10 % [W/W] aquaous sol^n of Glugose.

↓

(solvent H_2)

= 10 gm solute (Glucose) present in <u>100</u> gm of solution.

↓

i am assuming in gram

Then cross check it is right or wrong – $\frac{10}{100} \times 100 = \underline{\underline{10\%}}$

Right <u>proved</u>

$100 - 10 = 90$ solv

Solvent formula

$$\boxed{\begin{array}{l}\text{Solute} - \text{Solution} \\ = \text{Solvent}\end{array}}$$

* – Volume percentage (V/V):

Volume % of the components:

$$\frac{\text{Volume of the component in Sol}^n}{\text{Total Volume of the sol}^n} \times 100$$

*← Mass by Volume percentage [w/v] :

Volume solution

Mass (solute)

w/v % of a componentx :

$$\frac{\text{Mass of the componentx}}{\text{Total volume of the solution}} \times 100$$

* Parts per million – 10^6

Parts per million =

$$PPF = \frac{\text{Number of parts of the components}}{\text{Total number of parts ofc all components of the soln.}} \times 10^6$$

*– Density (d) = $\frac{\text{Mass}}{\text{Volume}}$

0.9 gm / ml → 0.9 gm perecent in 1 ml

1 ml – 0.9 gm

100 ml – 90 gm

1 litre – 900 gm

10 min

* Mole Fraction → *(X)

$\boxed{\frac{n_A - \text{Solute}}{n_B\ \text{sol}^n}}$

Imp.

Mole fraction of a components =

$$\frac{\text{Number of moles of the components}}{\text{Total number of moles of all components}}$$

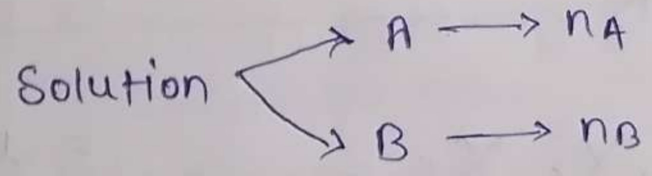
⇓

(Total moles of solution)

$$\underline{\text{Mole}} = \frac{\text{Given mass (gm)}}{\text{Molar mass}} \quad \Big| \quad \frac{\text{Vol. of gas (STP) (L)}}{22.4\ (L)}$$

only in gases.

* Example of calculating moles:



Total moles of solution (n_T)
= moles of A + moles of B

$$\boxed{n_T = n_A + n_B}$$

Mole Fraction of A (X_A)

$$= \frac{\text{Moles of A}}{\text{Moles of Soln}} = \frac{n_A}{n_A + n_B}$$

$$X_A = \frac{n_A}{n_A + n_B} \quad \text{—①}$$

// similarly

$$X_B = \frac{n_B}{n_A + n_B} \quad \text{—②}$$

eqn ① + eqn ②

$$X_A + X_B = \frac{n_A}{n_A+n_B} + \frac{n_B}{n_A+n_B}$$

$$X_A + X_B = \overset{L.H.S}{} \quad \overset{R.H.S}{} \frac{n_A+n_B}{(n_A+n_B)(n_a+n_B)}$$

$$X_A + X_B = \frac{\cancel{(n_A+n_B)}}{\cancel{(n_A+n_B)}} = 1$$

* $\boxed{X_A X_B = 1}$

Imp. A, B, C, D - - - - -

then

X_A, X_B, X_C, X_C - - - - - $= 1$

Que – $X_A = 0.2$, $X_B = ?$

and Also find n_A and n_B

If total moles of sol^n = 10

Sol^n = $X_A + X_B = 1$

$0.2 + X_B = \boxed{X_B = 0.8}$

$$= X_A = \frac{n_A}{n_T}$$

$$0.2 = \frac{n_A}{n_T}$$

$$n_A = 10 \times 0.2$$

$$n_A = 2$$

$$n_A + n_B = 10$$

$$2 + n_B = 10$$

$$n_B = 10 - 2$$

$$\boxed{n_B = 8}$$

$$X_B = \frac{n_B}{n_T}$$

$$0.8 = \frac{n_B}{n_T}$$

$$n_B = 10 \times 0.8$$

$$\boxed{n_B = 8}$$

Que - Calculate the mass percentage of benzene (C_6H_6) and carbon techraichlorid (CCl_4) if 22 g of benzene is dissolved in 122g of carbon tetrachride?

Soln → Mass % → (w/w) %

$$\text{Benzene} = \frac{W_{Benzene}}{W_{Benzene} + W_{CCl_4}} \times 100$$

$$= \frac{22}{(22+122)} \times 100 = \frac{22}{144} \times 100$$

$$= CCl_4 = \frac{122}{144} \times 100 \boxed{= 84.72}$$

$$\boxed{\text{Benze} = \frac{22}{144} \times 100 = 15.28}$$

Que - Calculate the mole fraction of benzene in solution containing 30% by mass in carbon tetrachloride?

Sol^n ⇒ 30% by mass — 30 gm solute (benzene) present in 100 gm of solution.

Mass of solvent (CCl_4) = (100 - 30) = 70 gm

$M_{C_6H_6} = 78$
$M_{CCl_4} = 154$

$$n_{Benzene} = \frac{W_{Benzene}}{M_{Benzene}} = \frac{30}{78}$$

$$n_{(CCl_4)} = \frac{n_{(CCl_4)}}{M_{(CCl_4)}} = \frac{70}{154}$$

$$X_{Benzene} = \frac{n_{Benzene}}{n_T} = \frac{30/78}{\frac{30}{78} + \frac{70}{154}}$$

$$= 0.459$$

~~$X_{CCl_4} = \frac{n_{CCl_4}}{n_T}$~~

$X_{CCl_4} = 1 - X_{Benzene} = 0.541$

12 X6

* — Molarity – Number of moles ~~present~~ of
(M) solute present in 1 Litre
Denotes Volume of solution.

$$M = \frac{\text{Moles of solute}}{\text{Volume of solution (L)}}$$

$$\boxed{M = \frac{n_{solute}}{V_{soln}\,(L)}}$$

if Que in gm sol^n = $\frac{1}{1000}$ convert in litre

1 M soln of glucose in water

if V = 1 L
$M = n_{solute}$
(Densit 1g/ml)

↓

1 Mole present in 1 litre volume of sol^n.

↓

Glucose ($C_6H_{12}O_6$)

$$n = \frac{\text{given mass}}{\text{M weight}}$$

$$1 = \frac{w}{180} \Rightarrow \boxed{w = 180g}$$

So, 1000 g solution

1000 − 180 = 820

↓

solvent

Que – Calculate the molarity of a solution containing 5g of NaOH in 450 mL soln.

NaOH
= 40 moles

$$M = \frac{n_{solute}}{V_{soln}\,(L)} = \frac{\overset{1}{\cancel{5}} \times 10\cancel{0}\cancel{0}}{4\cancel{0} \times \underset{9}{\cancel{45}}\cancel{0}} = \frac{10}{36}$$

$= 0.\underline{278}$ mol/Litre

* — Molality — Number of moles of solute Present in 1 kg weight of solvent.
(m)
denote

$$m = \frac{\text{moles of solute}}{\text{Mass of solvent (kg)}}$$

$$\boxed{m = \frac{n_{solute}}{W_{solvent}\,(kg)}}$$

if que give in gram $= \frac{n_{solute} \times 1000}{W_{solvent}\,(gm)}$

Note — Mass %, ppm, mole fraction a molality are independent of temprature where molarity depent upon temp because of volume.

Volume Temprature pe depend hai.
Mass 〃 〃 〃 nahi hai.

Lec - 2 18/July

Liquid Solution

* Solubility — Maximum amount of substance that can be dissolved in specified amount of solvent at a particular temprature and pressure.

Solubility depends upon nature of solute and solvent, temproture and pressure.

ex - 10 gram glucose dissolved in 1 litre H_2O (water).

* अगर 1 Glass water $\overset{a}{\text{मे}}$ 1 gram suger dissolved ho rahi hai to wo 1 glass water का solubility hai agar 1 gram se adhik suger dissolve na ho raha to.

Dissolution — when a solid solution is added to the solvent, some solute dissolves and its concentration increases in solution

* Solubility depends upon nature of the solute and solvent, temprature and pressure.

Crystallization – some solute particles in solution colloid with the solid solute particles and get saprated out of the solution.

Saturated and unsaturated solution:

A solution in which no more solute dissolved at the same temprature and pressure is called a saturated solution. * An unsaturated solution is one in which more solute can be dissolved at the same temprature and pressure.

* — solubitlity of solid in liquid:

Every solid does not dissolved in the given liquid.

Polar solutes dissolved in polar solvents non polar ~~solvents~~ solutes dissolved in non-polar solvents. Like dissolve like.

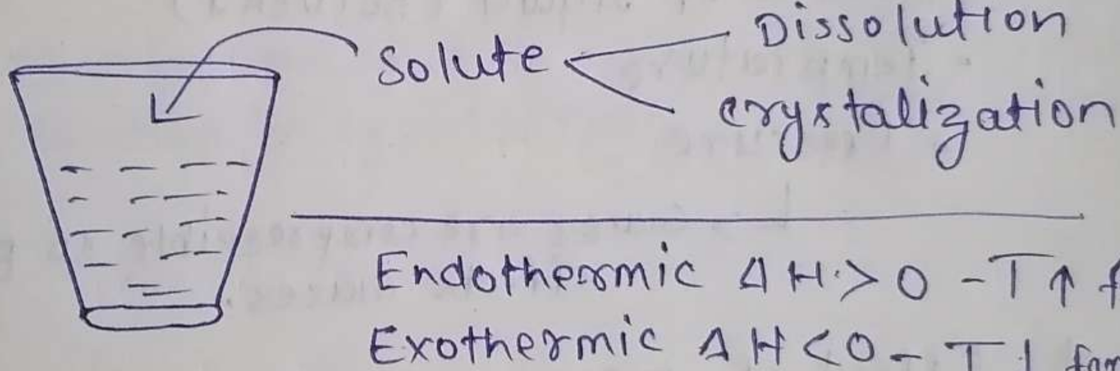
ex – Nacl, suger dissolve in H_2O and not in benzene. Nepthalene, Anthracene dissolve in benzene but not H_2O.

Polar = $\mu \neq 0$ – dipole (+ −)

दो charge hote hai

A stage is reached when dissolution and crystalization occurs at the same ~~time~~ rate. That means number of solute particles going into solution will be equal to the solute particles seprating out. This is dynamic equilibrium.

At a dynamic equilibirium, concerntration of solute in solution will remain constant under given temprature and pressure.



Endothermic $\Delta H > 0$ - T↑ forward
Exothermic $\Delta H < 0$ - T↓ forward.

* Effect of temprature on solubility of a solid in liquid.

solute + solvent $\rightleftharpoons$ solution

It is a dynamic equibilirium

so, according to the Le chartlier's principal.

* if dissolution proccess is endothermic solubility increases ($\Delta H > 0$) with increase in temprature

process is exothermic, solubillity

* - Effect of pressure :

There is no effect of pressure (As we consider solid and liquid to be incompressible).

* - solubility of Gases in liquid.

Gases ↓ Solute

liquid ↓ Solvent.

factors affecting solubillity.

- Nature of gas (solute)
- Nature of liquid (solvent)
- Temprature
- Pressure
  - ↳ Gases are compressible so pressure effects Gases.

* Effect of pressure by Henry's Law

The Henry's law state that at a constant temprature, the solubility of a gas in the a liquid is directly propotional to the partial pressure of the gas present above the surface of liquid or solution (in atmosphere)

At a constant temprature the solubility of a gas in a liquid is directly propotional to the pressure of the gas at which it is dissolved, or the partial presure of the gas vapoure phase (p), is propotional to the mole fraction of gas (x) in the solution.

X = Unitless

P = Pressure

Formula of Henry's Law.

$X \propto P$

$\boxed{P = K_h X}$

K_h = henry constant

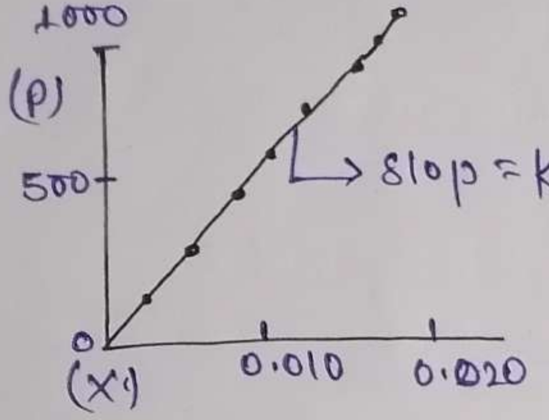
Units of K_h = atm / bar / pascal

$P = K_H X$ $\boxed{y = mx}$

Diffrent gases have diffrent values of K_h. It is fixed for a particular gas.

K_h increases as temprature increases

Heigher the values of K_h, lesser is the solubillity. (presure remains constant).



Mole fraction of HCl in its solution in cyclohexene

= water = 1 L = 1000 ml (d = 1gm/ml) = 1000g

$P_{N_2} = 0.987$ bar

$K_H = 76.48$ kbar

$= 76480$ bar

$P = K_H X$

$0.987 = 76480\, X_{N_2}$

$(n_{H_2O} = \frac{1000}{18})$

$X_{N_2} = \frac{0.987}{76480}$

$X_{N_2} = \frac{n_{N_2}}{n_{N_2} + n_{H_2O}}$

$\frac{0.987}{76480} = \frac{n_{N_2}}{+55.56}$

$= 0.7$

*- Effect of temprature on solubility

Solubility of gases decreases with increase in temprature at dissolution of gases in liquid on exothermic process.