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LIQUID SOLUTIONS

by

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LECTURE -I

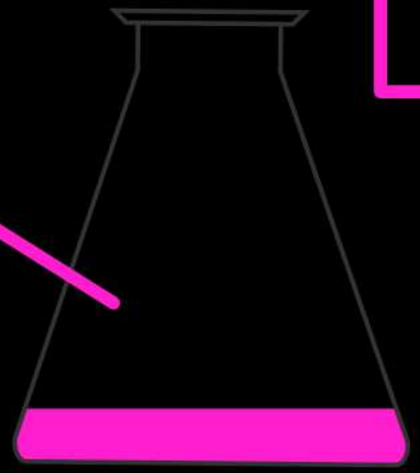
CONCENTRATION TERMS

Type of Solution	Solute	Solvent	Common Examples
Gaseous Solutions	Gas	Gas	Mixture of oxygen and nitrogen gases
	Liquid	Gas	Chloroform mixed with nitrogen gas
	Solid	Gas	Camphor in nitrogen gas
Liquid Solutions	Gas	Liquid	Oxygen dissolved in water
	Liquid	Liquid	Ethanol dissolved in water
	Solid	Liquid	Glucose dissolved in water
Solid Solutions	Gas	Solid	Solution of hydrogen in palladium Pd(s)
	Liquid	Solid	Amalgam of mercury with sodium Na(Hg)
	Solid	Solid	Copper dissolved in gold Cu in Au

There are several ways by which we can calculate the concentration

Solute + solvent = Solution

Solute
(B)



(A)
Solvent

Mass Percentage (w/w) %. w/w

x %. $\frac{w}{w}$ Urea (NH_2CONH_2)

x gm Urea is present in 100 gm soln

Urea → Solute

$w_B = x$ gm

$w_A + w_B = 100$ gm

#Temp Independent

30 %. $\frac{w}{w}$ Glucose

30gm Glucose is present in 100gm soln

$w_B = 30gm$

$w_A + w_B = 100gm$

$w_A = 100 - w_B$

$= 100 - 30$

$= 70\ gm$

formula

Solute

$$\% \frac{w}{w} = \frac{w_B}{w_{soln}} \times 100$$

Mass by Volume Percentage (w/v): % w/v

x % $\frac{w}{V}$ H_2SO_4

Temp. dependent

x gm H_2SO_4 is present in 100 mL soln

49 % $\frac{w}{V}$ H_2SO_4

49 gm H_2SO_4 is present in 100 mL soln

$w_B = 49$ gm

$V_{soln} = 100$ mL

formula

Solute

$$\%\,\frac{w}{v} = \frac{w_B}{V_{soln}(mL)} \times 100$$

Volume by Volume Percentage (v/v):

$x\%\ \frac{V}{V}$ Ethanol (C_2H_5OH) # Temp depen

x mL Ethanol is present in 100 mL soln

$42.8\%\ \frac{V}{V}$ **Ethanol**

42.8 mL Ethanol is present in 100 mL soln

formula

Solute

$$\% \frac{V}{V} = \frac{V_{B\,(mL)}}{V_{Soln\,(mL)}} \times 100$$

30 % → 30 % $\frac{w}{w}$ = 30 % by weight

30 % → 30 % $\frac{w}{V}$

30 % → 30 % $\frac{V}{V}$

MI ☆ In the case of conc acid like 98 % H_2SO_4

$\frac{w}{V}$

PPM (Parts per Million)

$$ppm = \frac{\omega_B}{\omega_{soln}} \times 10^6$$

Temp Indepen.

x ppm
x gm solute is present in 10^6 gm soln

no. of moles of solute is present per Ltr of soln

Temp depend.

$$M = \frac{n_B}{V_{soln(L)}}$$

The no. of moles of solute is present in per kg of the solvent

$$m = \frac{n_B}{W_{A(kg)}}$$

Temp Indepen.

The no. of gm equivalent is present per Ltr of the soln.

$$N = \frac{\text{no. of gm equi}}{V_{soln(L)}} = \frac{n \times (n.f)}{V_{soln(L)}}$$

$$\text{no. of gm equi} = \frac{\omega}{E.W} = \frac{\omega}{\left(\frac{M.W}{n.f}\right)} = \frac{\omega}{M.W} \times n.f$$

$$= n \times n.f$$

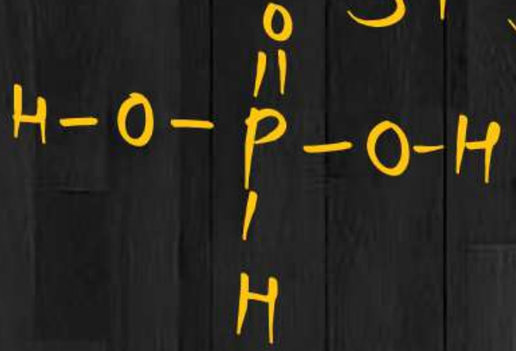
n.f (n-factor or x-factor or Valency factor

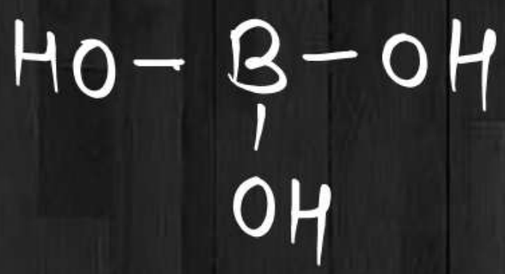
Case ① for Acids ÷ no. of ionisable H^+

$H_2SO_4 \longrightarrow n.f = 2$

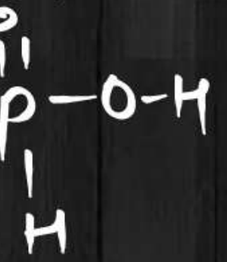
$H_3PO_4 \longrightarrow n.f = 3$

$H_3PO_3 \longrightarrow n.f = 2$





$H_3PO_2 \longrightarrow nf = 1$



* $H_3BO_3 \longrightarrow nf = 1$

$H_3BO_3 + H_2O$

$\downarrow$

$[B(OH)_4^{\ominus}] + H^{\oplus}$

Case ② for Bases ⟶ No. of OH^- ions furnished

$MOH \longrightarrow nf = 1$

$M(OH)_2 \longrightarrow nf = 2$

$Al(OH)_3 \longrightarrow nf = 3$

Case ③ for salts

n.f = Total +ve charge or Total -ve charge

$Na^{+}Cl^{-}$ n.f = 1

$Ca^{2+}Cl^{-}_{2}$ n.f = 2

$Al^{3+}Cl^{-}_{3}$ → n.f = 3

Thank You Lakshyians