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Saturated, Unsaturated and Super Saturated Solution

Depending upon the amount of solute present in the given volume of solvent, the solution is classified into *three* categories.

1. **Saturated Solution:-** ***The solution which contain maximum amount of solute at given temperature and pressure is called saturated solution.***

2. **Unsaturated Solution:-** ***The solution which contains less solute than saturated solution is called unsaturated solution.***

3. **Super Saturated Solution:-** ***The solution which contains more solute than saturated solution is called supersaturated solution.***

Basicity Of Acid

The number of ionisable hydrogen atoms (**H^+** Ion) present in a molecule of an acid is known as basicity of acid.

Example:-

1. HCl, HNO_3 , CH_3COOH are monobasic acids.

(Basicity = 1)

2. H_2SO_4 , $H_2C_2O_4$ are dibasic acids.

(Basicity = 2)

3. H_3PO_4 , H_3AsO_4 are tribasic acids.

(Basicity = 3)

Ways of Expressing Concentration of solution

Concentration of solution= >

Amount of solution dissolved in a specific amount (1 m^3 or dm^3)of solution.

$$\text{Concentration} = \frac{\text{Amount of solute}}{\text{Volume of solvent or solution}}$$

It expressed in various ways or units.

Ie. N, M, m, W/W, V/V, W/V etc.

Formulae for calculation of Equivalent Weight of substance

$$\text{Eq. Wt. of an Acid} = \frac{\text{Strength of Acid}}{\text{Normality of Acid}}$$

$$\text{Eq. Wt. of a Base} = \frac{\text{Strength of Base}}{\text{Normality of Base}}$$

$$\text{Normality of Acid} = \text{Molarity} \times \text{Basicity}$$

$$\text{Normality of Base} = \text{Molarity} \times \text{Acidity}$$

Eg. Calculate the Normality of solution when 5.6 g of KOH is dissolved in 1 dm^3 of solution.

Solution:- Given

Wt.of the KOH =W♦ = 5.6 g , Vol. of solution Y dm^3

= 1

$$\text{Eq. Wt. of KOH} = \frac{\text{Molecular Wt. of KOH}}{\text{Acidity of KOH}} = \frac{56}{1} = 56$$

$$N = \frac{\text{Wt. of the substance (Ws)}}{\text{g. Eq. Wt. of the substance (Es)}} \times \frac{1}{\text{Vol. of solution Y } dm^3}$$

$$N = \frac{5.6}{56} \times \frac{1}{1} = 0.1 \text{ N KOH}$$

Eg. Calculate the Normality of NaOH solution containing 10×10^{-3} kg of it dissolved in 2 dm^3 of water.

Solution:- Given Wt.of the NaOH = Ws = 10×10^{-3} kg Vol. of solution Y dm^3 = 2

$$\text{Eq. Wt. of NaOH} = \frac{\text{Mol. Wt. of NaOH}}{\text{Acidity of NaOH}} = \frac{40 \times 10^{-3}\text{ kg}}{1} = 40 \times 10^{-3}\text{ kg}$$

$$N = \frac{\text{Wt. of the substance (Ws)}}{\text{g. Eq. Wt. of the substance (Es)}} \times \frac{1}{\text{Vol. of solution Y dm}^3}$$

$$N = \frac{10 \times 10^{-3}\text{ kg}}{40 \times 10^{-3}\text{ kg}} \times \frac{1}{2} = 0.125\text{ N NaOH}$$

Eg. Calculate Normality & Molarity of solution containing 9.8 g of H_2SO_4 In 1 dm^3 of solution.

Solution:- **Solution:- Given**

Ws = 9.8 g , Vol. of solution(Y) =1 dm^3

Eq. Wt. of H_2SO_4 = 98 / 2 = 49 g Ms = 98 N & M =?

$$N = \frac{Ws}{Es} \times \frac{1}{Y\,(dm^3)}$$

$$N = \frac{9.8}{49} \times \frac{1}{1} = 0.2\,N\ H_2SO_4$$

$$M = \frac{Ws}{Ms} \times \frac{1}{Y\,(dm^3)}$$

$$N = \frac{9.8}{98} \times \frac{1}{1} = 0.1\,M\ H_2SO_4$$

Molality(m)

$$m = \frac{\text{Wt. of the substance (Ws)}}{\text{Mol. Wt. of the substance (Ms)}} \times \frac{1000}{\text{Mass of solvent in gram (Y)}}$$

Ws = 25 g, Ms = 286 g, mass of solvent (Y)g= ?

$$\text{Vol. of sol}^n = \frac{\text{Mass of solution}}{\text{Density}}$$

Mass of solution = Vol. of sol^n × Density

Mass of solution = 200 × 1.04 = 208 g

Mass of solution = Mass of solute ($Na_2CO_3 .10H_2O$) + Mass of solvent(Water)

208 = 25 + Mass of solvent(Water) Y

Mass of solvent(Water) (Y) = 208 – 25 = 183

Molarity of Mixed Solution

A mixture of different solutions of same or different substances or solutes (acids, bases, salt) has the molarity as given by the relation,

$M_1 V_1 + M_2 V_2 + M_3 V_3 + \ldots\ldots\ldots\ldots\ldots = M_m V_m$

Where,

$M_1, M_2, M_3 \ldots.$ Are the molarities of different components of the mixture. And

$V_1, V_2, V_3 \ldots.$ Are their volumes in the mixture.

M_m & V_m are the molarity and volume of resultant mixure. ($V_m = V_1 + V_2 + V_3 + \ldots\ldots$)