**SOLUTIONS**

* Solution:- The homogenous mixture of two (or) more substances is called solution.

 Ex:- glucose solution , sugar solution , etc….

* Solute:- The substance present in smaller quantity in a solution is called solute.

Ex:- glucose , sugar , salt , etc….

Solvent:- The substance present in larger quantity in a solution is called solvent.

Ex:- water,…

Classification of solution on the basis of physical state:

* The solutions are classified into three types on the basis of physical state.
1. Gaseous solutions: These are three types
2. Gas in gas:- Ex: H2 & O2 mixture , air , etc…
3. Liquid in gas:- Ex: water in air , etc….
4. Solid in gas:- Ex: dust in air , etc…
5. Liquid solutions: These are three types
6. gas in Liquid:- Ex: soda water , etc….
7. Liquid in Liquid:- Ex: alcohol in water , etc…
8. Solid in liquid:- Ex: salt in water , etc…
9. Solid solutions: These are three types
10. Gas in Solid:- Ex: “H2” gas in “Ni” , etc….
11. Liquid in solid:- Ex: “Hg” in “Zn” (amalgam) , etc..
12. Solid in solid:- Ex: alloys , etc…

Mole: The substance which contains avogadro’s number (6.023x1023) of particles is called mole.

It is denoted by “n”.

Ex-1: “23gm” of “Na” = 1 mole.

 Ex-2: “16gm” of “O” = 1 mole.



 🡪 Formulae:-1) n = Wt / G.M.Wt.

 2) Wt = n x G.M.Wt.

* Units: moles.

Problems:

Model-1:-

Find the number of moles present in 32 grams SO2

Ans: n=?

 Given that , Wt = 32gm

 G.M.Wt of SO2 = S + 2(O)

 = 32 + 2(16)

 = 64gm.

 since, n = Wt / G.M.Wt

 = 32 / 64.

 = 1/2.

 = 0.5moles]

* Find the number of moles present in 1Kg of NaOH.

Ans: n=?

 Given that , Wt = 1Kg = 1000gm.

 G.M.Wt of NaOH = Na + O +H

 = 23 + 16 + 1

 = 40gm.

 since, n = Wt / G.M.Wt

 = 1000 / 40.

 = 25moles.

Model-2:-

* Calculate the weight of 0.2moles of CaCO3.

Ans: Wt=?

 Given that , n=0.2moles.

 G.M.Wt of CaCO3 = Ca + C + 3(O)

 = 40 + 12 + 3(16)

 = 40 + 12 + 48

 = 100gm.

 since , Wt = n x G.M.Wt.

 = 0.2 x 100

 = 20gm.

* Atomic weight:- the number of times of an atom is heavier than 1/12th of weight of 12C atom is called atomic weight.

 Ex-1: The atomic weight of “N” = 14.

 Ex-2: The atomic weight of “O” = 16.

* Molecular weight:- The sum of atomic weights of all atoms present in a molecule is called molecular weight.

 Ex: HCl

 M.Wt = H + Cl

 = 1 + 35.5

 = 36.5gm

* Equivalent weight:- The amount of substance that reacts with 1gm Hydrogen (or) 8gm of Oxygen (or) 35.5gm of Chlorine is called equivalent weight.

Ex: HCl

 Eq.Wt of “Cl” = 35.5/1

 = 35.5gm.

NOTE:







Calculation of equivalent weight of given acids , bases and salts:

1. Acids :
2. Equivalent weight of acids: The ratio of G.M.Wt of acids to its basicity is called Eq.Wt of acids.



Basicity: The number of replaceable hydrogen atoms present in an acid is called basicity .

Ex: HCl

 Eq.Wt of HCl = G.M.Wt of HCl / Basicity.

 G.M.Wt of HCl = H + Cl = 1 + 35.5 = 36.5

 Basicity = 1

 Eq.Wt of HCl = 36.5 /1

 = 36.5gm

Bases:-

Eq.Wt of bases: The ratio of G.M.Wt of bases to it’s acidity is called Eq.Wt of bases.



Ex:

Acidity : The number of replaceable “OH” groups present in a base is called acidity.

Ex: KOH

 Eq.Wt of KOH = G.M.Wt of KOH / Acidity.

 G.M.Wt of KOH = K + O + H = 39 + 16 + 1 = 56

 Acidity = 1

Eq.Wt of KOH = 56 / 1 = 56gm

Bases:-

Eq.Wt of bases: The ratio of G.M.Wt of bases to it’s acidity is called Eq.Wt of bases.

Acidity : The number of replaceable “OH” groups present in a base is called acidity.

Ex: KOH

 Eq.Wt of KOH = G.M.Wt of KOH / Acidity.

 G.M.Wt of KOH = K + O + H = 39 + 16 + 1 = 56

 Acidity = 1

Eq.Wt of KOH = 56 / 1 = 56gm.

Salts :-

Eq.Wt of salts: The ratio of G.M.Wt of salts to it’s total valency of cations (or) anions is called Eq.Wt of salts.

**Eq.Wt of salts = G.M.Wt of salts**

 **total valency of cations (or) anions**

Ex: Na2CO3  🡪G.Wq.Wt = 53gm

Ex: NaCl

 Eq.Wt of salts = G.M.Wt of salts / total valency of cations (or) anions

G.M.Wt of NaCl = Na + Cl = 23 + 35.5 = 58.5gm

total valency of cations (or) anions = 1

Eq.Wt of salts = 58.5 / 1 = 58.5gm

Molarity : The number of moles of solute present in 1liter of solution is called molarity

* It is denoted by “M”

**M = Wt. x 1000**

 **G.M.Wt Vml**

Units: M (or) moles/lit

FORMULAE:

* M = Wt. x 1000

 G.M.Wt Vml

* Wt. = M x G.M.Wt x Vml  / 1000
* M = n x 1000 / Vml
* For dilute solution : M1V1 = M2V2

PROBLEMS:-

MODEL-1:

1. Calculate the molarity of solution containing 2gm of NaOH dissolved in 250ml of solution .

Ans: Given That, Wt = 2gm.

 volume (v) = 250ml

 G.M.Wt Of NaOH = Na+ O + H

 =23+16+1

 = 40gm

 Since , M = Wt. x 1000

 G.M.Wt Vml

 = 2 x 1000

 40 250

 = 0.2M

MODEL-2:

* Calculate the weight of NaOH present in 250ml of 0.1M solution

Ans: Given that, Molarity(m) =0.1M.

 volume (v) =250ml·.

 G.M.Wt of NaOH = Na + O + H

 = 23 + 16 + 1

 = 40gm

 Since, Wt. = M x G.M.Wt x Vml  / 1000

 = 0.1 x 40 x 250 / 1000

 = 1gm

MODEL-3:

* 100ml of 0.05M solution contains how many moles of the solute

Ans: n =?

 given that , Molarity (M) = 0.05M

 Volume (V) =100ml

 Since , M = n x 1000 / Vml

 🡪 n = M x Vml / 1000

 = 0.05 x 100 /1000

 = 0.005 moles

MODEL-4:

* 100ml of 0.5M Solution is diluted to 1 liter of solution . Calculate the molarity of dilute solution.

Ans: Given that , M1=0.5M.

 V1 = 100ml.

 V2 =1litre =1000ml.

 M2= ?

 Since, For dilute solutions :M1V1 = M2V2

 0.5 x 100 = M2 x 1000

M2  = 0.5 x 100 / 1000

= 0.05M

Calculate the volume of water to be added to l00ml of 0.2M HCl Solution to get 0.1m HCl solution.

Ans: Given that , M1=0.2M.

 V1 = 100ml.

 M2 =0.1 M

 V2= ?

 Since, For dilute solutions :M1V1 = M2V2

 0.2 x 100 = 0.1 xV2

V2  = 0.2 x 100 / 0.1

= 200ml

 The volume of water to be added (V) = V2 -V1

= 200 - 100

 = 100ml

Normality: The number of gram equivalents of solute present in 1litre of solution is called Normality.

* It is denoted by “N”.

**N = Wt. x 1000**

 **G.Eq.Wt Vml**

* Units : N

 FORMULAE:

* N = Wt. x 1000

 G.Eq.Wt Vml

* Wt. = N x G.Eq.Wt x Vml  / 1000
* For dilute solution : N1V1 = N2V2

PROBLEMS:-

MODEL-1:

1. Find the normality of solution prepared by dissolving 10gm NaOH in 500ml of water.

Ans: N=?

 Given That, Wt = 10gm. .

 volume (v) = 500ml

 G.Eq.Wt of NaOH = G.M.Wt of NaOH / Acidity

 G.M.Wt Of NaOH = Na+ O + H

 =23+16+1

 = 40gm

 Acidity = 1.

 G.Eq.Wt of NaOH = 40 / 1 = 40gm.

 Since , N = Wt. x 1000

 G.Eq.Wt Vml

 = 10 x 1000

 40 500

 = 0.5 N

MODEL-2:

1.Calculate the weight of HCl present in 500ml of 0.1N

Ans: Given that, normality (N)=0.1N

 volume (v) = 500ml

 G.Eq.Wt of HCl = G.M.Wt of HCl / basicity

 G.M.Wt of HCl = H + Cl

 = 1+35.5

 = 36.5gm

 basicity = 1

 G.Eq.Wt of HCl = 36.5 / 1 = 36.5gm

 Since , Wt. = N x G.Eq.Wt x Vml  / 1000

 = 0.1 x 36.5 x 500 / 1000

 = 1.825gm

MODEL-3:

1. 500ml of 0.2N solution is diluted to 1lit calculate the normality of dilute solution.

Ans: Given that , N1=0.2M.

 V1 = 500ml.

 V2 =1litre =1000ml.

 N2= ?

 Since, For dilute solutions : N1V1 = N2V2

 0.2 x 500 = M2 x 1000

M2  = 0.5 x 500 / 1000

= 0.1M

PRACTICE PROBLEMS:

Molarity:

1. Calculate the molarity of 10% NaOH
2. Find the weight of urea (NH2CONH2) is required to prepare 2litre of 0.2M solution.
3. 500ml of 0.02M solution contains how many moles of the solute.
4. 500ml of 0.1M Solution is diluted to 1000ml of solution . Calculate the molarity of dilute solution.
* Normality:
1. Calculate the normality of Na2CO3 solution containing 10.6g/lit
2. Calculate the weight of oxalic acid (H2C2O4 . 2H20) required to prepare 0.05N solution in 2litre
3. Calculate the normality of 20ml of NaOH that exactly neutralize to 50ml 0f 0.02N H2SO4

MOLARITY & NORMALITY:

* Calculate the molarity and normality of solution is prepared by dissolving 10.6gm Na2CO3 in 500ml of water