Solution & Colligative Property

No. of Ques.
1 – 2
4 – 8 marks.

#A Homogenius mixture of two or more then two Components is k/a Solution.

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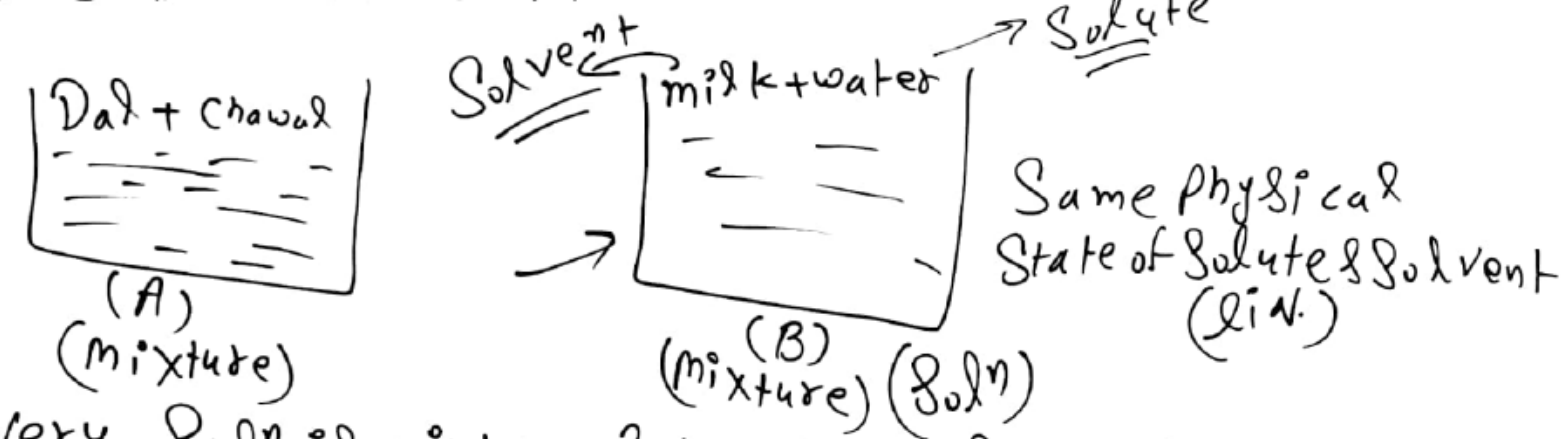

Every Soln is mixture But every mixture is not a Soln.

Solution = Solute + Solvent

Ex:- Sugar + water, glucose + water

In Solution Solute have more then one Component But Solvent always a Single Component.

Concentration of Solution :- (C)

Relative amount of Solute & Solvent present in a Solution. is k/a Conc. of Solution.

OR

No. of moles of Solute present in a 1 ltr of Solution. is k/a Concentration of Solution.

Unit :- $\frac{mol}{ltr.}$

$C = \frac{\text{no. of moles of Solute}}{\text{Volume of Soln (ltr.)}} \Rightarrow \boxed{C = \frac{n}{V_{(ltr)}}}$

gm glucose

(A) ⟹ 1 lt Soln. $n = \frac{90}{180} = 1/2$

(B) ⟹ 180 gm glucose | $n = \frac{180}{180} = 1 mol$ ⟹ 1 ltr Soln.

Types of Concentration Terms.

(1) % by mass $\left(\% \frac{w}{w}\right)$
(2) % by Volume (% v/v)
(3) % mass by Volume $\left(\% \frac{w}{V}\right)$
(4) molarity (m)
(5) Normality (N)
(6) molality (m)
(7) Formality(F)
(8) mole Fraction(X)
(9) Parts Per million (P.P.m) & Parts Per Billion (P.P.B)

(1) % by mass or % (w/w) $\div$ w(gm) of Solute Present in 100gm of Solution is k/a % by mass.

$$\% \, w/w = \frac{\text{mass of Solute in (gm)}}{\text{mass of Soln in gm)}} \times 100$$

ex:- 40% by mass of Aq. H_2SO_4 Soln.

$\Rightarrow$ 40 gm of Solute (H_2SO_4) present in 100 gm of Soln.

$\Rightarrow$ mass of Solute = 40 gm. mass of Solvent = 100 − 40
— " — Soln = 100 gm. = 60 gm.

(2) % By Volume or % (V/V) :-

V (ml) of Solute present in 100 ml of Soln. is k/a % (V/V).

$$\% (V/V) = \frac{\text{Volume of Solute in (ml)}}{\text{Volume of Soln in (ml)}} \times 100$$

ex:- 40 % by Volume of Aq. H_2SO_4 Soln

$\Rightarrow$ 40ml of Solute (H_2SO_4) present in 100ml of Soln.

Volume of Solute = 40ml, Vol. of Soln = 100ml, Vol. of Solvent = 60ml.

(3) % mass by Volume or % (w/V) ÷

w (gm) of Solute present in 100ml of Soln is k/a % (w/V).

% (w/V) = $\frac{\text{mass of Solute in gm (w)}}{\text{Volume of Soln in (ml)}} \times 100$

ex ÷ 40 % (w/V) Aq. Soln of H_2SO_4. $\{d_{Soln} = 1.2\ gm/ml\}$

⇒ 40gm of Solute (H_2SO_4) present in 100ml of Soln.

⇒ mass of Solute = 40gm.

⇒ Volum of Soln. = 100ml

⇒ mass of Solvent. =

$d_{Soln} = \frac{\text{mass of Soln}}{\text{Volume of Soln.}}$

mass of Soln = 1.2 × 100 = 120 gm.

mass of Solvent = 120 − 40 = 80gm.

(4) Molarity (M) :- Number of mole's of Solute present in 1 ltr of Solution is k/a molarity of Soln.

$$M = \frac{\text{No. of mole's of Solute}}{\text{Volume of Soln (ltr)}} \Rightarrow \boxed{M = \frac{n}{V_{(l+s)}}}$$

$\boxed{M = \frac{w_{(gm)}}{m.w} \times \frac{1}{V_{(l+s)}}}$; $\boxed{M = \frac{w_{(gm)}}{m.w} \times \frac{1000}{V_{(ml)}}}$ ***

Ex :- 2M. Aq. Soln of H_2SO_4.

$\Rightarrow$ 2 mole of H_2SO_4 Present in 1 ltr of Soln.

$\Rightarrow n = \frac{w_{(gm)}}{m.w} \Rightarrow w = n.m.w \Rightarrow w = 2 \times 98$

$\boxed{w = 196 \text{ gm.}}$ Ans.

(5) Normality (N) :- Number of gm-equivalent of Solute present in 1 ltr of Solution. $\rightarrow (w/E)$

$$N = \frac{\text{no. of gm-equivalent}}{\text{Volume of Soln (ltr)}} \Rightarrow \boxed{N = \frac{w_{(gm)}}{E} \times \frac{1}{V_{(ltr)}}}$$

Here $E \Rightarrow$ Equivalent weight $= \frac{\text{m.w.}}{\text{V.f.}}$; V.f. $\Rightarrow$ Valency factor.

$\boxed{N = \frac{w_{(gm)}}{E} \times \frac{1000}{V_{(ml)}}}$ Unit :- gm-eq./ltr.

ex :- 2N Aq. H_2SO_4 Soln. $\rightarrow$ V.f. =

$\Rightarrow$ 2-gm-eq. of H_2SO_4 present in 1 ltr of Soln.

$\frac{w}{E} = 2 \Rightarrow w = 2 \times 49 = \boxed{w = 98 \text{ gm.}}$ Ans.

$E = \frac{98}{2}$

$\boxed{E = 49}$