CHAPTER-1

Chemical Reactions & Equations

NOTES:

* Whenever a chemical change occurs, chemical reaction takes place.

* The following observations helps us to determine whether a chemical reaction has taken place -

i) Change in state
ii) Change in colour
iii) Evolution of a gas
iv) Change in temperature.

ACTIVITY

★ Activity 1.1 :

* Clean a magnesium ribbon by rubbing it with sand paper.

* Hold it with a pair of tongs

* Burn it using a burner and collect the ash so formed in a watch glass.

* Observation: The magnesium ribbon burns with a dazzling white flame and changes into white powder(magnesium oxide).

* Magnesium oxide is formed due to reaction between magnesium & oxygen present in air.

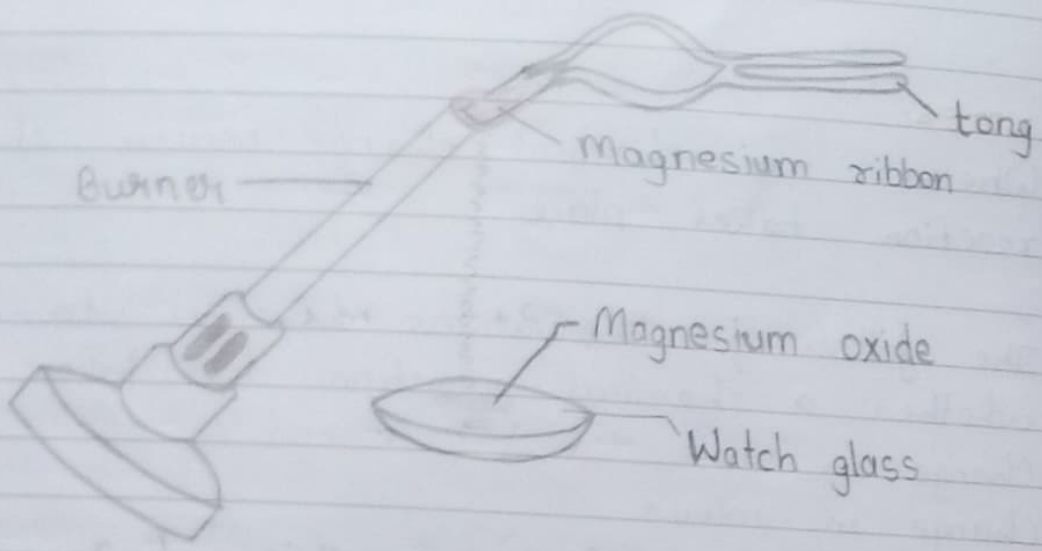

Fig: Burning of magnesium oxide

★ Activity 1.2:

* Take lead nitrate solution in a test tube

* Now put potassium iodine solution to this.

* Observation: Lead nitrate solution colour changes from colourless to yellow

Activity 1.3:

* Take a few zinc granules in a ~~conif~~ conical flask or test tube.

* Add dilute hydrochloric acid (HCl) or sulphuric (H_2SO_4) acid to it

* Observation: → Bubbles are formed around zinc granules

→ Temperature of flask also rises.

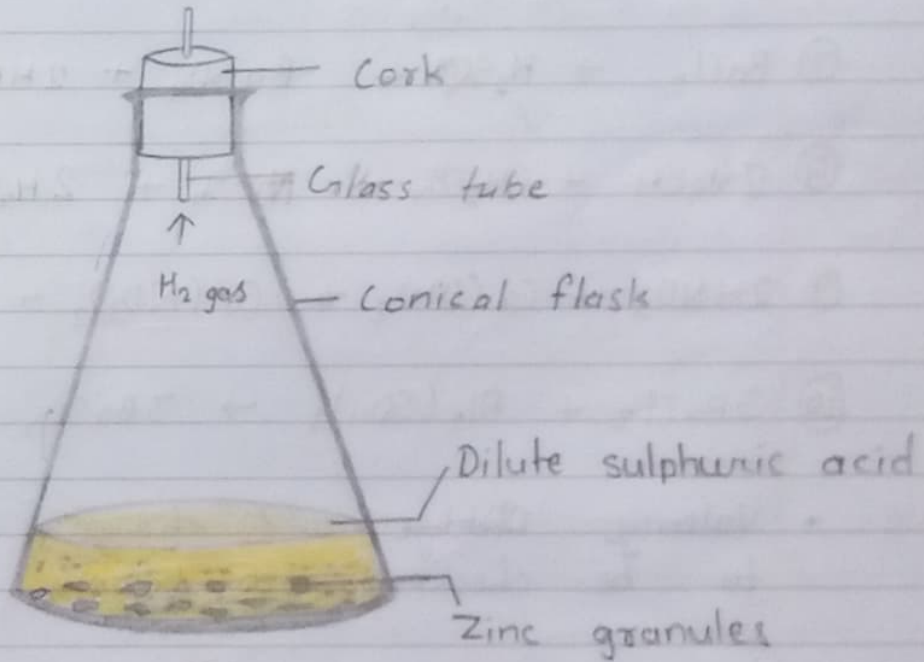

Fig: Formation of H_2 gas by the action of dilute H_2SO_4 on zinc

Q Why we rubbed magnesium ribbon in Activity 1?

Ans We did so to remove dust & oxygen layer, which prevents proper & complete burning.

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BALANCED CHEMICAL EQUATIONS:

① $3Fe + 4H_2O \rightarrow Fe_3O_4 + 4H_2$

② $2Mg + O_2 \rightarrow 2MgO$

③ $2Na + O_2 \rightarrow 2NaO$

④ $2Cu + O_2 \rightarrow 2CuO$

⑤ $2PbO + C \rightarrow 2Pb + CO_2$

⑥ $Fe_2O_3 + 2Al \rightarrow Al_2O_3 + 2Fe$

⑦ $BaCl_2 + H_2SO_4 \rightarrow BaSO_4 + 2HCl$

⑧ $2NaOH + H_2SO_4 \rightarrow Na_2SO_4 + 2H_2O$

⑨ $2HNO_3 + Ca(OH)_2 \rightarrow Ca(NO_3)_2 + 2H_2O$

⑩ $3BaCl_2 + Al_2(SO_4)_3 \rightarrow 3BaSO_4 + 2AlCl_3$

* Valency ~~charge~~ and charges are needed to be checked to balance an equation.

TYPES OF CHEMICAL REACTIONS:

i) Combination Reaction:

* Reactant + Substrate → Product

* One reactant combines with one substrate to form only ~~only~~ one product.

* Example – i) $CaO + H_2O \rightarrow Ca(OH)_2$

ii) $2HgCl_2 + Cl \rightarrow 2HgCl_2$

iii)

CW:

① $H_2 + N_2 \rightarrow 2NH_3$

⇒ $H_2 + N_2 \rightarrow 2NH_3$

⇒ $3H_2 + N_2 \rightarrow 2NH_3$

② $Na + O_2 \rightarrow ?$

⇒ $Na + O_2 \rightarrow NaO$

⇒ $Na + O_2 \rightarrow 2NaO$

⇒ $2Na + O_2 \rightarrow 2NaO$

③ $Cu + O_2 \rightarrow CuO$

⇒ $Cu + O_2 \rightarrow 2CuO$

⇒ $2Cu + O_2 \rightarrow 2CuO$

ii) Decomposition

- In this, the substance is decomposed.
- This is ~~jus~~ opposite of combination reaction

C.W.

- Example:- ① $HCl \rightarrow$

$\Rightarrow HCl \rightarrow H + Cl_2$

$\Rightarrow 2HCl \rightarrow H + Cl_2$

$\Rightarrow 2HCl \rightarrow 2H + Cl_2$

② $AgCl \rightarrow Ag + Cl_2$

$\Rightarrow 2AgCl \rightarrow Ag + Cl_2$

$\Rightarrow 2AgCl \rightarrow 2Ag + Cl_2$

Questions (Pg. 6):

1. Why Mg ribbon is cleaned before burning in air?

Ans → Magnesium ribbon is exposed to air, it forms a layer of magnesium oxide on its surface.

- Being a stable compound, it prevent further reaction of magnesium with oxygen. Hence, it should be cleaned before burning in air to remove oxide layer.

2. ~~Convert~~ Write balanced chemical equation of the following:

i) Hydrogen + Chlorine → Hydrogen Chloride

⇒ $H_2 + Cl_2 \rightarrow 2HCl$

ii) Barium chloride + Aluminium sulphate → Barium sulphate + Aluminium chloride

⇒ $3BaCl_2 + Al_2(SO_4)_3 \rightarrow 3BaSO_4 + 2AlCl_3$

iii) Sodium + Water → Sodium hydroxide + Hydrogen

⇒ $2Na + 2H_2O \rightarrow 2NaOH + H_2$

3. Write a balanced chemical equation with states of symbol:

i) Solutions of barium chloride and sodium sulphate in water react ~~with~~ to give insoluble barium sulphate and also the solution of sodium

chloride.

⇒ $BaCl_{2(aq)} + Na_2SO_{4(aq)} \rightarrow BaSO_{4(s)} + 2NaCl_{(aq)}$

ii) Sodium hydroxide solution (in water) reacts with hydrochloric acid solution (in water) to produce sodium chloride solution and water.

⇒ $NaOH + HCl \rightarrow NaCl + H_2O_{(l)}$

Questions (Pg. 10):

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

i) Name the substance 'X' and write its formula.

Ans ⇒ 'X' is lime or quick lime & the molecular formula is CaO.

ii) Write the reaction of substance 'X', named in (i) above, with water.

Ans ⇒ $CaO + H_2O \rightarrow Ca(OH)_2 + heat$

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

Ans ⇒ Water contains 2 part of hydrogen and 1 part of oxygen. ∴ during electrolysis of water amount of hydrogen gas collected in one test tube is double than that of oxygen

collected in other test tube

Questions (Pg. 13)

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

Ans. • Iron is more reactive than copper, so when iron nail is dipped in copper sulphate solution, iron displaced copper from its solution to form iron sulphate which is green in colour

• $Fe_{(s)}$ (nail) + $CuSO_{4(aq)}$ → $FeSO_{4(aq)}$ (green) + $Cu_{(s)}$

• The blue colour of copper sulphate solution changes into green, because of displacement reaction, which shows redoxomechanism

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

Ans. • Sodium carbonate and calcium chloride exchange ions to form two new products, i.e. calcium carbonate and sodium chloride.

• $Na_2CO_{3(aq)}$ + $CaCl_{2(aq)}$ → $CaCO_{3(s)}$ + $2NaCl_{(aq)}$

3. Identify the substance that are oxidized & the substance that are reduced in the following reactions

i) $4Na(s) + O_2(g) \rightarrow 2Na_2O(s)$

Ans: Sodium is oxidised to (Na_2O) and oxygen is getting reduced to O^{2-}

ii) $CuO(s) + H_2(g) \rightarrow Cu(s) + H_2O(l)$

Ans: Copper oxide is reduced to copper (Cu), while H_2 is oxidized to H_2O.

EXERCISES: ~~OR EXTRA~~ QUESTIONS:

1. (a) and (b) are incorrect reactions, because lead and CO_2 are products and not reactants.

2. The correct answer is (d)
Aluminium is displacing iron from Fe(III) oxide, ∴ it is displacement and redox reaction.

~~(a) and (b) are~~

3. • (a) Hydrogen gas & iron chloride are produced.
• $Fe_{(s)} + 2HCl_{(dil)} \rightarrow FeCl_{2(aq)} + H_{2(g)}$
• H_2 gas and Fe III chloride are produced

4. Balanced chemical equation means total no. of atom of each element should be equal on both sides of ~~the~~ reaction equation.

• For example: combination reaction of Mg and O. – $2Mg_{(s)} + O_{2(g)} \rightarrow 2MgO$

• "Mass can never be created nor be destroyed."

• The total mass of reactant should be equal to

the total mass of product. This law is called the law of conservation of mass

5. a) Hydrogen gas combines with Nitrogen to form ammonia

=> $3H_2 + N_2 \rightarrow \underset{(g)}{2NH_3}$

b) Hydrogen sulphide gas burns in air to give water & sulphur dioxide

=> $2H_2S + 3O_2 \rightarrow \underset{(l)}{2H_2O} + \underset{(g)}{2SO_2}$

c) Barium chloride reacts with aluminium sulphate to give aluminium chloride and a ppt of barium sulphate

=> $\underset{(aq)}{3BaCl_2} + \underset{(aq)}{Al_2(SO_4)_3} \rightarrow \underset{(s)}{3BaSO_4} + \underset{(l)}{2AlCl_3}$

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

=> $\underset{(s)}{2K} + 2H_2O \rightarrow \underset{(aq)}{2KOH} + \underset{(g)}{H_2}$

6. a) $HNO_3 + Ca(OH)_2 \rightarrow Ca(NO_3)_2 + H_2O$

=> $2HNO_3 + Ca(OH)_2 \rightarrow Ca(NO_3)_2 + 2H_2O$

b) $NaOH + H_2SO_4 \rightarrow Na_2SO_4 + H_2O$

=> $NaOH + H_2SO_4 \rightarrow NaSO_4 + 2H_2O$

c) $NaCl + AgNO_3 \rightarrow AgCl + NaNO_3$

=> $NaCl + AgNO_3 \rightarrow AgCl + NaNO_3$

d) $BaCl_2 + H_2SO_4 \rightarrow BaSO_4 + HCl$.
⇒ $BaCl_2 + H_2SO_4 \rightarrow BaSO_4 + 2HCl$

7. a) ~~Write the balanced chem~~ $CaOH + CO_2 \rightarrow CaCO_3 + H_2O$
⇒ $Ca(OH)_2 + CO_2 \rightarrow CaCO_3 + H_2O$

b) Zinc + Silver nitrate → Zinc Nitrate + Silver
⇒ $Zn + 2AgNO_3 \rightarrow Zn(NO_3)_2 + 2Ag$

c) Aluminium + Copper chloride → Aluminium chloride + Copper
⇒ $2Al + 3CuCl_2 \rightarrow 2AlCl_3 + 3Cu$

d) Barium chloride + Potassium sulphate → Barium sulphate + Potassium chloride
⇒ $BaCl_2 + K_2SO_4 \rightarrow BaSO_4 + 2KCl$

8. a) ~~Barium~~ Potassium bromide (aq) + Barium iodine(aq) →
Potassium iodine(aq) + Barium bromide (s).
⇒ $2KBr + BaI_2 \rightarrow 2KI + BaBr_2$
Double displacement reaction

b) Zinc carbonate(s) → Zinc oxide(s) + Carbon dioxide (g)
⇒ $ZnCO_3 \rightarrow ZnO + CO_2$
Decomposition reaction

c) Hydrogen (g) + Chlorine (g) → Hydrogen chloride (g)
⇒ $H_2 + Cl_2 \rightarrow 2HCl$
Combination reaction and Redox reaction

d) Magnesium (s) + Hydrochloric acid (aq) → Magnesium chloride (aq) + Hydrogen (g)

⇒ $Mg + 2HCl \rightarrow MgCl_2 + H_2$
Displacement and redox reaction.

9. • Exothermic are those reactions in which heat is evolved.

• Example: i) $\underset{(S)}{C} + \underset{(g)}{O_2} \rightarrow \underset{(g)}{CO_2}$ + heat

~~ii) $N_2 + O_2 \rightarrow 2NO$~~
~~(g) (g) (g)~~

ii) $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$ + heat

• Endothermic are those reactions in which heat is absorbed.

• Example: i) $CaCO_3 \xrightarrow{heat} CaO + CO_2$

ii) $N_2 + O_2 \xrightarrow{heat} 2NO$

10. • During respiration glucose combines with oxygen in the cell of our body and provide energy.

• As energy is ~~real~~ released during respiration, ∴ respiration regarded as exothermic reaction.

• $\underset{\text{glucose}}{C_6H_{12}O_6} + CO_2 \rightarrow 6CO_2 + 6H_2O$ + Energy

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

Ans ⇒ ★ Decomposition reaction:

- In this a compound is broken down into simpler compounds or elements.
- Example:- $\underset{(s)}{CuCO_3} \xrightarrow{heat} \underset{(s)}{CuO} + \underset{(g)}{CO_2}$

★ Combination reaction.

- In this reaction two or more elements or compounds combine to form new compounds.
- Example: $\underset{(g)}{N_2} + \underset{(g)}{3H_2} \rightarrow \underset{(g)}{2NH_3}$

- In this manner decomposition and combination reactions are opposite of each other.

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

Ans ⇒
- $CaCO_3 \xrightarrow{heat} \underset{(s)}{CaO} + \underset{(g)}{CO_2}$
- $\underset{(s)}{2AgCl} \xrightarrow{sunlight} \underset{(s)}{2Ag} + \underset{(g)}{Cl_2}$
- $\underset{(l)}{2H_2O} \xrightarrow{electricity} \underset{(g)}{2H_2} + \underset{(g)}{O_2}$

13. Difference between:

★ Displacement reaction ~~Double displacement~~

- Those reactions in which more reactive metal displaces less reactive metal from its salt solution are called displacement reaction.
- Example: $Fe + CuSO_4 \rightarrow FeSO_4 + Cu$

★ Double displacement reaction

- Those reactions in which 2 compounds exchange their ions to form 2 new compounds are called double displacement reaction.
- It is redox reaction.
- Ex: $HCl + NaOH \rightarrow NaCl + H_2O$

14. $Cu + 2AgNO_3 \rightarrow Cu(NO_3)_2 + 2Ag$

15. - Those reaction in which two components react to form insoluble compound, which is called precipitate are precipitation reaction

- White precipitate of silver chloride will formed
$AgNO_3 + NaCl \rightarrow AgCl + NaNO_3$

- On adding dilute HCl to aqous solution of lead nitrate, forms precipitate of lead chloride
$Pb(NO_3)_2 + 2HCl \rightarrow PbCl_2 + 2HNO_3$

16. a) Oxidation:
It is process in which gain of oxygen takes place.

Example – i) $2Mg + O_2 \xrightarrow{\text{burning}} 2MgO$

ii) $2Cu + O_2 \xrightarrow{\text{heating}} 2CuO$

b) Reduction
It is process in which removal of oxygen takes place.

Example – i) $CuO + H_2 \xrightarrow{\text{heat}} Cu + H_2O$

ii) $Fe_2O_3 + 2Al \longrightarrow Al_2O_3 + 2Fe$

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.

Ans → • 'X' is Copper.

- Copper gets oxidised to copper oxide which

is black in colour.

$$\underset{\text{(Reddish Brown)}}{2Cu} + O_2 \xrightarrow{\Delta} \underset{\text{(Black)}}{2CuO}$$

Extra Questions :

Q.1 Case Study: A zinc plate was put into a solution of copper sulphate kept in glass container. It was found that blue colour of solution gets fader as time passes. After few days zinc plate was taken out of solution. A no. holes were observed on it.

(I) State the reason for change ~~in~~ observed on zinc plate.

Ans → • A no. of holes were observed, as zinc has displaced copper from $CuSO_4$ solution.

• Zinc metal has been used to form zinc sulphate.

(2) Write a baloced chemical equation involved in it.

Ans → • $Zn + \underset{\text{(Blue)}}{CuSO_4} \rightarrow \underset{\text{(colourless)}}{ZnSO_4} + Cu$

Q.① Which type of reaction it shows?

Ans→ Displacement reaction in which ~~zinc~~ Zn ~~displaces~~ displaces Cu by forming $ZnSO_4$.

Q.2 What is observed when a potassium iodine solution (KI) is added to lead nitrate. Name the type of reaction. Write a balaced chemical equation for it.

Ans→
- Yellow precipitate of lead nitrate is formed.
- It is precipitation reaction.
- It is also called double displacement reaction.

$$Pb(NO_3)_2 + 2KI \longrightarrow PbI_2 + 2KNO_3$$

Q. 3 A solution of substance 'X' is used for whitewash. What is substance 'X'? Write chemical equation of 'X' with with

Ans→
- X = CaO
- $CaO + H_2O \rightarrow Ca(OH)_2 + heat$
- The reaction is exothermic in reaction.

Q. 4 A metal nitrate 'A' on heating gives yellow brown colour metal oxide along with brown gas 'B' and a colourless gas 'C'. 'A' upon reaction with KI

forms yellow precipitate known as D. Identify A, B, C & D. Also mention type of reaction involved in it.

Ans → Metal nitrate ($PbNO_3$)

$2Pb(NO_3)_2 \rightarrow 2PbO + 4NO_2 + O_2$
(A) (B) (C)

$Pb(NO_3)_2 + 2KI \rightarrow PbI_2 + 2KNO_3$
(D)

Q. Balance the equations:

① $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$
⇒ Already balanced (Indirect combination)

② $Pb(NO_3)_2 + KI \rightarrow PbI_2 + 2KNO_3$
⇒ $Pb(NO_3)_2 + 2KI \rightarrow PbI_2 + 2KNO_3$ (Double displacement)

③ $CaO + H_2O \rightarrow$
⇒ $CaO + H_2O \rightarrow Ca(OH)_2$ (combination reaction)

④ $CuSO_4 + Zn \rightarrow ZnSO_4 + Cu$
⇒ Already balanced (Displacement reaction)

⑤ $Zn + 2AgNO_3 \rightarrow$
⇒ ~~$Zn(NO_3)_2$~~ + $Zn + 2AgNO_3 \rightarrow Zn(NO_3)_2 + 2Ag$
(Displacement reaction)

Solve the following:

① $4NH_3 + 5O_2 \rightarrow$

⇒ $4NH_3 + 5O_2 \rightarrow 4NO + 6H_2O$

Displacement & redox reaction

②

② $H_2O + F_2 \rightarrow$

⇒ $H_2O + F_2 \rightarrow HF + HOF$

Redox reaction

③ $Fe_2O_3 + 3CO \rightarrow$

⇒ $Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$

Redox reaction

④ $Pb_3O_4 + HCl \rightarrow$

⇒ $Pb_3O_4 + 8HCl \rightarrow 3PbCl_2 + Cl_2 + 4H_2O + Cl_2$

Redox reaction

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