.
- Change in colour.
- Evolution of gas.
- Change in temperature.

e.g. lead nitrate is white crystalline solid, on heating gives yellowish brown solid (lead monoxide), brown gas is evolved and a colourless gas is evolved. It shows chemical reaction has taken place.

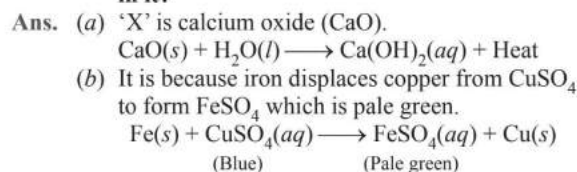


33. Write balanced chemical equations for the following reactions:

- Silver bromide on exposure to sunlight decomposes into silver and bromine.
- Sodium metal reacts with water to form sodium hydroxide and hydrogen gas.

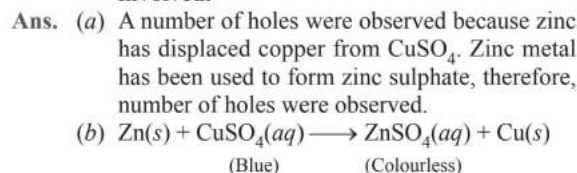


34. (a) A solution of substance 'X' is used for white washing. What is the substance 'X'? State the chemical reaction of 'X' with water. [HOTS]
 (b) Why does the colour of copper sulphate solution change when an iron nail is dipped in it?



35. A zinc plate was put into a solution of copper sulphate kept in a glass container. It was found that blue colour of the solution gets fader and fader with the passage of time. After a few days when zinc plate was taken out of the solution, a number of holes were observed on it. [CBSE 2020]

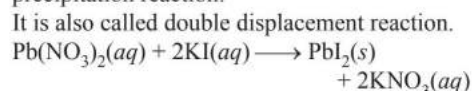
- State the reason for changes observed on the zinc plate.
- Write the chemical equation for the reaction involved.



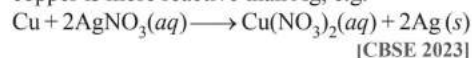
36. (a) What is observed when a solution of potassium iodide solution is added to a solution of lead nitrate? Name the type of reaction. Write a balanced chemical equation to represent the above chemical reaction. [CBSE 2023, 22, 14, 13]

(b) Why copper can displace silver from silver nitrate and silver cannot displace copper from copper sulphate solution?

Ans. (a) Yellow precipitate of lead iodide is formed. It is precipitation reaction.



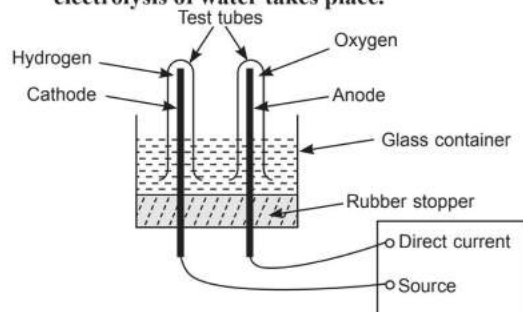
(b) Copper can displace silver from AgNO_3 because copper is more reactive than Ag, e.g.



Silver cannot displace copper from CuSO_4 because silver is less reactive than Cu.

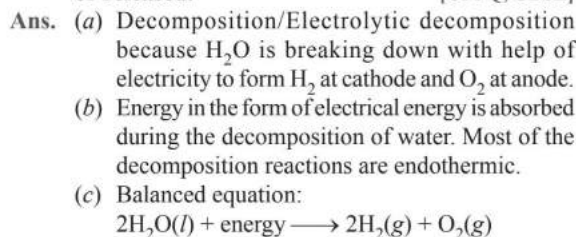
SA Short Answer Type Questions 3 Marks

37. The diagram below shows the set-up in which electrolysis of water takes place.



- What type of reaction takes place?
- Explain why this is an example of an endothermic reaction?
- The test tube containing hydrogen is removed carefully from the apparatus. A lit match stick is brought near the mouth of this test tube. The gas burns with an explosive "pop" sound.

Write a balanced chemical equation for this reaction and indicate whether energy is absorbed or released. [CFPQ, CBSE]



38. Identify the following changes as chemical or physical.

- Crumpling a sheet of aluminium foil.

- (b) Baking a cake.
 (c) Shredding paper.
 (d) Sublimation of dry ice.
 (e) Changing colour and properties.
 (f) Burning of paper.

Ans. (a) Physical change. (b) Chemical change.
 (c) Physical change. (d) Physical change.
 (e) Chemical change. (f) Chemical change.

39. Write the chemical equation of the reaction in which the following changes have taken place with an example of each:

- (a) change in colour.
 (b) change in temperature.
 (c) formation of precipitate. [CBSE 2015, 14]

Ans. (a) $\text{Cu(s)} + 2\text{AgNO}_3(\text{aq}) \rightarrow \text{Cu(NO}_3)_2(\text{aq}) + 2\text{Ag}$
 The solution will become blue in colour and shiny silver metal will be deposited.
 (b) $\text{NaOH} + \text{HCl} \rightarrow \text{NaCl} + \text{H}_2\text{O} + \text{Heat}$
 The temperature will increase because heat will be evolved.
 (c) $\text{Pb(NO}_3)_2(\text{aq}) + 2\text{KI}(\text{aq}) \rightarrow \text{PbI}_2(\text{s}) + 2\text{KNO}_3(\text{aq})$
 (Yellow ppt.)
 Yellow precipitate of PbI_2 will be formed.

40. What is meant by skeletal type chemical equation? What does it represent? Using the equation for electrolytic decomposition of water, differentiate between a skeletal chemical equation and a balanced chemical equation.

Ans. The equations in which gaseous are written in atomic form instead of molecular form and equation is not balanced are called skeletal type of chemical equations. They represent gaseous elements formed in atomic state and equation is not balanced.
 $\text{H}_2\text{O} \xrightarrow{\text{electrolysis}} \text{H} + \text{O}$ (Skeletal equation)
 Hydrogen and oxygen are written in atomic forms and equation is not balanced.
 $2\text{H}_2\text{O} \rightarrow 2\text{H}_2 + \text{O}_2$ (Balanced chemical equation)
 $\text{H}_2\text{O} \rightarrow \text{H}_2 + \text{O}_2$ is also skeletal equation.

41. (a) Which of the following reactions is/are an endothermic reaction(s) where decomposition also happens?

- Respiration
- Heating of lead nitrate
- Decomposition of organic matter
- Electrolysis of acidified water

(b) Silver chloride when kept in the open turns grey. Illustrate this with a balanced chemical equation. [CBSE Sample Paper 2021]

Ans. (a) Heating of lead nitrate; and electrolysis of acidified water. (2 marks)

(b) $2\text{AgCl(s)} \xrightarrow{\text{Sunlight}} 2\text{Ag(s)} + \text{Cl}_2(\text{g})$
 (1 mark)

[CBSE Marking Scheme]

42. Write chemical equation for the reactions taking place when

- (a) Iron reacts with steam.
 (b) Magnesium reacts with dil. HCl.
 (c) Copper is heated in air. [CBSE 2014]

Ans. (a) $3\text{Fe(s)} + 4\text{H}_2\text{O(g)} \rightarrow \text{Fe}_3\text{O}_4(\text{s}) + 4\text{H}_2(\text{g})$
 (b) $\text{Mg} + 2\text{HCl} \rightarrow \text{MgCl}_2 + \text{H}_2$
 (c) $2\text{Cu} + \text{O}_2 \xrightarrow{\text{heat}} 2\text{CuO(s)}$

43. Write balanced equations for the following, mentioning the type of reaction involved.

- (a) Aluminium + Bromine \rightarrow Aluminium bromide
 (b) Calcium carbonate \rightarrow Calcium oxide
 + Carbon dioxide
 (c) Silver chloride \rightarrow Silver + Chlorine

Ans. (a) $2\text{Al(s)} + 3\text{Br}_2(\text{g}) \rightarrow 2\text{AlBr}_3(\text{s})$
 (b) $\text{CaCO}_3(\text{s}) \rightarrow \text{CaO(s)} + \text{CO}_2(\text{g})$
 (c) $2\text{AgCl(s)} \xrightarrow{\text{Sunlight}} 2\text{Ag(s)} + \text{Cl}_2(\text{g})$

44. 2 g of ferrous sulphate crystals are heated in a dry boiling tube.

- (a) List any two observations.
 (b) Name the type of chemical reaction taking place.
 (c) Write the chemical equation for the reaction.

[CBSE 2020, 15]

Ans. (a) (i) Green colour of FeSO_4 disappears and reddish brown Fe_2O_3 is formed.
 (ii) Smell of burning sulphur.

(b) Decomposition reaction.

(c) $2\text{FeSO}_4(\text{s}) \xrightarrow{\text{heat}} \text{Fe}_2\text{O}_3(\text{s}) + \text{SO}_2(\text{g}) + \text{SO}_3(\text{g})$

45. (a) $\text{A} + \text{BC} \rightarrow \text{AC} + \text{B}$
 (b) $\text{AB} + \text{CD} \rightarrow \text{AC} + \text{BD}$

Identify the types of reaction mentioned above in (a) and (b). Give one example for each type in the form of a balanced chemical equation.

[CBSE Sample Paper 2023]

Ans. (a) Displacement - (½ Mark)

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

• $\text{Zn(s)} + \text{CuSO}_4(\text{aq}) \rightarrow \text{ZnSO}_4(\text{aq}) + \text{Cu(s)}$

• $\text{Pb(s)} + \text{CuCl}_2(\text{aq}) \rightarrow \text{PbCl}_2(\text{aq}) + \text{Cu(s)}$

(Any one of the reaction or other displacement reaction.)

(b) Double displacement (½ Mark)

$\text{Na}_2\text{SO}_4(\text{aq}) + \text{BaCl}_2(\text{aq}) \rightarrow \text{BaSO}_4(\text{s})$
 + $2\text{NaCl}(\text{aq})$ (1 Mark)

(Any one of the reaction or other double displacement reaction.)

[CBSE Marking Scheme]

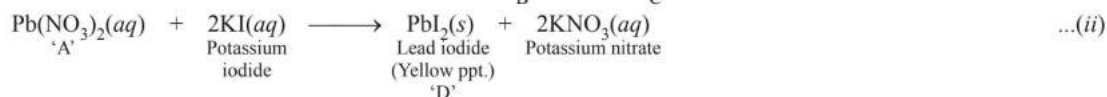
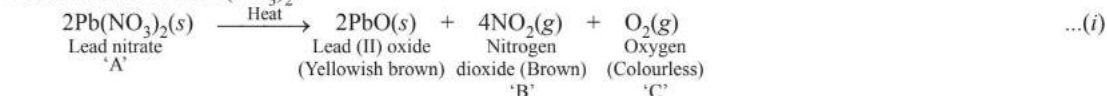


Long Answer Type Questions

5 Marks

46. A metal nitrate 'A' on heating gives yellowish brown coloured metal oxide along with brown gas 'B' and a colourless gas 'C'. Aqueous solution of 'A' on reaction with potassium iodide forms a yellow precipitate of compound 'D'. Identify 'A, B, C, D'. Also identify the types of both the reactions. Metal present in 'A' is used in alloy which is used for soldering purposes. [CBSE 2023] [HOTS]

Ans. Metal nitrate 'A' is $\text{Pb}(\text{NO}_3)_2$.



'A' is lead nitrate, 'B' is nitrogen dioxide, 'C' is oxygen and 'D' is lead iodide.

(i) Is decomposition reaction and (ii) Is double displacement reaction (Precipitation reaction).

47. (a) Write chemical equations for the following and balance them.

(i) Zinc carbonate(s) \longrightarrow Zinc oxide + Carbon dioxide

(ii) Potassium bromide (aq) + Barium iodide (aq) \longrightarrow Potassium iodide + Barium bromide

(iii) Nitrogen + Hydrogen \longrightarrow Ammonia.

(b) What happens when electricity is passed through acidified water? [KVS]

- Ans. (a) (i) $\text{ZnCO}_3(s) \xrightarrow{\text{Heat}} \text{ZnO}(s) + \text{CO}_2(g)$
 (ii) $2\text{KBr}(aq) + \text{BaI}_2(aq) \longrightarrow \text{BaBr}_2(aq) + 2\text{KI}(aq)$
 (iii) $\text{N}_2(g) + 3\text{H}_2(g) \longrightarrow 2\text{NH}_3(g)$
 (b) H_2 gas is formed at cathode and O_2 gas at anode.

PRACTICE QUESTIONS

1. Identify the type of reaction



- (i) Displacement reaction
 (ii) Redox reaction
 (iii) Combination reaction
 (iv) Double displacement reaction
 (a) (i) and (ii) (b) (ii) and (iii)
 (c) (i) and (iv) (d) (iii) and (iv)

2. $\text{CH}_4 + 2\text{O}_2 \longrightarrow \text{CO}_2 + 2\text{H}_2\text{O}$

The above reaction is

- (a) oxidation
 (b) decomposition reaction
 (c) endothermic reaction
 (d) double displacement reaction

3. Which of the following observations help(s) us to determine that a chemical change has taken place? [KVS]

- (a) Change in temperature
 (b) Change in colour
 (c) Evolution of gas
 (d) All of these

4. On placing a copper coin in a test tube containing green ferrous sulphate solution, it will be observed that the ferrous sulphate solution [CBSE Sample Paper 2023]

- (a) turns blue, and grey substance is deposited on copper coin.
 (b) colourless and a grey substance is deposited on the copper coin.
 (c) turns colourless and a reddish brown substance is deposited on the copper coin.
 (d) remains green with no change in the copper coin.

5. Which of the following represents a balanced chemical equation? [CBSE Sample Paper 2023]

- (a) $\text{Fe}(s) + 4\text{H}_2\text{O}(g) \longrightarrow \text{Fe}_3\text{O}_4(s) + 4\text{H}_2(g)$
 (b) $3\text{Fe}(s) + 4\text{H}_2\text{O}(g) \longrightarrow \text{Fe}_3\text{O}_4(s) + 4\text{H}_2(g)$
 (c) $3\text{Fe}(s) + \text{H}_2\text{O}(g) \longrightarrow \text{Fe}_3\text{O}_4(s) + \text{H}_2(g)$
 (d) $3\text{Fe}(s) + 4\text{H}_2\text{O}(g) \longrightarrow \text{Fe}_3\text{O}_4(s) + \text{H}_2(g)$

6. The chemical reaction between copper and oxygen can be regarded as [CBSE Sample Paper 2022]

- (a) displacement reaction
 (b) decomposition reaction
 (c) combination reaction
 (d) double displacement reaction

7. Why is it important to balance a skeletal chemical equation? [CBSE Sample Paper 2022]

- (a) To verify law of conservation of energy.
 (b) To verify law of constant proportion.
 (c) To verify law of conservation of mass.
 (d) To verify law of conservation by momentum.

8. Lime stone $\xrightarrow[\text{Heated}]{\text{Step 1}}$ $X + \text{CO}_2$;
 $X + \text{H}_2\text{O} \xrightarrow{\text{Step 2}}$ Slaked lime
 The Step 1 and Step 2 respectively are
 (a) endothermic, exothermic
 (b) both endothermic
 (c) both exothermic
 (d) exothermic, endothermic
9. Give two example of double displacement reaction.
10. Consider the following chemical reaction
 $X + \text{Barium chloride} \longrightarrow Y + \text{Sodium chloride}$
 (White ppt.)
 (a) Identify 'X' and 'Y'.
 (b) The type of reaction.
11. 2 g of silver chloride is taken in a china dish and the china dish is placed in sunlight for sometime. What will be your observation in this case? Write the chemical reaction involved in the form of a balanced chemical equation. Identify the type of chemical reaction. [Delhi 2019]
12. 2 g of lead nitrate powder is taken in a boiling tube. The boiling tube is heated over a flame. Now answer the following:
 (a) State the colour of the fumes evolved and the residue left.
 (b) Name the type of chemical reaction that has taken place stating its balanced chemical equation.
13. Balance the following chemical equations:
 (a) $\text{C}_6\text{H}_{12}\text{O}_6 + \text{O}_2 \longrightarrow \text{CO}_2 + \text{H}_2\text{O}$
 (b) $\text{CH}_4 + \text{O}_2 \longrightarrow \text{CO}_2 + \text{H}_2\text{O}$
 (c) $\text{KClO}_3 \longrightarrow \text{KCl} + \text{O}_2$
 (d) $\text{CO} + \text{H}_2 \longrightarrow \text{CH}_3\text{OH}$
 (e) $\text{CuSO}_4 + \text{NaOH} \longrightarrow \text{Cu}(\text{OH})_2 + \text{Na}_2\text{SO}_4$
 (f) $\text{Fe} + \text{H}_2\text{O} \longrightarrow \text{Fe}_3\text{O}_4 + \text{H}_2$
14. Write the balanced equation for the following equations for the following reactions.
 (a) Hydrogen combines with nitrogen to form ammonia.
 (b) Magnesium burns in oxygen to form magnesium oxide.
 (c) Barium chloride solution is added to copper sulphate solution to form barium sulphate along with copper chloride solution.
15. (a) What happens when
 (i) a piece of magnesium metal is placed in copper sulphate solution?
 (ii) a piece of copper metal is placed in iron sulphate solution?
 (b) Giving an example list two information which make a chemical equation more useful (informative). [CBSE 2015]
16. Give an example, each for thermal decomposition and photochemical decomposition reactions. Write balanced equation for the same. [KVS]

TOPICS COVERED

Redox Reactions, Corrosion and Rancidity



Multiple Choice Questions

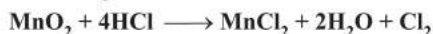
1 Mark

1. A student notices that new hammer made of iron is shiny while an old one kept in the tool box has a reddish brown deposit over it. What does the change in colour of hammer indicate? [CBSE T.E.R.M.*]
 (a) Effect of moisture on metals
 (b) Iron hammer turns brown after sometime.
 (c) Effects of kept in a box for longer duration.
 (d) Iron changes colour when kept with other tools.
2. A student notices her jewellery turned dull and had grey black film over it after wearing for a few months. What results in the change in its colour? [CBSE T.E.R.M.*]
 (a) Dust deposit over the jewellery which changes its colour.
 (b) The jewellery comes in contact with air, moisture, acids and corrodes.
 (c) The polish over the jewellery was removed after wearing for few months.
 (d) Silver breaks due to wear and tear and turns its colour change due to rusting.
3. A student notices that bread kept out has a green coating over it after few days. What explains the reason for the student's observation? [CBSE T.E.R.M.*]
 (a) The oils of bread oxidises and cause rancidity.
 (b) Bread comes in contact with atmospheric moisture and corrodes.
 (c) The oils in the bread reduces and causes change in colour of bread.
 (d) Comes in contact with the atmospheric nitrogen and layer deposit over it.

4. A student learns that food companies fill bags of chips with nitrogen gas. What is the purpose of packing it with N_2 gas? [CBSE T.E.R.M.*]

(a) It prevents rancidity of chips.
 (b) It keeps mosquitos away from chips.
 (c) It keeps the chips dry if pack falls in water.
 (d) Prevents chips from spilling out when pack is opened.

5. Which of the following statements about the reaction given below are correct?



(i) HCl is oxidised to Cl_2 [CBSE 2021]

(ii) MnO_2 is reduced to $MnCl_2$

(iii) $MnCl_2$ acts as an oxidising agent

(iv) HCl acts as an oxidising agent

(a) (ii), (iii) and (iv) (b) (i), (ii) and (iii)
 (c) (i) and (ii) only (d) (iii) and (iv) only

6. In the reaction $Hg_2Cl_2 + Cl_2 \longrightarrow 2HgCl_2$

The reducing agent is

(a) Hg_2Cl_2 (b) Cl_2
 (c) $HgCl_2$ (d) Both Cl_2 and $HgCl_2$

7. Oxidation involves

(i) gain of electron

(ii) loss of electron

(iii) addition of oxygen or electronegative element

(iv) removal of hydrogen or electropositive element [KVS]

(a) (i), (ii), (iii) (b) (ii), (iii), (iv)
 (c) (i), (iii), (iv) (d) (i), (ii), (iv)

8. $MnO_2(s) + 4HCl(conc.) \longrightarrow MnCl_2(aq) + H_2O(l) + Cl_2(g)$

The oxidising agent is

(a) MnO_2 (b) HCl
 (c) $MnCl_2$ (d) $Ag + Zn(NO_3)_3$

9. In the reaction of iron with copper sulphate solution: $CuSO_4 + Fe \longrightarrow Cu + FeSO_4$

Which option in the given table correctly represents the substance oxidised and the reducing agent?

[CBSE Sample Paper 2022]

Option	Substance Oxidized	Reducing Agent
(a)	Fe	Fe
(b)	Fe	$FeSO_4$
(c)	Cu	Fe
(d)	$CuSO_4$	Fe

10. Chemically the rust is [KVS]

(a) Ferric sulphate
 (b) Ferric oxide
 (c) Hydrated ferrous oxide
 (d) Hydrated ferric oxide

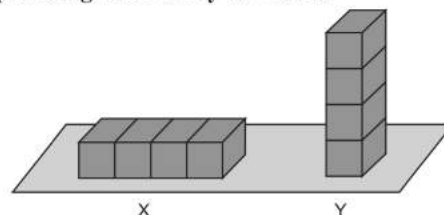
Answers

- (a) $Fe_2O_3 \cdot xH_2O$ is formed.
- (b) Silver turns black due to Ag_2S .
- (a) Oxidation causes rancidity.
- (a) N_2 being inert, prevents oxidation.
- (c) MnO_2 is oxidising agent and HCl is reducing agent
- (a) Hg_2^{2+} is losing electron to form $2Hg^{2+}$.
- (b)
- (a) MnO_2 is oxidising agent because it is removing hydrogen from HCl to form Cl_2 .
- (a) Fe and Fe respectively.
- (d) The chemical formula of rust is $Fe_2O_3 \cdot xH_2O$.



Very Short Answer Type Questions 2 Marks

11. Eight identical, iron blocks are placed on the ground in the two arrangements X and Y as shown below. The block arrangements are kept moist by sprinkling water every few hours.



Which of the arrangements is likely to gather more rust after ten days? Justify your answer.

[CFPQ, CBSE]

Ans. Arrangement Y is likely to gather more rust after ten days. Rusting is a surface phenomenon. Arrangement Y has a larger surface area exposed to air. Greater the surface area more rusting will take place.

12. (a) Potato chips manufacturers fill the packet of chips with nitrogen gas. Why? [DoE]
 (b) Why do gold and platinum not corrode in moist air?

Ans. (a) To provide an inert atmosphere to prevent chips from getting oxidised. N_2 does not allow chips to get spoiled by oxidation.
 (b) They are least reactive and do not react with substances present in moist air.

13. A reddish brown coloured metal, used in electrical wires, when powdered and heated strongly in an open china dish, its colour turns black. When hydrogen gas is passed over this black substance, it regains its original colour. Based on the above information answer the following questions.

(a) Name the metal and the black coloured substance formed.

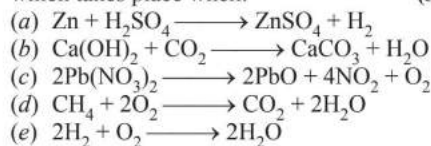
$$\text{CuO}(s) + \text{H}_2(g) \xrightarrow{\text{heat}} \text{Cu}(s) + \text{H}_2\text{O}(l)$$

1. (a) In the reaction represented by the equation.

$$\text{CuO} + \text{H}_2 \longrightarrow \text{Cu} + \text{H}_2\text{O} \quad \text{(3 Marks)}$$
 (i) Name the oxidising agent.
 (ii) Name the reducing agent.
 (iii) Name the substance oxidised.
 (iv) Name the substance reduced.
- (b) What type of chemical reactions are represented by the following equations?
 (i) $\text{X} + \text{YZ} \longrightarrow \text{XZ} + \text{Y}$ (ii) $\text{X} + \text{Y} \longrightarrow \text{Z}$
2. (a) Identify the type of reaction from the following equations: **(5 Marks)**
 (i) $\text{CH}_4 + 2\text{O}_2 \rightarrow \text{CO}_2 + 2\text{H}_2\text{O}$
 (ii) $\text{Pb}(\text{NO}_3)_2 + 2\text{KI} \rightarrow \text{PbI}_2 + 2\text{KNO}_3$
 (iii) $\text{CaO} + \text{H}_2\text{O} \rightarrow \text{Ca}(\text{OH})_2$
 (iv) $\text{CuSO}_4 + \text{Zn} \rightarrow \text{ZnSO}_4 + \text{Cu}$ [CBSE 2012]
 (v) $2\text{KNO}_3(\text{s}) \longrightarrow 2\text{KNO}_2(\text{s}) + \text{O}_2(\text{g})$
 (vi) $\text{Zn}(\text{s}) + 2\text{AgNO}_3(\text{aq}) \longrightarrow \text{Zn}(\text{NO}_3)_2 + 2\text{Ag}(\text{s})$
- (b) Name the reducing agent in the following reaction:
- $$3\text{MnO}_2 + 4\text{Al} \longrightarrow 3\text{Mn} + 2\text{Al}_2\text{O}_3$$

 State which is more reactive, Mn or Al and why? [CBSE 2015]
3. (a) Explain how rancidity can be retarded by storing foods away from light? [DoE] **(5 Marks)**
- (b) Give reason for the following:
 Digestion of food in the body is an example of decomposition reaction. [DoE]
- (c) Write the balanced chemical equation for the following reaction:
 (i) phosphorus burns in presence of chlorine to form phosphorus pentachloride.
 (ii) burning of natural gas.
 (iii) the process of respiration.
4. (a) Explain two ways by which food industries prevent rancidity. **(5 Marks)**
- (b) Discuss the importance of decomposition reaction in metal industry with three points. [CBSE 2015]

5. State one characteristic each of the chemical reaction which takes place when: (5 Marks)



6. Identify the type of chemical reaction taking place in each of the following: (5 Marks)

(a) Barium chloride solution is mixed with copper sulphate solution and a white precipitate is observed.

- (b) On heating copper powder in air in a china dish, the surface of copper powder turns black.
(c) On heating green coloured ferrous sulphate crystals, reddish brown solid is left and smell of a gas having odour of burning sulphur is experienced.
(d) Iron nails when left dipped in blue copper sulphate solution become brownish in colour and the blue colour of copper sulphate fades away.
(e) Quick lime reacts vigorously with water releasing a large amount of heat.



ASSERTION AND REASON QUESTIONS

Direction: In the following Questions, the Assertion and Reason have been put forward. Read the statements carefully and choose the correct alternative from the following:

- (a) Both the Assertion and the Reason are correct and the Reason is the correct explanation of the Assertion.
(b) The Assertion and the Reason are correct but the Reason is not the correct explanation of the Assertion.
(c) Assertion is true but the Reason is false.
(d) The statement of the Assertion is false but the Reason is true.

1. **Assertion:** Burning of Natural gas is an endothermic process.

Reason: Methane gas combines with oxygen to produce carbon dioxide and water.

2. **Assertion:** AgBr is used on photographic and X-ray film.

Reason: AgBr is photosensitive and changes to Ag and bromine in presence of sunlight and undergoes decomposition reaction. [KVS]

3. **Assertion:** Magnesium ribbon keeps on burning in atmosphere of nitrogen.

Reason: Magnesium reacts with nitrogen to form magnesium nitrides and this reaction is combination reaction. [KVS]

4. **Assertion:** Zinc reacts with sulphuric acid to form zinc sulphate and hydrogen gas and it is displacement reaction.

Reason: Zinc reacts with oxygen to form zinc oxide. [KVS]

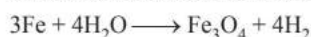
5. **Assertion:** $\text{MnO}_2 + 4\text{HCl} \longrightarrow \text{MnCl}_2 + \text{Cl}_2 + 2\text{H}_2\text{O}$ is redox reaction.

Reason: MnO_2 oxidises HCl to Cl_2 and gets reduced to MnCl_2 . [KVS]

6. **Assertion:** A lead nitrate on thermal decomposition gives lead oxide, brown coloured nitrogen dioxide and oxygen gas.

Reason: Lead nitrate reacts with potassium iodide to form yellow ppt of lead iodide and the reaction is double displacement as well as precipitation reaction.

7. **Assertion:** Following is a balanced chemical equation for the action of steam on iron.



Reason: The law of conservation of mass holds good for a chemical equation. [CBSE 2020]

8. **Assertion:** A reaction in which a substance is decomposed into two or more simpler products is known as decomposition reaction.

Reason: The decomposition of a substance is impossible without supplying energy. [CBSE 2020]

9. **Assertion:** $\text{PbO}_2 + 4\text{HCl} \longrightarrow \text{PbCl}_2 + \text{Cl}_2 + 2\text{H}_2\text{O}$ is redox reaction.

Reason: PbO_2 oxidise HCl to Cl_2 and gets reduced to PbCl_2 .

10. **Assertion:** After white washing the walls, a shiny white finish on the walls is obtained after two to three days.

Reason: Calcium oxide reacts with carbon dioxide to form calcium hydrogen carbonate which gives shiny finish. [CBSE 2020]

11. **Assertion:** A reaction in which a substance is decomposed into two or more substances is known as decomposition reaction.

Reason: The decomposition of a substance is impossible without supplying energy. [CBSE 2020(C)]

12. **Assertion:** Combustion reaction is also called exothermic oxidation reaction.

Reason: In a combustion reaction O_2 is added and heat is released.

13. **Assertion:** Silver bromide decomposition is used in black and white photography.

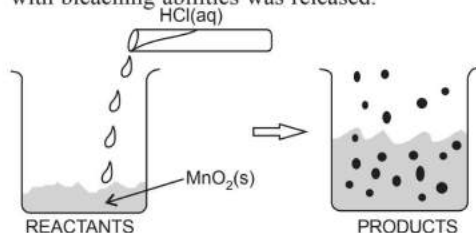
Reason: Light provides energy for this exothermic reaction.



CASE-BASED QUESTIONS

1. Read the given passage and answer the questions based on passage and related studied concepts.

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



- What type of reaction is between MnO_2 and conc. HCl ?
- Which compound reacts with Cl_2 to form bleaching powder?
- Identify oxidising agent, reducing agent, substance oxidised and substance reduced in reaction of MnO_2 and HCl .

Or

- What will happen if we take dry HCl instead of aqueous HCl ? What is colour of MnO_2 ?

2. Read the given passage and answer the questions based on passage and related studied concepts.

The metal sodium reacts with air and water.

A student reacted sodium with water and measured the volume of gas at intervals of 30 seconds. The results are shown below:

Time/s	0	30	60	90	120	150	180
Volume/ cm^3	0	40	60	74	86	96	140

- Up to what time reaction was fastest? Why?
- Which gas is liberated in above reaction?
- What will be colour of universal indicator in the solution formed? Write balanced chemical reaction.

Or

- What will be colour of phenolphthalein in solution formed?
 - Which ions are responsible for basic nature of NaOH ?

3. Read the given passage and answer the questions based on passage and related studied concepts.

Chemical reaction involves chemical changes in which new substances with new properties are formed, when two or more substances react with each other. Combination, decomposition (thermal, electrical and photochemical), displacement, double displacement (precipitation), redox (oxidation and

reduction) are various type of chemical reactions.

- What is formula of marble?
- Which compound is used in photographic and X-ray films?
- What happens when potassium reacts with water? Write balanced chemical equation.

Or

- What happens when
 - Iron reacts with chlorine
 - Copper reacts with oxygen on heating

4. Answer the questions on the basis of your understanding of the following paragraph and the related studied concepts.

Redox reactions involves both oxidation as well as reduction. If we cut an apple, it turns reddish brown after some time because Fe^{2+} present in apple gets converted into Fe^{3+} by loss of electrons. Oxidation is a process in which loss of electrons takes place. Oxidation is carried out with the help of oxidising agent which can give O_2 or remove hydrogen or can gain electrons. Non-metals are good oxidising agents, KMnO_4 , $\text{K}_2\text{Cr}_2\text{O}_7$ are also good oxidising agent in acidic medium. Combustion is oxidation reaction. Reduction involves gain of electrons. Reducing agent can add H_2 or remove O_2 or can lose electrons. Metals are good reducing agents. Reducing agents are used in extraction of metals.

- $\text{Fe}_2\text{O}_3(\text{s}) + 3\text{CO}(\text{g}) \longrightarrow 2\text{Fe}(\text{s}) + 3\text{CO}_2(\text{g})$
Identify oxidising and reducing agents in the above equation.
- $\text{H}_2\text{S}(\text{g}) + \text{Cl}_2(\text{g}) \longrightarrow 2\text{HCl}(\text{g}) + \text{S}(\text{s})$
Name the substance which are getting oxidised and reduced.
- $\text{Mg}(\text{s}) + 2\text{H}^+(\text{aq}) \longrightarrow \text{Mg}^{2+}(\text{aq}) + \text{H}_2(\text{g})$
Why is magnesium acting as reducing agent and H^+ are oxidising agent?

Or

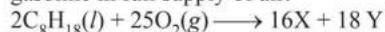
- $\text{Cr}_2\text{O}_3 + 2\text{Al} \longrightarrow \text{Al}_2\text{O}_3 + 2\text{Cr}$
Identify the type of above reaction.
 - $\text{Fe}_3\text{O}_4 + 4\text{H}_2 \longrightarrow 3\text{Fe} + 4\text{H}_2\text{O}$
Which substance undergoes oxidation and reduction?

5. Read the given passage and answer the questions based on passage and related studied concepts.

Chemistry in Automobiles:

For an internal combustion engine to move a vehicle down the road, it must convert the energy stored in the fuel into mechanical energy to drive the wheels. In your car, the distributor and battery provide this starting energy by creating an electrical "spark", which

helps in combustion of fuels like gasoline. Below is the reaction depicting complete combustion of gasoline in full supply of air:



- What products are obtained in above reaction?
- Identify the type of reaction taking place during combustion of fuel.
- On the basis of evolution/absorption of energy which of the following processes are similar to combustion of fuel?
 - Photosynthesis in plants
 - Respiration in human body
 - Decomposition of vegetable matter
 - Decomposition of Ferrous sulphate

Or

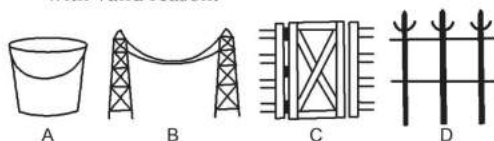
- Why is there rich smoke in the exhaust of moving trucks on the road?
 - Why does N_2 not take part in combustion?
- Two students decided to investigate the effect of water and air on iron object under identical experimental conditions. They measured the mass of each object before placing it partially immersed in 10 ml of water. After a few days, the object were removed, dried and their masses were measured. The table shows their results. [CBSE Sample Paper 2023]

Student	Object	Mass of Object before Rusting in g	Mass of the coated object in g
A	Nail	3.0	3.15
B	Thin plate	6.0	6.33

- What might be the reason for the varied observations of the two students?
- In another set up the students coated iron nails with zinc metal and noted that, iron nails coated with zinc prevents rusting. They also observed that zinc initially acts as a physical barrier, but an extra advantage of using zinc is that it continues to prevent rusting even if the layer of zinc is damaged. Name this process of rust prevention and give any two other methods to prevent rusting.

Or

- In which of the following applications of Iron, rusting will occur most? Support your answer with valid reason.



- A - Iron Bucket electroplated with Zinc
 B - Electricity cables having iron wires covered with aluminium
 C - Iron hinges on a gate
 D - Painted iron fence



NCERT ZONE

NCERT INTTEXT QUESTIONS

Page 6

- Why should a magnesium ribbon be cleaned before burning in air?

Ans. When magnesium ribbon is exposed to air, it forms a layer of magnesium oxide on its surface. This layer of magnesium oxide, being a stable compound, prevents further reaction of magnesium with oxygen. Hence, it should be cleaned before burning in air to remove this layer so that the metal can be exposed to air properly (the oxide layer may prevent or slow down the burning of magnesium).

- Write the balanced equation for the following chemical reactions.

- Hydrogen + Chlorine \longrightarrow Hydrogen chloride
- Barium chloride + Aluminium sulphate \longrightarrow Barium sulphate + Aluminium chloride

- Sodium + Water \longrightarrow Sodium hydroxide + Hydrogen

- Ans. (a) $\text{H}_2(g) + \text{Cl}_2(g) \longrightarrow 2\text{HCl}(g)$
 (b) $3\text{BaCl}_2(aq) + \text{Al}_2(\text{SO}_4)_3(aq) \longrightarrow 3\text{BaSO}_4(s) + 2\text{AlCl}_3(aq)$
 (c) $2\text{Na}(s) + 2\text{H}_2\text{O}(l) \longrightarrow 2\text{NaOH}(aq) + \text{H}_2(g)$

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

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

- Ans. (a) $\text{BaCl}_2(aq) + \text{Na}_2\text{SO}_4(aq) \longrightarrow \text{BaSO}_4(s) + 2\text{NaCl}(aq)$
 (b) $\text{NaOH}(aq) + \text{HCl}(aq) \longrightarrow \text{NaCl}(aq) + \text{H}_2\text{O}(l)$

1. A solution of a substance X is used for white washing.

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

Ans. (a) The substance X is lime or quick lime which is used for white washing. Its formula is CaO.



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

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

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

Ans. Iron is more reactive than copper. So, when an iron nail is dipped in a copper sulphate solution,

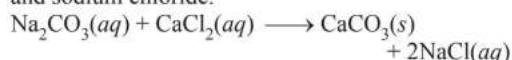
iron displaces copper from its solution to form iron sulphate, which is green in colour.



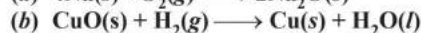
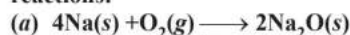
Hence, the blue colour of copper sulphate solution changes into green colour because of this displacement reaction. It is redox reaction.

2. Give an example of a double displacement reaction other than the one given in Activity 1.10.

Ans. Sodium carbonate and calcium chloride exchange ions to form two new compounds calcium carbonate and sodium chloride.



3. Identify the substances that are oxidized and the substances that are reduced in the following reactions:

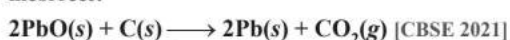


Ans. (a) Sodium (Na) is oxidized to Na_2O , oxygen is getting reduced to O^{2-} ion.

(b) CuO (Copper oxide) is reduced to Cu, while H_2 gas is oxidized to H_2O .

NCERT EXERCISES

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



(a) Lead is getting reduced.
 (b) Carbon dioxide is getting oxidised.
 (c) Carbon is getting oxidised.
 (d) Lead oxide is getting reduced.

- (i) (a) and (b)
 (ii) (a) and (c)
 (iii) (a), (b) and (c)
 (iv) all

Ans. (i) (a) and (b) are incorrect statements because 'Pb' and ' CO_2 ' are products and not reactants.

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

The above reaction is an example of a

(a) combination reaction.
 (b) double displacement reaction.
 (c) decomposition reaction.
 (d) displacement reaction.

Ans. (d) Al is displacing iron from iron (III) oxide. Therefore, it is a displacement and redox 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.

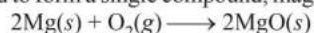
(d) Iron salt and water are produced.

Ans. (a) $\text{Fe(s)} + 2\text{HCl(dil.)} \longrightarrow \text{FeCl}_2(\text{aq}) + \text{H}_2(\text{g})$
 Hydrogen gas and Iron (II) chloride are produced.

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

Ans. Balanced chemical equation means total number of atoms of each element should be equal on both sides of the reaction.

For example, magnesium and oxygen combine, when heated to form a single compound, magnesium oxide.



The reaction should be balanced because matter can neither be created nor be destroyed. The total mass of reactants should be equal to the total mass of products.

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

(a) Hydrogen gas combines with nitrogen to form ammonia. [CBSE 2023]

(b) Hydrogen sulphide gas burns in air to give water and sulphur dioxide.

(c) Barium chloride reacts with aluminium sulphate to give aluminium chloride and a precipitate of barium sulphate.

(d) Potassium metal reacts with water to give potassium hydroxide and hydrogen gas.

- Ans. (a) $3\text{H}_2(\text{g}) + \text{N}_2(\text{g}) \longrightarrow 2\text{NH}_3(\text{g})$
 (b) $2\text{H}_2\text{S}(\text{g}) + 3\text{O}_2(\text{g}) \longrightarrow 2\text{H}_2\text{O}(\text{l}) + 2\text{SO}_2(\text{g})$
 (c) $3\text{BaCl}_2(\text{aq}) + \text{Al}_2(\text{SO}_4)_3(\text{aq}) \longrightarrow 3\text{BaSO}_4(\text{s}) + 2\text{AlCl}_3(\text{aq})$

6. Balance the following chemical equations.

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

- Ans. (a) $2\text{HNO}_3(\text{aq}) + \text{Ca}(\text{OH})_2(\text{aq}) \longrightarrow \text{Ca}(\text{NO}_3)_2(\text{aq}) + 2\text{H}_2\text{O}(\text{l})$
 (b) $2\text{NaOH}(\text{aq}) + \text{H}_2\text{SO}_4(\text{aq}) \longrightarrow \text{Na}_2\text{SO}_4(\text{aq}) + 2\text{H}_2\text{O}(\text{l})$
 (c) $\text{NaCl}(\text{aq}) + \text{AgNO}_3(\text{aq}) \longrightarrow \text{AgCl}(\text{s}) + \text{NaNO}_3(\text{aq})$
 (d) $\text{BaCl}_2(\text{aq}) + \text{H}_2\text{SO}_4(\text{aq}) \longrightarrow \text{BaSO}_4(\text{s}) + 2\text{HCl}(\text{aq})$

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

- (a) Calcium hydroxide + Carbon dioxide \longrightarrow Calcium carbonate + Water
 (b) Zinc + Silver nitrate \longrightarrow Zinc nitrate + Silver
 (c) Aluminium + Copper chloride \longrightarrow Aluminium chloride + Copper
 (d) Barium chloride + Potassium sulphate \longrightarrow Barium sulphate + Potassium chloride.

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

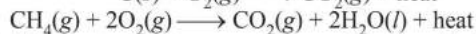
8. Write the balanced chemical equation for the following and identify the type of reaction in each case.

- (a) Potassium bromide(aq) + Barium iodide(aq) \longrightarrow Potassium iodide(aq) + Barium bromide(s)
 (b) Zinc carbonate(s) \longrightarrow Zinc oxide(s) + Carbon dioxide(g)
 (c) Hydrogen(g) + Chlorine(g) \longrightarrow Hydrogen chloride(g)
 (d) Magnesium(s) + Hydrochloric acid(aq) \longrightarrow Magnesium chloride(aq) + Hydrogen(g)

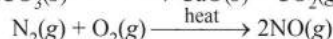
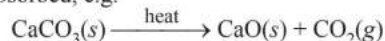
- Ans. (a) $2\text{KBr}(\text{aq}) + \text{BaI}_2(\text{aq}) \longrightarrow 2\text{KI}(\text{aq}) + \text{BaBr}_2(\text{s})$
 Double displacement reaction.
 (b) $\text{ZnCO}_3(\text{s}) \longrightarrow \text{ZnO}(\text{s}) + \text{CO}_2(\text{g})$
 Decomposition reaction.
 (c) $\text{H}_2(\text{g}) + \text{Cl}_2(\text{g}) \longrightarrow 2\text{HCl}(\text{g})$
 Combination reaction and redox reaction.
 (d) $\text{Mg}(\text{s}) + 2\text{HCl}(\text{aq}) \longrightarrow \text{MgCl}_2(\text{aq}) + \text{H}_2(\text{g})$
 Displacement reaction and redox reaction.

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

Ans. **Exothermic reactions** are those reactions in which heat is evolved, e.g.

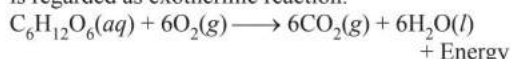


Endothermic reactions are those reactions in which heat is absorbed, e.g.



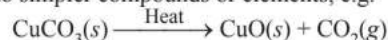
10. Why is respiration considered an exothermic reaction? Explain.

Ans. During respiration, glucose combines with oxygen in the cells of our body and provides energy. As energy is released during respiration, therefore, respiration is regarded as exothermic reaction.



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

Ans. In decomposition reaction, a compound is broken down into simpler compounds or elements, e.g.



Combination reaction is a reaction in which two or more elements or compounds combine to form new compound, e.g.



Thus, decomposition and combination reactions are opposite to each other.

12. Write one equation each for decomposition reactions where energy is supplied in the form of heat, light or electricity. [KVS] [CBSE 2018, 16]

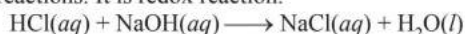
- Ans. (i) $\text{CaCO}_3(\text{s}) \xrightarrow{\text{Heat}} \text{CaO}(\text{s}) + \text{CO}_2(\text{g})$
 (ii) $2\text{AgCl}(\text{s}) \xrightarrow{\text{Sunlight}} 2\text{Ag}(\text{s}) + \text{Cl}_2(\text{g})$
 (iii) $2\text{H}_2\text{O}(\text{l}) \xrightarrow{\text{Electricity}} 2\text{H}_2(\text{g}) + \text{O}_2(\text{g})$

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

Ans. **Displacement reaction:** Those reactions in which more reactive metal displaces less reactive metal from its salt solution are called displacement reactions.



Double displacement reaction: Those reactions in which two compounds exchange their ions to form two new compounds are called double displacement reactions. It is redox reaction.

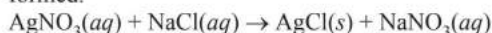


14. In the refining of silver, the recovery of silver from silver nitrate solution involved displacement by copper metal. Write down the reaction involved.

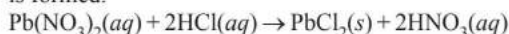
- Ans. $\text{Cu}(\text{s}) + 2\text{AgNO}_3(\text{aq}) \longrightarrow \text{Cu}(\text{NO}_3)_2(\text{aq}) + 2\text{Ag}(\text{s})$
 Copper Silver nitrate Copper nitrate Silver
 Thus, silver metal can be recovered. [CBSE 2023]

15. What do you mean by a precipitation reaction? Explain by giving examples. [DoE] [KVS]

Ans. Those reactions in which two compounds react to form insoluble compound, which is called precipitate, are called precipitation reactions, e.g.
When solutions of silver nitrate and sodium chloride are mixed, white precipitate of silver chloride is formed.



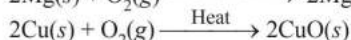
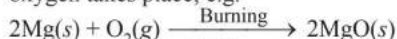
On adding dilute hydrochloric acid to the aqueous solution of lead nitrate, precipitate of lead chloride is formed.



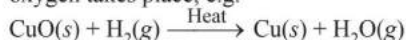
16. Explain the following in terms of gain or loss of oxygen with two examples each. [CBSE 2023]

(a) Oxidation (b) Reduction

Ans. (a) **Oxidation:** It is a process in which gain of oxygen takes place, e.g.



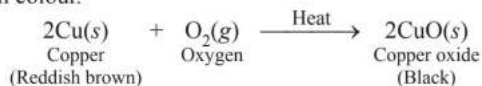
(b) **Reduction:** It is a process in which removal of oxygen takes place, e.g.



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. [CBSE 2023] [KVS]

Ans. 'X' is copper.

Copper gets oxidised to copper oxide which is black in colour.



18. Why do we apply paint on iron articles?

Ans. Painting is done so as to prevent iron from rusting. When the surface of iron is coated with paint, its surface does not come in contact with oxygen and moisture and therefore, rusting does not take place.

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

Ans. When food items prepared in oil are kept for a long time, fat and oils present in them get oxidised by the oxygen. As a result of oxidation, some products are formed which have unpleasant smell and taste. To prevent the food items containing oil and fat from being oxidised and turned rancid, they are flushed with an unreactive gas like nitrogen.

20. Explain the following terms with one example each.

(a) Corrosion (b) Rancidity

Ans. (a) **Corrosion:** It is a process in which metal reacts with substances present in the atmosphere to form surface compounds, e.g. iron reacts with oxygen in presence of moisture to form rust, $\text{Fe}_2\text{O}_3 \cdot x\text{H}_2\text{O}$ (hydrated Iron(III) oxide).

(b) **Rancidity:** When food items prepared in oil such as potato chips are kept for long time, fat and oil present in them get oxidised by the oxygen, and they start giving unpleasant smell and taste. This condition, produced by aerial oxidation of fats and oils in foods marked by unpleasant smell and taste, is called rancidity. Rancidity spoils the food materials and makes them unfit for eating.

SELECT NCERT EXEMPLAR PROBLEMS

1. The following reaction is an example of a $4\text{NH}_3(g) + 5\text{O}_2(g) \longrightarrow 4\text{NO}(g) + 6\text{H}_2\text{O}(g)$

(i) displacement reaction

(ii) combination reaction

(iii) redox reaction

(iv) neutralisation reaction

(a) (i) and (iv) (b) (ii) and (iii)

(c) (i) and (iii) (d) (iii) and (iv)

Ans. (c) NH_3 is reducing agent and O_2 is oxidising agent.

2. Which of the following are exothermic processes?

(i) Reaction of water with quick lime

(ii) Dilution of an acid

(iii) Evaporation of water

(iv) Sublimation of camphor (crystals)

(a) (i) and (ii) (b) (ii) and (iii)

(c) (i) and (iv) (d) (iii) and (iv)

Ans. (a)

3. Barium chloride on reacting 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) (iv) only (d) (ii) and (iv)

Ans. (d) $\text{BaCl}_2(aq) + (\text{NH}_4)_2\text{SO}_4(aq) \longrightarrow \text{BaSO}_4(s) + 2\text{NH}_4\text{Cl}(aq)$

4. Electrolysis of water is a decomposition reaction. The molar ratio of hydrogen and oxygen gases liberated during electrolysis of water is

[CBSE 2023] [KVS]

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

Ans. (b)

5. Which of the following is (are) an endothermic process(es)?

- (i) Dilution of sulphuric acid
(ii) Sublimation of dry ice
(iii) Condensation of water vapours
(iv) Evaporation of water

- (a) (i) and (iii) (b) (ii) only
(c) (iii) only (d) (ii) and (iv)

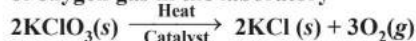
Ans. (d)

6. Which of the following gases can be used for storage of fresh sample of an oil for a long time?

- (a) Carbon dioxide or oxygen
(b) Nitrogen or oxygen
(c) Carbon dioxide or helium
(d) Helium or nitrogen

Ans. (d) These are inert gases.

7. The following reaction is used for the preparation of oxygen gas in the laboratory



Which of the following statement(s) is (are) correct about the reaction?

- (a) It is a decomposition reaction and endothermic in nature
(b) It is a combination reaction
(c) It is a decomposition reaction and accompanied by release of heat
(d) It is a photochemical decomposition reaction and exothermic in nature

Ans. (a)

8. Which one of the following processes involve chemical reactions?

- (a) Storing of oxygen gas under pressure in a gas cylinder
(b) Liquefaction of air
(c) Keeping petrol in a china dish in the open
(d) Heating copper wire in presence of air at high temperature

Ans. (d)

9. In which of the following chemical equations, the abbreviations represent the correct states of the reactants and products involved at reaction temperature?

- (a) $2\text{H}_2(\text{l}) + \text{O}_2(\text{l}) \longrightarrow 2\text{H}_2\text{O}(\text{g})$
(b) $2\text{H}_2(\text{g}) + \text{O}_2(\text{l}) \longrightarrow 2\text{H}_2\text{O}(\text{l})$
(c) $2\text{H}_2(\text{g}) + \text{O}_2(\text{g}) \longrightarrow 2\text{H}_2\text{O}(\text{l})$
(d) $2\text{H}_2(\text{g}) + \text{O}_2(\text{g}) \longrightarrow 2\text{H}_2\text{O}(\text{g})$

Ans. (c)

10. Three beakers labelled as A, B and C each containing 25 ml of water were taken. A small amount of NaOH, anhydrous CuSO_4 and NaCl were added to the beakers A, B and C respectively. It was observed that there was an increase in the temperature of the solutions contained in beakers A and B, whereas in case of beaker C, the temperature of the solution falls. Which one of the following statements(s) is (are) correct?

- (i) In beakers A and B, exothermic process has occurred.
(ii) In beakers A and B, endothermic process has occurred.
(iii) In beaker C exothermic process has occurred.
(iv) In beaker C endothermic process has occurred.

- (a) (i) only (b) (ii) only
(c) (i) and (iv) (d) (ii) and (iii)

Ans. (c) (i) and (iv) are correct. In beakers A and B, exothermic process takes place whereas in beaker 'C' endothermic process takes place.

11. A dilute ferrous sulphate solution was gradually added to the beaker containing acidified potassium permanganate solution. The light purple colour of the solution fades and finally disappears. Which of the following is the correct explanation for the observation?

- (a) KMnO_4 is an oxidising agent, it oxidises FeSO_4
(b) FeSO_4 acts as an oxidising agent and oxidises KMnO_4
(c) The colour disappears due to dilution : no reaction is involved
(d) KMnO_4 is an unstable compound and decomposes in presence of FeSO_4 to a colourless compound.

Ans. (a) KMnO_4 oxidises FeSO_4 to $\text{Fe}_2(\text{SO}_4)_3$ and gets reduced to MnSO_4 .

12. Which among the following statement(s) is/(are) true?

Exposure of silver chloride to sunlight for a long duration turns grey due to

- (i) the formation of silver by decomposition of silver chloride
(ii) sublimation of silver chloride
(iii) decomposition of chlorine gas from silver chloride
(iv) oxidation of silver chloride

- (a) (i) only (b) (i) and (iii)
(c) (ii) and (iii) (d) (iv) only

Ans. (a) It is due to formation of Ag by decomposition of AgCl .

13. Solid calcium oxide reacts vigorously with water to form calcium hydroxide accompanied by liberation of heat. This process is called slaking of lime. Calcium hydroxide dissolves in water to

form its solution called lime water.

Which among the following is (are) true about slaking of lime and the solution formed?

- (i) It is an endothermic reaction
- (ii) It is an exothermic reaction
- (iii) The pH of the resulting solution will be more than seven
- (iv) The pH of the resulting solution will be less than seven
- (a) (i) and (ii)
- (b) (ii) and (iii)
- (c) (i) and (iv)
- (d) (iii) and (iv)

Ans. (b) The reaction is highly exothermic. pH of Ca(OH)_2 is more than 7 because it is basic.

14. In the double displacement reaction between aqueous potassium iodide and aqueous lead nitrate, a yellow precipitate of lead iodide is formed. While performing the activity if lead nitrate is not available, which of the following can be used in place of lead nitrate? [KVS]

- (a) Lead sulphate (insoluble)
- (b) Lead acetate
- (c) Ammonium nitrate
- (d) Potassium sulphate

Ans. (b) Lead acetate can be used instead of $\text{Pb(NO}_3)_2$ because it is soluble in water.

15. Which of the following are combination reactions?

- (i) $2\text{KClO}_3 \xrightarrow{\text{Heat}} 2\text{KCl} + 3\text{O}_2$
- (ii) $\text{MgO} + \text{H}_2\text{O} \longrightarrow \text{Mg(OH)}_2$
- (iii) $4\text{Al} + 3\text{O}_2 \longrightarrow 2\text{Al}_2\text{O}_3$
- (iv) $\text{Zn} + \text{FeSO}_4 \longrightarrow \text{ZnSO}_4 + \text{Fe}$
- (a) (i) and (iii)
- (b) (iii) and (iv)
- (c) (ii) and (iv)
- (d) (ii) and (iii)

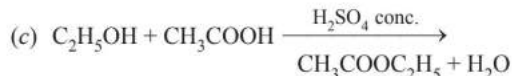
Ans. (d) Two elements or compounds combine to form a single compound

16. Write the balanced chemical equation for the following equations for the following reaction and identify the type of reaction in each case.

- (a) Nitrogen gas is treated with hydrogen gas in the presence of a catalyst at 773 K to form ammonia gas.
- (b) Sodium hydroxide solution is treated with acetic acid to form sodium acetate and water.
- (c) Ethanol is warmed with ethanoic acid to form ethyl acetate in presence of conc. H_2SO_4 .
- (d) Ethene is burnt in presence of oxygen to form carbon dioxide, water and releases heat and light.

Ans. (a) $\text{N}_2(\text{g}) + 3\text{H}_2(\text{g}) \xrightarrow[773 \text{ K}]{\text{Catalyst}} 2\text{NH}_3(\text{g})$
Combination reaction

(b) $\text{NaOH} + \text{CH}_3\text{COOH} \longrightarrow \text{CH}_3\text{COONa} + \text{H}_2\text{O}$
Double displacement reaction/Neutralisation reaction.



Double displacement reaction/Esterification.

(d) $\text{C}_2\text{H}_4 + 3\text{O}_2 \longrightarrow 2\text{CO}_2 + 2\text{H}_2\text{O} + \text{heat} + \text{light}$
Redox reaction/combustion reaction.

17. Write the balanced chemical equations for the following reactions and identify the type of reaction in each case.

(a) Thermite reaction, iron (III) oxide reacts with aluminium and gives molten iron and aluminium oxide. [CBSE 2012]

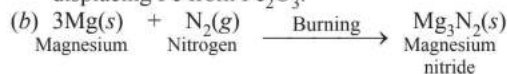
(b) Magnesium ribbon is burnt in an atmosphere of nitrogen gas to form solid magnesium nitride.

(c) Chlorine gas is passed in an aqueous potassium iodide solution to form potassium chloride solution and solid iodine.

(d) Ethanol is burnt in air to form carbon dioxide, water and releases heat.

Ans. (a) $\text{Fe}_2\text{O}_3(\text{s}) + 2\text{Al}(\text{s}) \longrightarrow \text{Al}_2\text{O}_3(\text{s}) + 2\text{Fe}(\text{l}) + \text{heat}$
Iron (III) oxide Aluminium Aluminium oxide Molten iron

It is a displacement reaction because Al is displacing Fe from Fe_2O_3 .



It is a combination reaction as magnesium on burning reacts with N_2 to form magnesium nitride.

(c) $\text{Cl}_2(\text{g}) + 2\text{KI}(\text{aq}) \longrightarrow 2\text{KCl}(\text{aq}) + \text{I}_2(\text{aq})$
It is a displacement reaction because chlorine is displacing iodine from potassium iodide to form potassium chloride and solid iodine.

(d) $\text{C}_2\text{H}_5\text{OH}(\text{l}) + 3\text{O}_2(\text{g}) \longrightarrow 2\text{CO}_2(\text{g}) + 3\text{H}_2\text{O}(\text{l})$
+ heat

It is oxidation reaction. It is also called combustion reaction.

18. Complete the missing components/variables given as x and y in the following reactions:

(a) $\text{Pb(NO}_3)_2(\text{aq}) + 2\text{KI}(\text{aq}) \longrightarrow \text{PbI}_2(\text{x}) + 2\text{KNO}_3(\text{y})$

(b) $\text{Cu}(\text{s}) + 2\text{AgNO}_3(\text{aq}) \longrightarrow \text{Cu(NO}_3)_2(\text{aq}) + \text{x}$

(c) $\text{Zn}(\text{s}) + \text{H}_2\text{SO}_4(\text{aq}) \longrightarrow \text{ZnSO}_4(\text{x}) + \text{H}_2(\text{y})$

(d) $\text{CaCO}_3(\text{s}) \xrightarrow{\text{x}} \text{CaO}(\text{s}) + \text{CO}_2(\text{g})$

Ans. (a) $\text{Pb(NO}_3)_2(\text{aq}) + 2\text{KI}(\text{aq}) \longrightarrow \text{PbI}_2(\text{s}) + 2\text{KNO}_3(\text{aq})$ therefore 'x' is (s), 'y' is (aq).

(b) $\text{Cu}(\text{s}) + 2\text{AgNO}_3(\text{aq}) \longrightarrow \text{Cu(NO}_3)_2(\text{aq}) + 2\text{Ag}(\text{s})$ therefore 'x' is Ag(s).

(c) $\text{Zn}(\text{s}) + \text{H}_2\text{SO}_4(\text{aq}) \longrightarrow \text{ZnSO}_4(\text{aq}) + \text{H}_2(\text{g})$ therefore 'x' is (aq), 'y' is (g).

(d) $\text{CaCO}_3(\text{s}) \xrightarrow{\text{heat}} \text{CaO}(\text{s}) + \text{CO}_2(\text{g})$
'x' is 'heat'.

19. Which among the following changes are exothermic or endothermic in nature?

- Decomposition of ferrous sulphate.
- Dilution of sulphuric acid.
- Dissolution of sodium hydroxide in water.
- Dissolution of ammonium chloride in water.

Ans. (a) It is endothermic reaction.
(b) It is exothermic process.
(c) It is exothermic process.
(d) It is endothermic process.

20. Write the balanced chemical equations for the following reactions.

- Sodium carbonate on reaction with hydrochloric acid in equal molar concentrations gives sodium chloride and sodium hydrogen-carbonate.
- Sodium hydrogencarbonate on reaction with hydrochloric acid gives sodium chloride, water and liberates carbon dioxide.
- Copper sulphate on treatment with potassium iodide precipitates cuprous iodide (Cu_2I_2), liberates iodine gas and also forms potassium sulphate.

Ans. (a) $\text{Na}_2\text{CO}_3(s) + 2\text{HCl}(aq) \longrightarrow \text{NaCl}(aq) + \text{CO}_2(g) + \text{H}_2\text{O}(l)$
(b) $\text{NaHCO}_3(s) + \text{HCl}(aq) \longrightarrow \text{NaCl}(aq) + \text{H}_2\text{O}(l) + \text{CO}_2(g)$
(c) $2\text{CuSO}_4(aq) + 4\text{KI}(aq) \longrightarrow 2\text{K}_2\text{SO}_4(aq) + \text{Cu}_2\text{I}_2(s) + \text{I}_2(s)$
Potassium sulphate Copper(I) iodide

21. Identify the reducing agent in the following reactions:

- $4\text{NH}_3 + 5\text{O}_2 \longrightarrow 4\text{NO} + 6\text{H}_2\text{O}$
- $\text{H}_2\text{O} + \text{F}_2 \longrightarrow \text{HF} + \text{HOF}$
- $\text{Fe}_2\text{O}_3 + 3\text{CO} \longrightarrow 2\text{Fe} + 3\text{CO}_2$
- $2\text{H}_2 + \text{O}_2 \longrightarrow 2\text{H}_2\text{O}$ [CBSE 2023]

Ans. (a) NH_3 is reducing agent.
(b) H_2O is reducing agent.
(c) CO (Carbon monoxide) is reducing agent.
(d) H_2 is reducing agent.

22. Identify the oxidising agent (oxidant) in the following reactions:

- $\text{Pb}_3\text{O}_4 + 8\text{HCl} \longrightarrow 3\text{PbCl}_2 + \text{Cl}_2 + 4\text{H}_2\text{O}$
- $2\text{Mg} + \text{O}_2 \longrightarrow 2\text{MgO}$ [CBSE 2023]
- $\text{CuSO}_4 + \text{Zn} \longrightarrow \text{Cu} + \text{ZnSO}_4$
- $\text{V}_2\text{O}_5 + 5\text{Ca} \longrightarrow 2\text{V} + 5\text{CaO}$
- $3\text{Fe} + 4\text{H}_2\text{O} \longrightarrow \text{Fe}_3\text{O}_4 + 4\text{H}_2$
- $\text{CuO} + \text{H}_2 \longrightarrow \text{Cu} + \text{H}_2\text{O}$

Ans. (a) Pb_3O_4 (Red lead). It is also called *Sindur* used by married ladies. It is an oxidant (oxidising agent).
(b) O_2 is oxidising agent.
(c) CuSO_4 is oxidising agent.
(d) V_2O_5 is oxidising agent.

(e) H_2O is oxidising agent.

(f) CuO is oxidising agent.

23. A solution of potassium chloride when mixed with silver nitrate solution, an insoluble white substance is formed. Write the chemical reaction involved and also mention the type of the chemical reaction.

Ans. $\text{KCl}(aq) + \text{AgNO}_3(aq) \longrightarrow \text{AgCl}(s) + \text{KNO}_3(aq)$
Potassium Silver Silver chloride Potassium
chloride nitrate (White ppt.) nitrate
It is a double displacement reaction. It is also a precipitation reaction as AgCl is a white precipitate.

24. Why do fireflies glow at night?

Ans. It is because protein present in fireflies undergoes oxidation in presence of air and an enzyme. This chemical reaction involves emission of visible light. Therefore, fireflies glow at night.

25. Grapes hanging on the plant do not ferment but after being plucked from the plant can be fermented. Under what conditions do these grapes ferment? Is it a chemical or a physical change?

Ans. Grapes when attached to plants are living and therefore they have their immune system due to which they cannot get fermented. When microbes attack plucked grapes in absence of air, they undergo fermentation to form alcohol. This is a chemical process.

26. During the reaction of some metals with dilute hydrochloric acid, following observations were made.

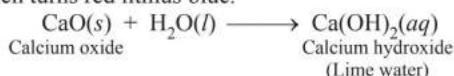
- Silver metal does not show any change.
 - The temperature of the reaction mixture rises when aluminium (Al) is added.
 - The reaction of sodium metal is found to be highly explosive.
 - Some bubbles of a gas are seen when lead (Pb) is reacted with the acid.
- Explain these observations giving suitable reasons.

Ans. (a) It is because silver is less reactive than hydrogen. It cannot displace hydrogen from dilute acid.
(b) It is because the reaction is exothermic.
(c) It is because sodium is highly reactive and forms hydrogen gas in the presence of moisture (H_2O) which catches fire as the reaction is highly exothermic and H_2 is highly inflammable.
(d) It is due to formation of hydrogen gas. The reaction becomes slow after some time as $\text{PbCl}_2(s)$ covers Pb metal.
 $\text{Pb}(s) + 2\text{HCl}(dil.) \longrightarrow \text{PbCl}_2(s) + \text{H}_2(g)$

27. A substance 'X', which is an oxide of a group 2 element, is used intensively in the cement industry. This element is present in bones also. On treatment with water, it forms a solution which turns red litmus blue. Identify 'X' and also write the chemical reactions involved. [HOTS]

Ans. The substance 'X' is calcium oxide (CaO), element is calcium. Calcium oxide is used in cement industry. Calcium is present in bones in form of calcium phosphate.

Calcium oxide dissolves in water forming alkali which turns red litmus blue.



28. Write a balanced chemical equation for each of the following reactions and also classify them.

(a) Lead acetate solution is treated with dilute hydrochloric acid to form lead chloride and acetic acid solution.

(b) A piece of sodium metal is added to absolute ethanol to form sodium ethoxide and hydrogen gas.

(c) Iron(III) oxide on heating with carbon monoxide reacts to form solid iron and liberates carbon dioxide gas.

(d) Hydrogen sulphide gas reacts with oxygen gas to form solid sulphur and liquid water.

Ans. (a) $\text{Pb}(\text{COOCH}_3)_2\text{(aq)} + 2\text{HCl(dil.)} \longrightarrow \text{PbCl}_2\text{(s)} + 2\text{CH}_3\text{COOH(l)}$
Double displacement reaction

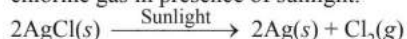
(b) $2\text{Na(s)} + 2\text{C}_2\text{H}_5\text{OH(l)} \longrightarrow 2\text{C}_2\text{H}_5\text{ONa(l)} + \text{H}_2\text{(g)}$
Displacement reaction

(c) $\text{Fe}_2\text{O}_3\text{(s)} + 3\text{CO(g)} \longrightarrow 2\text{Fe(s)} + 3\text{CO}_2\text{(g)}$
Redox reaction

(d) $2\text{H}_2\text{S(g)} + 3\text{O}_2\text{(g)} \longrightarrow 2\text{H}_2\text{O(l)} + 2\text{SO}_2\text{(g)}$
Redox reaction

29. Why do we store silver chloride in dark coloured bottles? [DoE]

Ans. It is because silver chloride decomposes to silver and chlorine gas in presence of sunlight.



30. Balance the following chemical equations and identify the type of chemical reaction.

(a) $\text{Mg(s)} + \text{Cl}_2\text{(g)} \longrightarrow \text{MgCl}_2\text{(s)}$

(b) $\text{HgO(s)} \xrightarrow{\text{Heat}} \text{Hg(l)} + \text{O}_2\text{(g)}$

(c) $\text{Na(s)} + \text{S(s)} \xrightarrow{\text{Fuse}} \text{Na}_2\text{S(s)}$

(d) $\text{TiCl}_4\text{(l)} + \text{Mg(s)} \longrightarrow \text{Ti(s)} + \text{MgCl}_2\text{(s)}$

(e) $\text{CaO(s)} + \text{SiO}_2\text{(s)} \longrightarrow \text{CaSiO}_3\text{(s)}$

(f) $\text{H}_2\text{O}_2\text{(l)} \xrightarrow{\text{U.V.}} \text{H}_2\text{O(l)} + \text{O}_2\text{(g)}$

Ans. (a) $\text{Mg(s)} + \text{Cl}_2\text{(g)} \longrightarrow \text{MgCl}_2\text{(s)}$
Combination reaction

(b) $2\text{HgO(s)} \longrightarrow 2\text{Hg(l)} + \text{O}_2\text{(g)}$
Decomposition reaction

(c) $2\text{Na(s)} + \text{S(s)} \xrightarrow{\text{Fuse}} \text{Na}_2\text{S(s)}$
Combination reaction

(d) $\text{TiCl}_4\text{(l)} + 2\text{Mg(s)} \longrightarrow \text{Ti(s)} + 2\text{MgCl}_2\text{(s)}$
Displacement reaction

(e) $\text{CaO(s)} + \text{SiO}_2\text{(s)} \longrightarrow \text{CaSiO}_3\text{(s)}$
Combination reaction

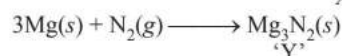
(f) $2\text{H}_2\text{O}_2\text{(l)} \xrightarrow{\text{U.V.}} 2\text{H}_2\text{O(l)} + \text{O}_2\text{(g)}$
Decomposition reaction

31. A magnesium ribbon is burnt in oxygen to give a white compound 'X' accompanied by emission of light. If the burning ribbon is now placed in an atmosphere of nitrogen, it continues to burn and forms a compound 'Y'.

(a) Write the chemical formulae of 'X' and 'Y'. [HOTS]

(b) Write a balanced chemical equation, when X is dissolved in water.

Ans. (a) $2\text{Mg(s)} + \text{O}_2\text{(g)} \xrightarrow{\text{Burning}} 2\text{MgO(s)} + \text{Light}$
'X'



(b) $\text{MgO(s)} + \text{H}_2\text{O(l)} \longrightarrow \text{Mg(OH)}_2\text{(aq)}$
Magnesium oxide Water Magnesium hydroxide
'X'

32. Zinc liberated hydrogen gas when reacted with dilute hydrochloric acid, whereas copper does not. Explain why?

Ans. $\text{Zn(s)} + 2\text{HCl(dil.)} \longrightarrow \text{ZnCl}_2\text{(aq)} + \text{H}_2\text{(g)}$
Zinc is more reactive than H_2 , therefore, displace H_2 from dil. HCl. Copper is less reactive than hydrogen, therefore, it does not liberate $\text{H}_2\text{(g)}$ from dilute acid.

33. A silver article generally turns black when kept in the open for a few days. The article when rubbed with toothpaste again starts shining.

(a) Why do silver articles turn black when kept in the open for a few days? Name the phenomenon involved.

(b) Name the black substance formed and give its chemical formula.

Ans. (a) Silver reacts with H_2S gas present in atmosphere to form a black compound Ag_2S (silver sulphide) on its surface. This phenomenon is called corrosion.

(b) Ag_2S (silver sulphide) is a black coloured solid.

34. On heating blue coloured powder of copper (II) nitrate in boiling tube, copper oxide (black), oxygen gas and a brown gas 'X' is formed.

(a) Write a balanced chemical equation of the reaction.

(b) Identify the brown gas 'X' evolved.

(c) Identify the type of reaction.

(d) What could be the pH range of aqueous solution of the gas 'X'?

Ans. (a) $2\text{Cu(NO}_3)_2\text{(s)} \xrightarrow{\text{heat}} 2\text{CuO(s)} + 4\text{NO}_2\text{(g)} + \text{O}_2\text{(g)}$
Copper(II) nitrate Copper oxide Nitrogen dioxide 'X'
(Blue) (Black) (Brown)

(b) The brown gas 'X' is nitrogen dioxide (NO_2).

(c) The reaction is a thermal decomposition reaction.

- (d) The gas 'X' is acidic in nature because it is a non-metallic oxide. Its aqueous solution has pH less than 7.

35. What happens when a piece of

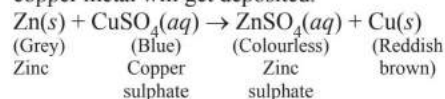
(a) zinc metal is added to copper sulphate solution? [CBSE 2020]

(b) aluminium metal is added to dilute hydrochloric acid?

(c) silver metal is added to copper sulphate solution?

Also, write the balanced chemical equation if the reaction occurs.

Ans. (a) The solution will become colourless due to formation of zinc sulphate and reddish brown copper metal will get deposited.



(b) Hydrogen gas and aluminium chloride solution will be formed.



(c) No reaction will take place because silver is less reactive than copper, it cannot displace copper from copper sulphate.