**Analytical Chemistry**

Analytical chemistry is that branch of chemistry which concerned with the separation, identification and determination of the amounts of the elements present in a sample.

**Analytical chemistry can be divided into two branches**

 **Qualitative analysis(** identify the elements or compounds present in a sample**)** and **Quantitative analysis(** determine the amounts of elements or compounds present in the sample**)**.

**Quantitative analysis divided into two methods:**

1. Gravimetric method (change in weight).
2. Volumetric method (change in volume).



**Preparation of Solution**

A solution is a mixture of 2 or more substances in a single phase. One constituent is usually regarded as the SOLVENT and the others as SOLUTES.

SOLUTES -- substances that are dissolved (sugar)

SOLVENTS -- substance in which solutes are dissolved (usually water)

**Solutions can be classified as saturated or unsaturated.**

1. A saturated solution contains the maximum quantity of solute that dissolves at that temperature.
2. An unsaturated solution contains less than the maximum amount of solute that can dissolve at a particular temperature

**Concentration of solutions:-**

**(1)Concentration in terms of percentage**

% by mass = Mass of solute/Volume of solution × 100

W / v %

% by volume = Volume of solute /Volume of solution ×100

 V/ v %

**Example/**

What is the weight/volume percentage concentration of 250mL of aqueous sodium chloride solution containing 5g NaCl?

Calculate the weight/volume (%) = mass solute ÷ volume of solution x 100

mass solute (NaCl) = 5g      volume of solution = 250mL

w/v (%) = 5g ÷ 250mL x 100 = 2g/100mL (%)

For example wine contains about 12% v/v ethanol, which means there are 12 mL of ethanol in every 100 mL of wine.

**(2) Molarity**

Amount of molecular weight of the solute present in one liter of solution.

 M = weight of solute per liter /Molecular wt. of solute

M = Wt. of Solute x 1000 / Mole. Wt. of Solute X Vol of solution

**Example**

 Calculate the molarity of a solution of NaOH in which 0.40g NaOH dissolved in 500 ml solution.

Solution:

M= (0.40 / 40× 500 )×1000 = 0.02 M

Problem 1:  Determine the Molarity of given 100ml of NaOH solution.

Problem 2: Determine the Molarity of given 250ml of HCl solution.

 Problem 3: Determine the Molarity of given 750 ml of Ca(OH)2.

Problem 4: Determine the Molarity of given 900 ml of H3PO4

Problem 5: Determine the weight required to prepare 5M KOH solution. Problem 6: Determine the weight required to prepare 2M HCl solution.

**(3)Normality**

Number of equivalents of solute present in one litre of solution.

N = Equivalent of solute /Volume of solution in litre

N=Mass of solute 1000/ Equivalent mass of solute volume (in ml)

 Also N= Equivalents /V(in litre)

**Example**

Find the normality of H2SO4 having 49g of H2SO4 present in 500 ml of solution.

Solution: N= Mass of solute 1000/ Equivalent mass volume (in ml)

N=49 1000/ (98/2) 500 = 2N

Problem 1:  Determine the normality of given 100ml of NaOH solution. Problem 2: Determine the Normality of given 250ml of HCl solution.

Problem 3: Determine the normality of given 750 ml of Ca(OH)2.

Problem 4: Determine the normality of given 900 ml of H3PO

Problem 5: Determine the amount required to prepare 1N KOH solution. Problem 6: Determine the amount required to prepare 5N HCl solution.

**Relation between normality and molarity**

**N=** Mass of solute 1000/ (Molecular mass/ n factor) volume (in ml)

**N=** M x n factor

For HCl, n = 1 H2SO4 , n = 2 H3PO4 , n = 3 NaOH, n = 1 Ca(OH)2 , n = 2

For monovalent compound (n = 1) Normality and molarity is same.

 **(4)Molality**

Molecular wt. of solute present in 1 Kg (or 1000 gram) of solvent. It is represented by m (small letter).

**m**= Number of mole X 1000/weight of solution

m= Mass of solute 1000/ Molecular mass Mass of solvent (gram)

**Example**

5% (w/w) glucose solution is given .Find the  molality of solution .
**Solution**

Molality (m) = W/MM  × 1000/(W gm in solvent)
     = 5/180  ×1000/95
    = 100/(18 ×19)=50/171

Problem 1:  Determine the Molality of given 100gm of NaOH.

Problem 2: Determine the Molality of given 250gm of HCl solution.

Problem 3: Determine the Molality of given 750 gm of Ca(OH)2.

Problem 4: Determine the gms of solute required to prepare 5m KOH solution.

Problem 5: Determine the gms of solute required to prepare 2m HCl solution.

**Example**

20 ml of 10 N HCl are diluted with distilled water to form one litre of the solution. What is the normality of the diluted solution?

Solution: **N1V1 = N2V2**

(20 /1000) x10 = N2x (1000 /1000)

= 0.2 N



