Chemical Equations.

chemical equation:

The symbolic representation of chemical reaction [reactants and products] is called chemical equation.

Example: ① $H_2 + O_2 \longrightarrow H_2O$

(H_2, O_2: Reactants; H_2O: Products)

② Quick lime (CaO) added to water, it forms slaked lime $[Ca(OH)_2]$

② $CaO + H_2O \longrightarrow Ca(OH)_2$

③ $Na_2SO_4 + BaCl_2 \longrightarrow NaCl + BaSO_4$.

Criss - cross:

He explained that how to write the chemical formula with their valency.

Examples:

Magnesium chloride [mg, cl]

(1)

Step 1: mg valency +2

cl valency -1

Step 2: mg^{+2} Cl^{-1}

Step 3: $mg \times Cl$

$mg_1 Cl_2$

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Criss - cross:

He explained that how to write the chemical formula with their valency.

Examples:

(9) Magnesium chloride [mg, cl]

Step 1: mg valency +2

cl valency -1

Step 2: mg^{+2} Cl^{-1}

Step 3: mg_1Cl_2

∴ magnesium chloride $MgCl_2$.

(ii) carbon dioxide $[C_4O_3]$

Step 1 : C valency 4

O valency 2

Step 2 : C^4 O^2

C_2 O_4

Step 3 : $C_{\not 4_1}$ $O_{\not 4_2}$ $\Rightarrow$ C_1O_2 $\Rightarrow CO_2$

(iii) calcium carbonate $[Ca, CO_3]$

Step 1 : Ca valency 2

CO_3 valency 2

Step 2 : Ca^2 $(CO_3)^2$

Ca_2 $(CO_3)_2$

Step 3 : $Ca_{\not 2}$ $(CO_3)_{\not 2}$ $\Rightarrow$ $CaCO_3$

(iv) Sodium carbonate $[NaCO_3]$

Step 1 : Na valency 1

CO_3 valency 2

Step 2 : Na^1 CO_3^2

Na_2 $(CO_3)_1$

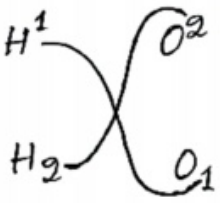
Step 3 : Na_2CO_3

(2)

(V) water $[H_2O]$

Step 1 : H valency 1

O valency 2

Step 2 : 

Step 3 : H_2O.

Types of reactions:

① Combination reaction : If two or more reactants combined to form single substances (or) [product].

$$A + B \longrightarrow AB$$

examples:

(i) $H_2 + O_2 \longrightarrow H_2O$ [Skeleton equation]

$2H_2 + O_2 \longrightarrow 2H_2O$. [Balanced equation]

(ii) $CaO + H_2O \longrightarrow Ca[OH]_2$ [Balanced equation

② Decomposition reaction: If a single substance divided into two or more substances is called [Heat] Decomposition reaction.

$$AB \longrightarrow A + B$$

Examples.

(i) $CaCO_3 \longrightarrow CaO + CO_2$ [Thermal]

$2CaCO_2 \longrightarrow 2CaO + CO_2$.

(ii) $AgBr \longrightarrow Ag + Br_2$ [Photo chemical / Photo electric]

$2AgBr \longrightarrow 2Ag + Br_2$

(iii) $H_2O \longrightarrow H_2 + O_2$ [Electrolytic]

$2H_2O \longrightarrow 2H_2 + O_2$

5) Displacement reaction: The displacement of an element [ion] from are compound to another compound is called Displacement reaction.

$$AB + C \longrightarrow A + BC$$

Examples:

(i) $Zn + HCl \longrightarrow ZnCl_2 + H_2$ [Skeleton equation]

$Zn + 2HCl \longrightarrow ZnCl_2 + H_2$ [Balanced equation]

(ii) $Fe + CuSO_4 \longrightarrow FeSO_4 + Cu.$ [Balanced equation]

Double displacement reaction [Double decomposition reaction]

The mutual exchange of the elements between two compounds is called Double displacement reaction.

$$AB + CD \longrightarrow AC + BD.$$

Examples:

(i) $NaOH + H_2SO_4 \longrightarrow Na_2SO_4 + H_2O.$ [Skeleton equation]

$2NaOH + H_2SO_4 \longrightarrow Na_2SO_4 + 2H_2O$ [Balanced equation]

(ii) $AgNO_3 + NaCl \longrightarrow NaNO_3 + AgCl.$

Oxidation reaction: Adding of oxygen is called oxidation reaction.

Removal of hydrogen is called oxidation reaction.
Removal of electron is called oxidation. reaction

Examples:

(i) $Mg + O_2 \longrightarrow MgO$ [skeleton equation]

$2Mg + O_2 \longrightarrow 2MgO$ [Balanced equation]

(ii) $Na \longrightarrow Na^+$

$\therefore$ + 1 electron

Reduction reaction: Adding of hydrogen is called Reduction reaction.

Removal of oxygen is called Reduction reaction.

Adding of electron is called Reduction reaction.

Examples:

(i) $Cl \longrightarrow Cl$ + 1 electron.

(ii) $CuO + H_2 \longrightarrow Cu + H_2O$.

Rancidity: Rancidity is an oxidation reaction.
The spoiling of food is called oxidation / Rancidity.

Examples:

(i) Chips packets are filled with Nitrogen gas to prevent rancidity / oxidation.

Balancing the chemical equations:

Skeleton equation: Unbalanced equation is called Skeleton equation.

Thermite reaction:

Example:

$$Fe_2O_3 + Al \longrightarrow Al_2O_3 + Fe$$

Precipitation:

$$BaCl_2 + Na_2SO_4 \longrightarrow NaCl + BaSO_4$$

$$AgCl \xrightarrow[\text{Sunlight}]{\text{contalist}\times} Ag + Cl_2$$

[Decomposition / Thermal reaction]

Exothermic:

$$C + O_2 \longrightarrow CO_2 + Q \ [\text{Heat}]$$

Endothermic:

$$N_2 + O_2 \longrightarrow NO - Q \ [\text{Heat}]$$

Why we balance the chemical equation ?

(A) According to law of conversation of mass. Mass neither be created norbe destroyed.

In chemical reaction before reaction total mass is equal to after reaction total mass.

Example :

Skeleton equation $Fe_2O_3 + Al \longrightarrow Al_2O_3 + Fe$

Balanced equation $Fe_2O_3 + 2Al \longrightarrow Al_2O_3 + 2Fe$

Thermite reaction $Fe_2O_3 + Al \longrightarrow Al_2O_3 + Fe$

Atom	LHS	RHS
Fe	2	1
O	3	3
Al	1	2

For Fe :

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

For Al :

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

∴ The Balanced equation is $Fe_2O_3 + 2Al \longrightarrow Al_2O_3 + 2Fe$

(8)

precipitate reaction :

skeleton reaction : $AgNO_3 + NaCl \longrightarrow AgCl + NaNO_3$

Elements	LHS	RHS.
Al	1	1
N	1	1
O	3	3
Cl	1	1
Na	1	1

∴ The balanced equation is $AgNO_3 + NaCl \longrightarrow AgCl + NaNO_3$

Examples of skeleton equation to Balanced equation:

(i) $Zn + HCl \longrightarrow ZnCl_2 + H_2$ [skeleton equation]

$2Zn + 4HCl \longrightarrow 2ZnCl_2 + 2H_2$ [Balanced equation]

(ii) $Al + HCl \longrightarrow H_2 + AlCl_3$ [skeleton equation]

$2Al + 6HCl \longrightarrow 3H_2 + 2AlCl_3$ [Balanced equation]

(iii) $K + Cl_2 \longrightarrow KCl$ [skeleton equation]

$2K + Cl_2 \longrightarrow 2KCl$ [Balanced equation]

(iv) $NaF + Br_2 \longrightarrow NaBr + F_2$ [skeleton equation]

$2NaF + Br_2 \longrightarrow 2NaBr + F_2$ [Balanced equation]

(v) $HgO \longrightarrow Hg + O_2$ [skeleton equation]

$2HgO \longrightarrow 2Hg + O_2$ [Balanced equation]

(vi) $Na + O_2 \longrightarrow Na_2O$ [skeleton equation]

$4\,Na + O_2 \longrightarrow 2\,Na_2O$ [Balanced equation]

(vii) $KNO_3 \longrightarrow KNO_2 + O_2$ [skeleton equation]

$6\,KNO_3 \longrightarrow 6\,KNO_2 + 3O_2$ [Balanced equation]

(viii) $K + Br_2 \longrightarrow KBr$ [skeleton equation]

$2K + Br_2 \longrightarrow 2\,KBr$ [Balanced equation]

(ix) $Ca + O_2 \longrightarrow CaO$ [skeleton equation]

$2Ca + O_2 \longrightarrow 2CaO$ [Balanced equation]

(x) $2\,H_2 + O_2 \longrightarrow 2\,H_2O$ [Balanced equation]

$2\,H_2 + O_2 \longrightarrow 2\,H_2O$ [Balanced equation]

Endothermic and Exothermic reaction :

The classification made by heat energy.

Exothermic reaction :

The reaction in which the heat energy released, that is called Exothermic reaction.

(i) $CaO + H_2O \longrightarrow Ca(OH)_2 + Q$ [Heat]

(ii) $C + O_2 \longrightarrow CO_2 + Q$ [Heat]

Respiration :

Endothermic reaction :

The reaction in which the heat absorbs that is called Endothermic reaction

(i) $N_2 + O_2 \longrightarrow 2NO - Q$ (Heat)

Photosynthesis reaction

(ii) $6CO_2 + 6H_2O \xrightarrow[\text{sunlight}]{\text{chlorophyll}} C_6H_{12}O_6 + 6O_2$

Mole concept:

* It is the unit of substance [Matter]

$$\text{Moles number } [m] = \frac{\text{Weight of substance}}{\text{gram molecular weight}}$$

Examples: Gram molecular weight.

(i) $H_2 \longrightarrow 1 \times 2 = 2$

(ii) $H_2O \longrightarrow 1 \times 2 + 16 = 18$

(iii) $CO_2 \longrightarrow 12 + 16 \times 2 = 44$

(iv) $NaCO_3 \longrightarrow 23 \times 2 + 12 + 16 \times 3 = 106$

(v) $NaOH \longrightarrow 23 + 16 + 1 = 40$

(vi) $H_2SO_4 \longrightarrow 1 \times 2 + 32 + 16 \times 4 = 98$

8) Find the moles number of 10 grams of H_2.

Sol:

$$\text{Moles Number } (n) = \frac{\text{weight of substance}}{\text{gram molecular weight}}$$

$$= 10/2$$

$$= 5/1$$

$$= 5$$

Note 1 :

one mole of any gas can occupy 22.4 l Its volume at STP.

STP : Standard Temperature pressure.

Note 2 :

If one mole. It contains 6.023×10^{23} molecules.

Q) calculate the amount mass of aluminium required to get 1120 grams of iron, when aluminium react with Fe_2O_3.

Sol:

$\therefore$ Fe = 56 U

Al = 27 U

O = 16 U

Sol:

Skeleton equation:

$$Al + Fe_2O_3 \longrightarrow Al_2O_3 + Fe$$

Balanced equation:

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

Note: 2 moles of Al react with 1 mole of Fe_2O_3 forms 1 moles of Al_2O_3 and 2 mole of Fe.

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

$$2(27) + (56\times2 + 16\times3) \longrightarrow (27\times2 + 16\times3) + 2(56)$$

$$54 + 160 \longrightarrow 102 + 112.$$

112 of Fe require 54 grm Al

1120 of Fe require ? grm Al.

$$= \frac{1120 \times 54}{112}$$

$$= 540 \text{ grms.}$$

5) calculate the volume, mass and number of molecules of Hydrogen liberated when 230 grms. of sodium [Na] reacts with excess of water at STP

$H = 1U$, $Na = 23U$, $C = 12U$, $O = 16$.

Sol:- Skeleton equation:

$$Na + H_2O \longrightarrow NaOH + H_2$$

Balanced equation:

$$2Na + 2H_2O \longrightarrow 2NaOH + H_2.$$

Note: 2 moles of Na react with 2 moles H_2O. and form 2 mole of NaOH and 1 mole of H_2O.

$$2Na + 2H_2O \longrightarrow 2NaOH + H_2$$

$$2(23) + 2(18) \longrightarrow 2(23+16+1) + 2\times1$$

$$46 + 36 \longrightarrow 80 + 2.$$

46 grms of Na can produce 2 grams of H_2.

230 grms of Na can produce ? grams of H_2.

$$= \frac{\overset{5}{\cancel{230}} \times 2}{\underset{1}{\cancel{46}}}$$

$$= 5 \times 2 = 10$$

= 10 grms of H_2 can prodce

moles number = w/m

$= 10/2$

$= 5$ moles

volume :

1 mole = 22.4 l

5 mole = $5 \times 22.4 = 112\ l$.

Molecular Number :

1 mole contains 6.023×10^{23} moles.

5 mole contains how many moles?

$\therefore 5 \times 6.023 \times 10^{23}$ molecules.

$= 30.115$ molecules.

9. 2 moles of zinc react with capric chloride [$CuCl_2$] solution containing 6.023×10^{23} formula a units of $CuCl_2$. calculate the moles of copper obtained.

Equation: $Zn + CuCl_2 \longrightarrow CaCl_2 + Cu$.

Sol: $Zn + CuCl_2 \longrightarrow CaCl_2 + Cu$.

2 moles + 6.023×10^{22}

6.023×10^{23} can produce?

$$= \frac{6.023 \times 10^{22}(1)}{6.023 \times 10^{23}}$$

$= 1/10$

$= 0.1$

$= 0.1$ moles of $CaCl_2$

0.1 mole of $CuCl_2$ can produce

(17)

2. calculate the volume and number of molecules of carbon dioxide (CO_2) liberated at STP if 50 grams of $CaCO_3$ is treated with dilute [HCl] which contains 7.3 grms of dissolved HCl gas.

Sol: Skeleton equation :

$$CaCO_3 + HCl \longrightarrow CaCl_2 + CO_2 + H_2O.$$

Balancing equation :

$$CaCO_3 + 2HCl \longrightarrow CaCl_2 + CO_2 + H_2O.$$

Note : 1 mole of $CaCO_3$ React with 2 moles of HCl and forms 1 mole of $CaCl_2$ and 1 mole of CO_2 and 1 mole of H_2O.

$$CaCO_3 + 2HCl \longrightarrow CaCl_2 + CO_2 + H_2O.$$

$$(40+12+48) + 2(1+35:5) \longrightarrow 40 + (35.5)_2 + (12+32) + (2\times1+16)$$

$$100 + 73 \longrightarrow 44 + 18$$

$$\therefore CaCO_3 + 2HCl \longrightarrow CaCl_2 + CO_2 + H_2O$$

$$(40+12+48) + 2(1+35:5) \longrightarrow 40 + (35.5)_2 + (12+32) + (2\times1+16)$$

$$100 + 73 \longrightarrow 44 + 18$$

73 grams of HCl react with 44grams of CO_2

7.3 grams of HCl produces ?

$$= \frac{7.3 \times 44}{73}$$

$$= \frac{\cancel{73}^{1} \times 44}{\cancel{730}\,10}$$

$$= 4.4 \text{ grms.}$$

$$\text{moles} = \frac{w}{gr.m.w}$$

$$= \frac{4.4}{44}$$

$$= \frac{\cancel{44}^{1}}{\cancel{440}\,10}$$

$$= 1/10 \text{ moles.}$$

$$= 0.1 \text{ moles.}$$

volume = 1 mole is 22.4 lit.

$$= 0.1 \times 22.4$$

$$= 2.24 \text{ litres}$$

Molecules = 1 mole contains 6.023×10^{23} moles.

0.1 mole contains ?

$0.1 \times 6.023 \times 10^{23}$ moles

06.023×10^{22} moles.

5. calculate the mass and volume of oxygen required at STP to convert 2.4 kg of graphite into carbondioxide.

Sol:- Skeleton equation:

$$C + O_2 \longrightarrow CO_2.$$

Balanced equation:

$$C + O_2 \longrightarrow CO_2.$$

Note: 1 mole of C reacts with 1 mole of O_2 and forms 1 mole of CO_2.

$$12 + 32 \longrightarrow 44.$$

12 grams of C required 32 grms of CO_2.

2.4 grams of C required ? grams of O_2.

$$= \frac{2.4 \times 32}{12} = \frac{32}{5} = 6.4 \text{ grams.}$$

$$= 6400 \text{ grams.}$$

$$\text{Moles Number (m)} = \frac{\text{weight of substance}}{\text{gram molecular weight}}$$

$$m = \frac{6400}{32} = 200 \text{ moles}$$

Volume = 1 mole = 22.4 litres

$$\therefore 200 \text{ moles} = 200 \times 22.4.$$

$$= 4480 \text{ litres}$$

Q. 1 mole of propane $[C_3+18]$ on combustion at STP give 'A' kilo joules of heat energy. calculate the heat liberated when 2.4 ltrs of propane on combustion at STP.

Sol: Skeleton equation:

$$C_3H_8 + O_2 \longrightarrow CO_2 + H_2O + A.K.J$$

Balanced equation:

$$C_3H_8 + 5O_2 \longrightarrow 3CO_2 + 4H_2O + A \text{ kilo joule.}$$

Note: 1 mole of C_3H_8 reacts with 5 moles of O_2 and forms 3 moles CO_2 and 4 moles of H_2O and A kilo joules.

22.4 l of occupy 1 mole of space.

2.4 l occupy ? Moles of space.

$= \frac{2.4 \times 1}{22.4}$ moles

$= \frac{2.4}{22.4}$ moles ..... ?

1 mole propane give A.K.J.

$\frac{2.4}{22.4}$ moles give how much propane?

$\frac{2.4}{22.4} \times A.K.J$

$= 0.1$ AKJ

(21)

Balance the chemical equations

1) $BaCl_2 + Na_2SOH \longrightarrow BaSO_4 + Nacl$

Sol:- $BaCl_2 + Na_2SO_4 \longrightarrow BaSO_4 + 2\ Nacl.$

2) $NaOH + HCl \longrightarrow Nacl + H_2O.$

Sol:- $NaOH + HCl \longrightarrow Nacl + H_2O$

3) $Mg + I2 \longrightarrow MgI$

Sol:- $2Mg + I_2 \longrightarrow 2MgI$

4) $C_6H_{12}O_6 \longrightarrow C_2H_5OH + CO_2$

Sol:- $C_6H_{12}O_6 \longrightarrow 2C_2H_5OH + 2CO_2$

5) $NH_3 + Cl_2 \longrightarrow N + NH_4\ Cl$

Sol:- $8NH_3 + 3Cl_2 \longrightarrow 2N + 6NH_4Cl.$

6) $Hg\ (NO_3)_2 + KI \longrightarrow HgI_2 + kNO_3$

Sol:- $Hg\ (NO_3)_2 + 2KI \longrightarrow HgI_2 + 2kNO_3$

7) $Na + H_2O \longrightarrow NaOH + H_2$

Sol:- $2Na + 2H_2O \longrightarrow 2NaOH + H_2$

8) $KClO_3 \longrightarrow KCl + O_2$

Sol:- $2KClO_3 \longrightarrow 2KCl + 3O_2$

9) $C_3H_8 + O_2 \longrightarrow CO_2 + H_2O$

Sol:- $C_3H_8 + 5O_2 \longrightarrow 3CO_2 + 4H_2O.$

Balance the chemical equations

1) $BaCl_2 + Na_2SO_4 \longrightarrow BaSO_4 + NaCl$

Sol:- $BaCl_2 + Na_2SO_4 \longrightarrow BaSO_4 + 2\,NaCl.$

2) $NaOH + HCl \longrightarrow NaCl + H_2O.$

Sol:- $NaOH + HCl \longrightarrow NaCl + H_2O$

3) $Mg + I2 \longrightarrow MgI$

Sol:- $2Mg + I_2 \longrightarrow 2MgI$

4) $C_6H_{12}O_6 \longrightarrow C_2H_5OH + CO_2$

Sol:- $C_6H_{12}O_6 \longrightarrow 2C_2H_5OH + 2CO_2$

5) $NH_3 + Cl_2 \longrightarrow N + NH_4Cl$

Sol:- $8NH_3 + 3Cl_2 \longrightarrow 2N + 6NH_4Cl.$

6) $Hg(NO_3)_2 + KI \longrightarrow HgI_2 + kNO_3$

Sol:- $Hg(NO_3)_2 + 2KI \longrightarrow HgI_2 + 2kNO_3$

7) $Na + H_2O \longrightarrow NaOH + H_2$

Sol:- $2Na + 2H_2O \longrightarrow 2NaOH + H_2$

8) $KClO_3 \longrightarrow KCl + O_2$

Sol:- $2KClO_3 \longrightarrow 2KCl + 3O_2$

9) $C_3H_8 + O_2 \longrightarrow CO_2 + H_2O$

Sol:- $C_3H_8 + 5O_2 \longrightarrow 3CO_2 + 4H_2O.$

10) $Al + Fe_2O_3 \longrightarrow Al_2O_3 + Fe$

Sol:- $2Al + Fe_2O_3 \longrightarrow Al_2O_3 + 2Fe.$

11) $CuO + HCl \longrightarrow CuCl_2 + H_2O.$

Sol:- $CuO + 2HCl \longrightarrow CuCl_2 + H_2O.$

12) $H_2 + O_2 \longrightarrow H_2O$

Sol:- $2H_2 + O_2 \longrightarrow 2H_2O.$

13) $Zn + AgNO_3 \longrightarrow Zn(NO_3) + Ag$

Sol:- $Zn + AgNO_3 \longrightarrow Zn(NO_3) + Ag.$

14) $Fe_2O + C \longrightarrow Fe + CO_2$

Sol:- $2Fe_2O + C \longrightarrow 4Fe + CO_2.$

15) $Ag + H_2S \longrightarrow AgS + H_2$

Sol:- $Ag + H_2S \longrightarrow AgS + H_2$

16) $Mg(OH)_2 + HCl \longrightarrow MgCl_2 + H_2O$

Sol:- $Mg(OH)_2 + 2HCl \longrightarrow MgCl_2 + 2H_2O.$

17) $BaCl_2 + H_2SO_4 \longrightarrow BaSO_4 + HCl.$

Sol:- $BaCl_2 + H_2SO_4 \longrightarrow BaSO_4 + 2HCl.$

18) $K_2CO_3 + HCl \longrightarrow KCl + H_2O + CO_2$

Sol:- $K_2CO_3 + 2HCl \longrightarrow 2KCl + H_2O + CO_2.$

Assessment

Q) Why is it necessary to balance a chemical equation.

Sol) 1) According to law of conservation of mass the total mass of the products formed in chemical reaction must be equal to the mass of reactants consumed.

2) The number of atoms of each element before and after reaction must be same.

3) Atoms are neither created nor destroyed in chemical reactions.

4) So, we should balance a chemical equation.

(24)

28) What information does a chemical equation give? Explain with an example.

Ans) A balanced chemical equation can give information on about the following:

1) About the reactants and products through their symbols and formulae.
2) It gives the ratio of molecules of reactants and products
3) The relative masses of rectants and products are known from the equation.
4) If the masses are expressed in grams then the equation also gives the molar ration of reactants. and products.
5) If goes are evolved we can calculate the volumes of those gases liberated
6) Using molar masses and Avagadro's number. we can calculate the number of molecules and atoms of different substances from the equation.
7) It gives information about relative masses of reactants and products.

Given an example each for endothermic and Exothermic reactions and write its chemical equations.

Sol: Endothermic reaction

1) Heat is observed during the reaction
2) Heat is observed is indicated by a (-) sign on the reactant side.
3) An endothermic reaction is represented reactants [⟶ product - heat] reactants → product - heat
4) Energy of the reaction is lesser than the product
5) (i) $HCO_3^- + H^+ \longrightarrow H_2O + CO_2$

(ii) $N_2 + O_2 \xrightarrow{\Delta} NO - \Delta T$

(iii) $C + H_2O \xrightarrow{\Delta} CO + H_2 - \Delta T.$

Exothermic reaction

Ans) 1) Heat is given out during the reaction.
2) Heat is liberated in indicated by a positive sign on product side.
3) An exothermic reaction is represented [reactants ⟶ product + Heat.]
4) Energy of the reactant is greates than the product.

5) (i) $NaOH + HCl \longrightarrow Nacl. + H_2O$

(ii) $H_2 + 3H_2 \xrightarrow{\Delta} 2NH_3 + Heat.$

(iii) $4N_3 + 5O_2 \xrightarrow{\Delta} 4NO + 6H_2O + \Delta T.$

4Q) Write a chemical equation for the reaction between zinc and hydrochloric acid and balance it ?

Sol:

$$Zn + HCl \longrightarrow ZnCl_2 + H_2$$

↓ metal ↓ Acid

$$2HCl + Zn \longrightarrow \underset{\uparrow \text{salt}}{ZnCl_2} + \underset{\uparrow \text{Hydrogen.}}{H_2}$$

5Q) Number of hydrogen atoms in 2 grms of hydrogen gas at STP.

Sol: Thus, 1 mole is present in 2 grms of hydrogen gas at STP.

Thus, 6.023×10^3 atoms are there in 2 grms of hydrogen gas.

1 mole ..... 6.023×10^{23}

STP = Standard temparature pressure.

68. The amount of hydrochloric acid required to consume 100 grms of calcium carbonate completely

Sol: skeleton equaction.

$$CaCO_3 + HCl \longrightarrow CaCl_2 + CO_2 + H_2O$$

Balancing equation

$$CaCO_3 + 2HCl \longrightarrow CaCl_2 + CO_2 + H_2O$$

NOTE:

1 mole of $CaCO_3$ reacts with 2 moles of HCl and forms 1 mole of $CaCl_2$ and 1 mole of CO_2 and 1 mole of H_2O

$$(40 + 12 + 48) + 2(1 + 35.5) \longrightarrow 40 + (2 \times 35.5) + (12 + 32) + (2 \times 1 + 16)$$

$$100 + 73 \longrightarrow 111 + 44 + 18$$

73 grms of HCl consume 100 grms of $CaCO_3$ completely

Q Balance the chemical equation along with their physical state.

(i) $Na_2SO_4 + BaCl \longrightarrow BaSO_4 + NaCl.$

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

(ii) $CaCO_3 \longrightarrow CaO + CO_2$

$CaCO_{3(s)} \longrightarrow CaO_{(s)} + CO_{2(aq)}$

(iii) $C + O_2 \longrightarrow CO_2$

$C_{(s)} + O_{2(g)} \longrightarrow CO_{2(g)}$

(iv) $Fe_2O_3 + CO \longrightarrow Fe + CO_2.$

$Fe_2O_{3(s)} + CO_{(g)} \longrightarrow 2Fe_{(s)} + CO_{2(g)}$

(v) $N_2 + O_2 \longrightarrow NO$

$N_{2(g)} + O_{2(g)} \longrightarrow 2NO_{(g)}$

(vi) $Fe_2O_3 + Al \longrightarrow Al_2O_3 + Fe.$

$Fe_2O_{3(s)} + 2Al_{(s)} \xrightarrow{\Delta} 2Fe_{(s)} + Al_2O_{3(s)}$

(vii) $AgCl \longrightarrow Ag + Cl_2$

$2AgCl_{(s)} \longrightarrow 2Ag_{(s)} + Cl_{2(g)}$

(viii) $Zn + H_2SO_4 \longrightarrow ZnSO_4 + H_2.$

$Zn_{(s)} + H_2SO_{4(aq)} \longrightarrow ZnSO_{4(aq)} + H_{2(g)}$