

## Chapter – 1 Chemical Reactions and Equations

### Multiple Choice Questions

**Q1. Which of the following is not a physical change?**

- a) Boiling of water to give water vapor
- b) Melting of ice to give water
- c) Dissolution of salt in water
- d) Combustion of Liquefied Petroleum Gas (LPG)

**Answer:** Option d)

Combustion of Liquefied Petroleum Gas (LPG) is a chemical change, as it is an irreversible reaction in which carbon dioxide and water vapor are formed and lot of heat is evolved.

**Q2. The following reaction is an example of a**

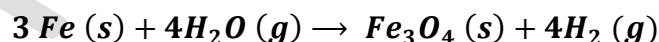


- 1. Displacement reaction
- 2. Combination reaction
- 3. Redox reaction
- 4. Neutralization reaction

**Answer:** Option d)

It is a redox reaction as oxidation and reduction both take place simultaneously. It is a displacement reaction because H of  $\text{NH}_3$  has been displaced by oxygen.

**Q3. Which of the following statements about the given reaction are correct?**



- 1. Iron metal is getting oxidized
- 2. Water is getting reduced
- 3. Water is acting as reducing agent
- 4. Water is acting as oxidizing agent

**Answer:** Option c)

$\text{Fe}$  is gaining oxygen to give  $\text{Fe}_3\text{O}_4$ .  $\text{H}_2\text{O}$  is losing oxygen to  $\text{H}_2$ . The substance which oxidizes the other substance in a chemical reaction is known as an oxidizing agent. So, water is acting as oxidizing agent.

**Q4. Which of the following are exothermic process?**

1. Reaction of water with quick lime
2. Dilution of an acid
3. Evaporation of water
4. Sublimation of camphor (crystals)

- a) 1 and 2
- b) 2 and 3
- c) 1 and 4
- d) 3 and 4

**Answer:** Option a)

When quick lime reacts with water, a large amount of heat is released along with the formation of calcium hydroxide. Similarly, the process of dissolving an acid or base in water is a highly exothermic reaction. Evaporation of water and sublimation of camphor are endothermic reactions.

**Q5. 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 statement (s) is(are) correct?**

1. In beakers A and B, exothermic process has occurred
2. In beakers A and B, endothermic process has occurred
3. In beakers C, exothermic process has occurred
4. In beaker C, endothermic process has occurred

- a) Only 1
- b) Only 2
- c) 1 and 4
- d) 2 and 3

**Answer:** Option c)

As in case of beakers A and B, heat is given out. So temperature became high, hence it is an exothermic reaction while in beaker C, heat is absorbed from water, so temperature falls, hence it is an endothermic process.

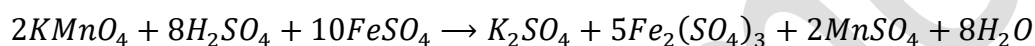
**Q6. A dilute ferrous sulphate solution was gradually added to the beaker containing acidified permanganate solution. The light purple color of the**

solution fades and finally disappears. Which of the following is the correct explanation for the observation?

- a)  $KMnO_4$  is an oxidizing agent, it oxidizes  $FeSO_4$ .
- b)  $FeSO_4$  acts as an oxidizing agent and oxidizes  $KMnO_4$ .
- c) The color disappears due to dilution, no reaction is involved
- d)  $KMnO_4$  is an unstable compound and decomposes in the presence of  $FeSO_4$  to a colorless compound?

**Answer:** Option a)

Potassium permanganate ( $KMnO_4$ ) in presence of diluted  $H_2SO_4$ , that is, in acidic medium acts as strong oxidizing agent. In acidic medium,  $KMnO_4$  oxidizes ferrous sulphate to ferric sulphate.



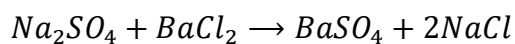
**Q7.** Which among the following is (are) double displacement reaction (s)?

- i)  $Pb + CuCl_2 \rightarrow PbCl_2 + Cu$
- ii)  $Na_2SO_4 + BaCl_2 \rightarrow 2NaCl$
- iii)  $C + O_2 \rightarrow CO_2$
- iv)  $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$

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

**Answer:** Option

In double displacement reaction, two compounds exchange their ions to form two new compounds. Only in reaction (ii), exchange of ions is taking place (cations and anions of both reactants are exchanged).



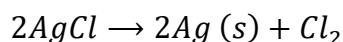
**Q8.** Which among the following statement (s) is / are true? Exposure of silver chloride to sunlight for a long duration turns grey due to

- i) The formation of silver by decomposition of silver chloride.
- ii) Sublimation of silver chloride
- iii) Decomposition of chloride gas from silver chloride
- iv) Oxidation of silver chloride

- a) Only i)
- b) i) and iii)
- c) ii) and iii)
- d) Only iv)

**Answer:** Option a)

Decomposition of silver chloride takes place in the presence of sunlight.



In this, white color of silver chloride changes greyish white due to the formation of silver metal.

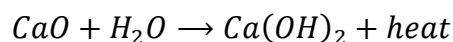
**Q9. Solid calcium oxide reacts vigorously with water to form calcium hydroxide accompanied by liberation of heat. This process is called slaking of lime. Calcium hydroxide dissolves in water to form its solution called lime water. Which among the following is (are) true about slaking of lime and the solution formed?**

- i) It is an endothermic reaction.
- ii) It is 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)

**Answer:** Option b)

It is an exothermic reaction as heat is evolved and the compound formed is  $Ca(OH)_2$  which is basic in nature so, the pH will be more than seven.



$Ca(OH)_2$  turns red litmus solution to blue. So, its pH value is greater than seven.

**Q10. 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?**

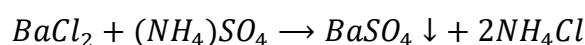
- i) Displacement reaction
- ii) Precipitation reaction

- iii) **Combination reaction**
- iv) **Double displacement reaction**

- a) **Only i)**
- b) **Only ii)**
- c) **Only iv)**
- d) **ii) and iv)**

**Answer:** Option d)

The reaction is a double displacement reaction as follows



It is also called precipitation reaction due to the formation of white precipitate of barium sulphate.

**Q11. Electrolysis of water is a decomposition reaction. The mole ratio of hydrogen and oxygen gases liberated during electrolysis of water is**

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

**Answer:** Option b)

The water decomposes during electrolysis to form hydrogen and oxygen gases in the ration 2:1 by volume.



**Q12. Which of the following is (are) an endothermic process(es)?**

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

- a) **Both (i) and (ii)**
- b) **Only (ii)**
- c) **Only (iii)**
- d) **Both (ii) and (iv)**

**Answer:** Option d)

Sublimation of dry ice and evaporation of water both are endothermic process and take heat (energy) from their surrounding and produce cooling. So dry ice is used as refrigerant. Dilution of sulphuric acid and condensation of water vapours evolve heat.

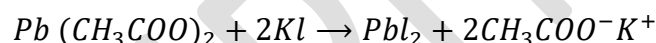
**Q13. In the double displacement reaction between aqueous potassium iodine and aqueous lead nitrate, a yellow precipitate of lead iodine is formed. While performing the activity if lead is not available, which of the following can be used in place of lead nitrate?**

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

**Answer:** Option b)

Lead acetate can be used in place of lead nitrate because like lead nitrate, it is also a soluble salt in water.

The reaction is –



Lead sulphate is insoluble in water, so not used.

**Q14. 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

**Answer:** Option d)

Helium and nitrogen both the gases provide inert atmosphere. When the packed food is surrounded by unreactive gas, there is no oxygen to cause its oxidation and make it rancid.

**Q15. The following reaction is used for the preparation of oxygen gas in the laboratory**



**Which of the following statements (s)/ 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

**Answer:** Option a)

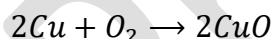
It is a decomposition reaction and endothermic in nature because decomposition of  $KClO_3$  requires heat for products formation.

**Q16. Which one of the following process 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 the presence of air at high temperature

**Answer:** Option d)

A chemical reaction is a change in which one or more substance or reactant react to form new substance with entirely different properties.



**Q17. In which of the following chemical equation, the abbreviations represent the correct states of the reactants and products involved at reaction temperature?**

- a)  $2H_2(l) + O_2(l) \rightarrow 2H_2O(g)$
- b)  $2H_2(l) + O_2(l) \rightarrow 2H_2O(l)$
- c)  $2H_2(g) + O_2(g) \rightarrow 2H_2O(l)$
- d)  $2H_2(g) + O_2(g) \rightarrow 2H_2O(g)$

**Answer:** Option c)

It is because the standard state for hydrogen and oxygen is gas and for water is liquid at reaction temperature.

**Q18. Which of the following are combination reactions?**

- i)  $2KClO_3 \rightarrow 2KCl + 3O_2$
- ii)  $MgO + H_2O \rightarrow Mg(OH)_2$
- iii)  $4Al + 3O_2 \rightarrow 2Al_2O_3$
- iv)  $Zn + FeSO_4 \rightarrow ZnSO_4 + Fe$

**Answer:** Option d)

A reaction in which reactants react together and form product, is called a combination reaction.

In reaction (ii)  $MgO$  and  $H_2O$  combine to form  $Mg(OH)_2$  and in reaction (iii)  $Al$  and  $O_2$  combine to form  $Al_2O_3$ .

### Short Answer Type Questions

**Q19.** Write the balanced chemical equations for the following reactions and identify the type of reaction in each case.

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

**Answer:**

- $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$  – example of combination reaction
- $NaOH(aq) + CH_3COOH(l) \rightarrow CH_3COONa(aq) + H_2O$  – example of neutralization reaction as well as double displacement reaction.
- $C_2H_5OH(l) + CH_3COOH(l) \rightarrow CH_3COOC_2H_5(l) + H_2O(l)$  – example of double displacement reaction.
- $2CH_3 - CH_3(g) + 7O_2 \rightarrow 4CO_2 + 6H_2O + Heat$  – example of combustion reaction.

**Q20.** Write the balanced chemical equations for the following reactions and identify the type of reaction in each case.

- Thermit reaction, iron (III) oxide reacts with aluminium and gives molten iron and aluminium oxide.



- 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.

**Answer:**

- a) Thermite reaction  $Fe_2O_3 (s) + 2Al (s) \rightarrow 2Fe (l) + Al_2O_3$   
This is an example of displacement reaction.
- b) Example of combination reaction -  $3Mg (s) + N_2 (g) \rightarrow Mg_3N_2 (s)$
- c) Example of displacement reaction -  $2KI (aq) + Cl_2 \rightarrow 2KCl (aq) + I_2 (s)$
- d) Combustion reaction -  $C_2H_5OH (l) + 3O_2 (g) \rightarrow 2CO_2(g) + 3H_2O + Heat$

**Q21. Complete the missing components/variables given as X and Y in the following.**

- a)  $Pb(NO_3)_2 (aq) + 2KI (aq) \rightarrow PbI_2(X) + 2KNO_3 (Y)$
- b)  $Cu (s) + 2AgNO_3 (aq) \rightarrow Cu(NO_3)_2(aq) + X (s)$
- c)  $Zn (s) + H_2SO_4 (aq) \rightarrow ZnSO_4(X) + H_2 (Y)$
- d)  $CaCO_3 (s) \rightarrow CaO (s) + CO_2 (g)$

**Answer:**

- a)  $Pb(NO_3)_2 (aq) + 2KI (aq) \rightarrow PbI_2(s) + 2KNO_3 (aq)$
- b)  $sCu (s) + 2AgNO_3 (aq) \rightarrow Cu(NO_3)_2 (aq) + 2Ag (s)$
- c)  $Zn (s) + H_2SO_4 (aq) \rightarrow ZnSO_4(aq) + H_2 (g)$
- d)  $CaCO_3 (s) \rightarrow CaO (s) + CO_2 (g)$

**Q22. Which among the following changes are exothermic or endothermic in nature?**

- a) Decomposition of ferrous sulphate
- b) Dilution of sulphuric acid
- c) Dissolution of sodium in water
- d) Dissolution of ammonium chloride in water

**Answer:**

- a) Decomposition of ferrous sulphate is an endothermic reaction because heat is absorbed during the reaction.
- b) The process of dissolving sulphuric acid in water is a highly exothermic reaction.

- c) The process of dissolving sodium hydroxide in water is again a highly exothermic reaction.
- d) Dissolution of ammonium chloride in water is an endothermic reaction as heat is absorbed during the reaction.

**Q23. Identify the reducing agent in the following reactions.**

- a)  $4NH_3 + 5O_2 \rightarrow 4NO + 6H_2O$
- b)  $H_2O + F_2 \rightarrow HF + HOF$
- c)  $Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$
- d)  $2H_2 + O_2 \rightarrow 2H_2O$

**Answer:**

- a)  $NH_3$  is the reducing agent because it gives hydrogen and itself gets oxidised to  $NO$ .  $O_2$  has been reduced to  $H_2O$ .
- b)  $H_2O$  is the reducing agent because of the addition of electronegative  $F$  to get oxidized to  $HOF$ . It reduces  $F_2$  to  $HF$ .
- c)  $Fe_2O_3$  has been reduced to  $Fe$ . Also,  $CO$  has been oxidized to  $CO_2$  and hence,  $CO$  is a reducing agent.
- d)  $H_2$  is the reducing agent which itself gets oxidized to  $H_2O$ .  $O_2$  has been reduced to  $H_2O$ .

**Q24. Identify the oxidising agent (oxidant) in the following reactions.**

- a)  $Pb_3O_4 + 8HCl \rightarrow 3PbCl_2 + Cl_2 + 4H_2O$
- b)  $2Mg + O_2 \rightarrow 2MgO$
- c)  $CuSO_4 + Zn \rightarrow Cu + ZnSO_4$
- d)  $V_2O_5 + 5Ca \rightarrow 2V + 5CaO$
- e)  $3Fe + 4H_2O \rightarrow Fe_3O_4 + 4H_2$
- f)  $CuO + H_2 \rightarrow Cu + H_2O$

**Answer:**

- a)  $HCl$  has been oxidized to  $Cl_2$  and  $Pb_3O_4$  has been reduced to  $PbCl_2$ . Hence,  $Pb_3O_4$  is the oxidising agent. (oxidant).
- b)  $Mg$  has been oxidised to  $MgO$ . Hence,  $O_2$  is the oxidant.
- c)  $Cu^{2+} + Zn \rightarrow Cu + Zn^{2+}$ . Here  $Cu^{2+}$  has gained two electrons to form  $Cu$ . Hence,  $Cu^{2+}$  has been reduced to  $Cu$ , but  $Zn$  has donated two electrons to form  $Zn^{2+}$  has been oxidized to  $Zn^{2+}$ . Thus,  $CuSO_4$  is the oxidising agent.
- d)  $Ca$  has been oxidised to  $CaO$ , whereas  $V_2O_5$  has been reduced to  $V$ . Hence,  $V_2O_5$  is the oxidant.
- e)  $Fe$  has been oxidised to  $Fe_3O_4$  whereas  $H_2O$  has been reduced to  $H_2$ . Hence,  $H_2O$  is the oxidant.

- f)  $CuO$  has been reduced to  $Cu$  whereas  $H_2$  has been oxidised to  $H_2O$ . Hence,  $CuO$  is the oxidant.

**Q25. Write the balanced chemical equations for the following reactions.**

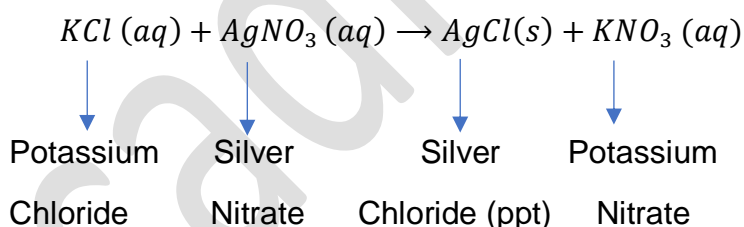
- Sodium carbonate on reaction with hydrochloric acid in equal molar concentrations gives sodium chloride and sodium hydrogen carbonate.
- Sodium hydrogen carbonate in reaction with hydrochloric acid gives sodium chloride, water liberates carbon dioxide.
- Copper sulphate on treatment with potassium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

**Answer:**

- $Na_2CO_3 (s) + HCl (aq) \rightarrow NaCl (aq) + NaHCO_3$
- $NaHCO_3 + HCl (aq) \rightarrow NaCl + H_2O + CO_2$
- $2CuSO_4 + 4KI \rightarrow Cu_2I_2 + I_2 + 2K_2SO_4$

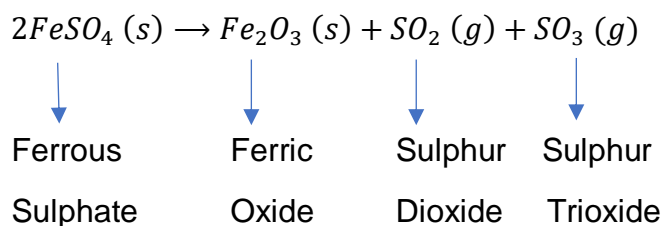
**Q26. A solution of potassium chloride when mixed with silver nitrate solution, an insoluble white substance is formed. Write the chemical reaction involved and also mention the type of the chemical reactions.**

**Answer:**



**Q27. Ferrous sulphate decomposes with the evolution of a gas having a characteristic odour of burning sulphur. Write the chemical reaction involved and identify the type of reaction.**

**Answer:**



**Q28. Why do fire flies' glow at night?**

**Answer:**

Fire flies have a substance called luciferin that undergoes oxidation by atmospheric oxygen in the presence of luciferase and there is emission of light. So, fire flies' glow at night.

**Q29. 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?**

**Answer:**

When grapes are on the plant, aerobic respiration takes place in the cells as the oxygen reaches there. But when plucked, no oxygen reached the cell, so fermentation starts in the absence of oxygen. Fermentation is a chemical change in which sugar is converted to alcohol.

**Q30. Which among the following are physical or chemical changes?**

- a) Evaporation of petrol
- b) Burning of Liquefied Petroleum Gas (LPG)
- c) Heating of an iron rod to red hot
- d) Curdling of milk
- e) Sublimation of solid ammonium chloride

**Answer:**

- a) Evaporation of petrol is a physical change since no new chemical substance is formed.
- b) Burning of LPG is a chemical change since on burning, LPG forms  $CO_2$  and  $H_2O$ .
- c) Heating of an iron rod is a physical change
- d) Curdling of milk is a chemical change since in the conversion of milk to curd, new chemical substances are formed.
- e) Sublimation of solid ammonium chloride is a physical change since  $NH_4Cl$  vapor and no new chemical substance is formed.

**Q31. During the reaction of some metals with dilute hydrochloric acid, following observations were made.**

- a) Silver metal does not show any change
- b) The temperature of the reaction mixture rises when aluminium (Al) is added.

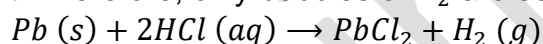
- c) The reaction of sodium metal is found to be highly explosive  
d) Some bubbles of a gas are seen when lead (Pb) is reacted with the acid.  
Explain these observations giving suitable reasons.

**Answer:**

- a) Silver metal does not show any change because the silver is below hydrogen in the reactivity series, so cannot displace hydrogen when reacted with acid.  
b) The reaction of *Al* with dilute *HCl* is exothermic, that is, heat is produced in the reaction, hence the temperature of the reaction mixture rises.



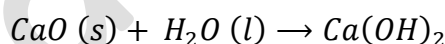
- c) Sodium is a very reactive metal. It reacts explosively with hydrochloric acid to form sodium chloride and hydrogen with the evolution of heat too.  $H_2$  gas produced catches fire immediately.  
d) Lead is present just above the hydrogen in the activity series of metals. Hence, it is slightly more reactive and displace hydrogen from acid very slowly and to a small extent. Therefore, only bubbles of  $H_2$  are seen evolve.



**Q32.** 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.

**Answer:**

X is calcium oxide (*CaO*), also called quick lime. It reacts with water to form calcium hydroxide which is a basic compound.



Calcium	Water	Calcium hydroxide
Oxide		(slaked lime)

↓  
Red litmus  
↓  
Blue

**Q33.** 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 gas 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.

**Answer:**

- a)  $Pb(CH_3COO)_2(aq) + 2HCl(dil) \rightarrow PbCl_2(s) \downarrow + 2CH_3COOH(aq)$  – this is a double displacement; it is a precipitation reaction.
- b)  $2C_2H_5OH(l) + 2Na(s) \rightarrow 2C_2H_5O^-Na^+ + H_2 \uparrow$  - this is displacement reaction.
- c)  $Fe_2O_3(s) + 3CO(g) \rightarrow 2Fe(s) + 3CO_2(g) \uparrow$  - this is a redox reaction.
- d)  $2H_2S + O_2(g) \rightarrow 2S(s) + 2H_2O(l)$  – this is a redox reaction.

**Q34. Why do we store silver chloride in dark coloured bottles?**

**Answer:**

Dark coloured bottles stops the path of light so it cannot reach silver chloride in the bottles and its decomposition is prevented, as silver chloride decomposes to silver and chlorine in the presence of light.



So, it is stored in dark coloured bottles.

**Q35. Balance the following chemical equation and identify the type of chemical reaction.**

- a)  $Mg(s) + Cl_2(g) \rightarrow MgCl_2(s)$
- b)  $HgO(s) \rightarrow Hg(l) + O_2(g)$
- c)  $Na(s) + S(s) \rightarrow Na_2S(s)$
- d)  $TiCl_4(l) + Mg(s) \rightarrow Ti(s) + MgCl_2(s)$
- e)  $CaO(s) + SiO_2(s) \rightarrow CaSiO_3(s)$
- f)  $H_2O_2(l) \rightarrow H_2O(l) + O_2(g)$

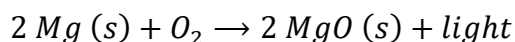
**Answer:**

- a)  $Mg(s) + Cl_2(g) \rightarrow MgCl_2$  – Combination reaction
- b)  $2HgO(s) \rightarrow 2Hg(l) + O_2(g)$  – thermal decomposition reaction
- c)  $2Na(s) + S(s) \rightarrow Na_2S(s)$  – Combination reaction
- d)  $TiCl_4(l) + 2Mg(s) \rightarrow Ti(s) + 2MgCl_2$  – Displacement reaction
- e)  $CaO(s) + SiO_2(s) \rightarrow CaSiO_3(s)$  Combination reaction
- f)  $2H_2O_2(l) \rightarrow 2H_2O(l) + O_2(g)$  – Photodecomposition reaction

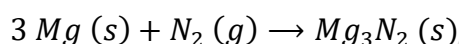
**Q36.** A magnesium ribbon is burnt in oxygen to give a white compound X accompanied by emission by light. If the burning is now placed in an atmosphere of nitrogen, it continues to burn and forms a compound Y.

- Write the chemical formulae of X and Y.
- Write a balanced chemical equation, when X is dissolved in water.

**Answer:**



Magnesium                      Magnesium oxide (X)



Magnesium                      Magnesium nitride (Y)

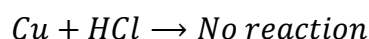
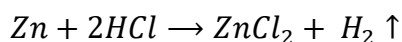
a) The chemical formulae of  $X = \text{MgO}$ ;  $Y = \text{Mg}_3\text{N}_2$

b)  $\text{MgO} + \text{H}_2\text{O} \rightarrow \text{Mg}(\text{OH})_2$   
Magnesium  
Hydroxide

**Q37.** Zinc liberates hydrogen gas when reacted with dilute hydrochloric acid whereas copper does not. Explain, why?

**Answer:**

The position of zinc reactivity series is above hydrogen whereas that of copper is below hydrogen. It means Zn oxidizes more easily than hydrogen whereas copper does not do so. So, copper does not displace  $\text{H}_2$  from dilute acids. The reaction is

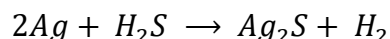


**Q38.** A silver article generally turns black when kept in the open for a few days. The article when rubbed with toothpaste again starts shining.

- Why do silver articles turn black when kept in the open for a few days? Name the phenomenon involved.
- Name the black substance formed and give its chemical formula.

**Answer:**

- a) Silver article turns black when kept in the air because silver article reacts with sulphur compounds such as hydrogen sulphide ( $H_2S$ ) present in air. The phenomenon is called corrosion. For particularly silver, it is called tarnishing of silver.
- b) The black substance formed is silver sulphide ( $Ag_2S$ ).



### Long Answer Type Questions

**Q39.** On heating blue coloured powder of copper (II) nitrate in a boiling tube, copper oxide (black), oxygen gas and 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?

**Answer:**

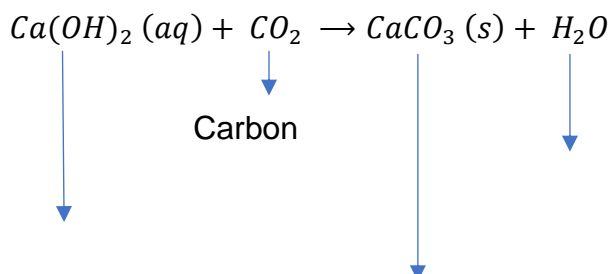
- a)  $2Cu(NO_3)_2 \xrightarrow{Heat} 2CuO + O_2 + 4NO_2$   
b) X is the nitrogen dioxide gas ( $NO_2$ ).  
c) This is a thermal decomposition reaction.  
d) The aqueous solution of the gas is acidic because it is an oxide of a non-metal, so its pH range would be in between 1 to 7.

**Q40.** Give the characteristic tests for the following gases.

- a)  $CO_2$   
b)  $SO_2$   
c)  $O_2$   
d)  $H_2$

**Answer:**

- a)  $CO_2$  gas (lime water test) – when  $CO_2$  gas is passes through lime water; it turns milky due to the formation of insoluble calcium carbonate.





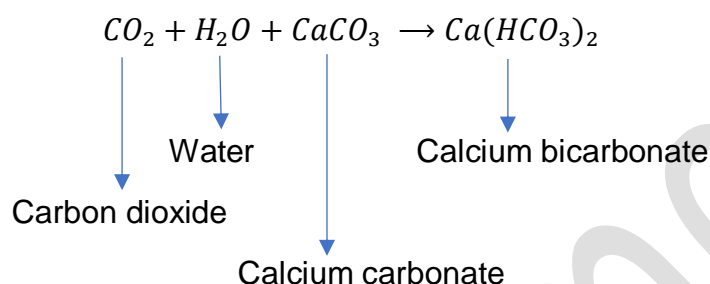
Dioxide

Water

Lime water

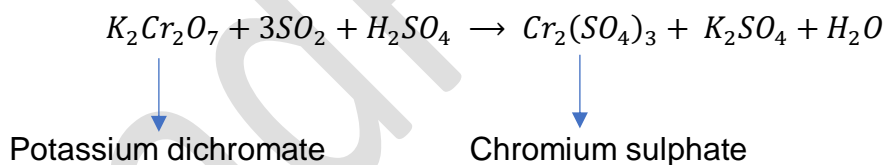
Calcium carbonate

If the gas is in excess, milkiness disappears due to the formation of soluble calcium bicarbonate.

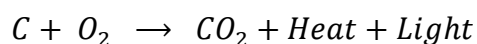


b)  $SO_2$  gas testing –

- i) sulphur dioxide gas turns moist litmus paper from blue to red because  $SO_2$  is acidic in nature.
- ii) Sulphur dioxide gas turns acidified potassium dichromate solution from orange to green.



c)  $O_2$  gas testing – when a wooden splinter is brought near the mouth of the gas jar containing oxygen gas. It burns brightly as oxygen is the supporter of combustion.



d)  $H_2$  gas testing – Hydrogen gas burns in the presence of air or oxygen with a pop sound when a burning candle is brought near it.

**Q41. What happens when a piece of**

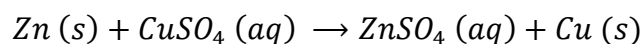
- a) Zinc metal is added to copper sulphate solution?
- b) Aluminium metal is added to dilute hydrochloric acid?
- c) Silver metal is added to copper sulphate solution?

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

**Answer:**

- a) Blue colour of  $CuSO_4$  solution disappears.

Since, zinc reacts with copper sulphate to form colourless zinc sulphate solution and solid copper is deposited from as  $Zn$  is more reactive than  $Cu$ . So, displaces  $Cu$  from  $CuSO_4$  solution,



- b) Hydrogen gas is evolved

Since, aluminium reacts with dilute hydrochloric acid to form aluminium chloride and hydrogen gas.



- c) No reaction occurs

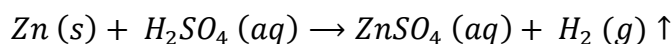
Since, silver metal is less reactive than copper, therefore, it cannot displace copper from copper sulphate solution.



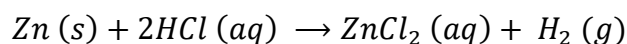
**Q42. What happens when zinc granules are treated with dilute solution of  $H_2SO_4$ ,  $HCl$ ,  $HNO_3$ ,  $NaCl$  and  $NaOH$  also write the chemical equations, if reaction occurs?**

**Answer:**

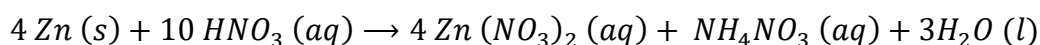
- i) Dilute  $H_2SO_4$  –



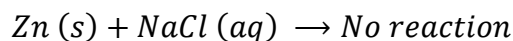
- ii) Dilute  $HCl$  –



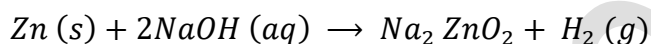
- iii) Dilute  $HNO_3$  – dilute  $HNO_3$  is an oxidising acid therefore, its reaction with a metal is different than other dilute acids.



iv) *NaCl* Solution – reaction does not take place



v) *NaOH* solution –



The hydrogen gas is evolved with  $\text{H}_2\text{SO}_4$ ,  $\text{HCl}$ ,  $\text{NaOH}$ , nitrous oxide gas is evolved with dilute  $\text{HNO}_3$  and no reaction takes place with  $\text{NaCl}$  solution.

**Q43. On adding a drop of barium solution to an aqueous solution of sodium sulphite, white precipitate is obtained.**

- Write a balanced chemical equation of the reaction involved.
- What other name can be given to this precipitation reaction?
- On adding dilute hydrochloric acid to the reaction mixture, white precipitate disappears, why?

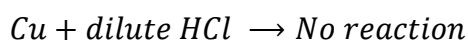
**Answer:**

- $\text{Na}_2\text{SO}_3 \text{ (aq)} + \text{BaCl}_2 \text{ (aq)} \rightarrow \text{BaSO}_3 + 2\text{NaCl (aq)}$
- Double displacement reaction
- $\text{BaSO}_3 \text{ (s)} + 2\text{HCl (aq)} \rightarrow \text{BaCl}_2 \text{ (aq)} + \text{H}_2\text{O (l)} + \text{SO}_2 \text{ (g)}$

**Q44. You are provided with two containers made up of copper and aluminium. You are also provided with solutions of dilute  $\text{HCl}$ , dilute  $\text{HNO}_3$ ,  $\text{ZnCl}_2$  and  $\text{H}_2\text{O}$ . In which of the containers these solutions can be kept?**

**Answer:**

- The container made up of copper or aluminium is suitable for storing the given solutions.
  - Dilute  $\text{HCl}$



So, it can be stored in *Cu* container.

- Dilute  $\text{HNO}_3$

Dilute  $HNO_3$  reacts with copper, so it cannot be stored in copper container.



c)  $ZnCl_2$

Copper is less reactive than zinc so, it does not react with  $ZnCl_2$  solution. It can be stored in copper container.

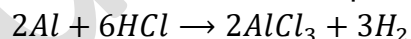
d)  $H_2O$

Copper does not react with water. Hence, its container can store  $H_2O$  in it. Thus, diluted  $HCl$ ,  $ZnCl_2$  solution and  $H_2O$  can be kept in copper vessel but diluted  $HNO_3$  cannot be kept in copper vessel.

ii) Reactions of aluminium with

a) Dilute  $HCl$

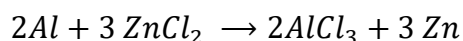
$Al$  reacts with dilute  $HCl$ , so it cannot to be kept in aluminium container.



b) Dilute  $HNO_3$

When dil.  $HNO_3$  is kept in  $Al$  container it forms a protective layer of aluminium oxide on it which makes it passive towards action with acid, so, it can be kept in  $Al$  container.

c)  $ZnCl_2$



d)  $H_2O$

*Al* does not react with  $H_2O$ . Hence, its container can store  $H_2O$  in it. Thus, diluted  $HNO_3$  and  $H_2O (l)$  can be kept in aluminium vessel but diluted  $HCl$  and  $ZnCl_2$  solution cannot be kept in aluminium vessel.

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