

SOLUTION

➤ Defination: solution is a homogeneous mixture of 2 or more substances in same or diff. physical phases.

- The substances forming the solution are called component of solution
- On basis of components of solution
2 component called Binary solution. [Solvent + solute]

➤ Solute & Solvent: In a binary solution, solvent is a component which is present in large quantity & another component called solute.

- If no. of solute is 2 then solution is known as Ternary solution.
- If no. of solute is 3 then solution is known as Quaternary solution.

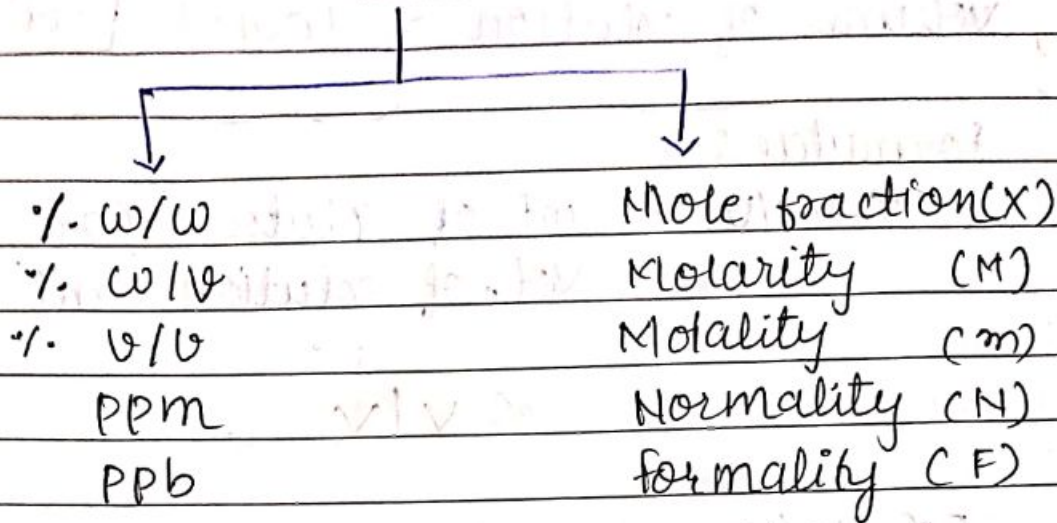
TYPES OF SOLⁿ:

TYPE OF SOL ⁿ	SOLUTE	SOLVENT	EXAMPLES
Gaseous sol ⁿ	Gas	Gas	mixture of O ₂ & N ₂
	Liquid	Gas	chloroform with N ₂
	solid	Gas	camphor in N ₂

Liquid solution	Gas	Liquid	O_2 in Water
	liquid	Liquid	C_2H_5OH in water
	solid	Liquid	glucose in water
Solid solution	Gas	solid	sol ⁿ of H_2 in Pd
	liquid	solid	Amalgam of Hg in ^{without}
	solid	solid	Cu dissolved in Au.

- If water is used as a solvent then solⁿ called Aquous soln. & If not then solⁿ called Non-aquous soln.
- Depending upon the amount of solute dissolved in solvent we have:—
 - i. Unsaturated solⁿ: More solute can be dissolved without raising temp. called unsaturated solution.
 - ii. Saturated solⁿ: No solute can dissolve further without giving temp. called Saturated solution.
 - iii. Supersaturated solⁿ: A solution which contains more solute than that would be necessary to saturate at given temp called supersaturated solⁿ.

(unit to measure conc.)

concentration of solⁿ% W/W5% W/W NaOH solⁿ.

It means 5gm NaOH available in 100gm of solution.

We have given data, ∴

wt of solute = 5gm

wt of solution = 100gm

wt of solvent = 100 - 5 = 95gm

Formulae:

$$\%W/W = \frac{\text{wt of solute (gm)}}{\text{wt of solution (gm)}} \times 100$$

% W/V

5% W/V it means,

5gm NaOH available in 100 ml of solution.

data given:

wt of solute

= 5 gm


volume of solution

= 100 ml

wt of solvent of
solⁿ ⇒ X

Formulae:

$$\% \text{ w/v} = \frac{\text{wt of solute (gm)}}{\text{Vol. of solution (ml)}} \times 100$$

 % v/v

c

5% v/v means,

5 ml CH_3OH is available in 100 ml of solution

data given:

volume of solute = 5 ml

volume of solution = 100 ml

volume of solvent = 95 ml

Formulae:

$$\% \text{ v/v} = \frac{\text{Vol of solute (ml)}}{\text{Vol of solution (ml)}} \times 100$$

d

PPM:

We can denote PPM as w/w, w/v, & v/v.

But here mainly in % w/v,

5% PPM (w/v) NaOH solⁿ,

It means 5 gm NaOH solⁿ available in one million (ml) of solⁿ.

Formulae:

$$\%W/V = \frac{\text{wt of solute (g)}}{\text{vol. of sol}^n \text{ (ml)}} \times 10^6$$

e.

MOLE FRACTION

Formulae:

$$\text{Mole fraction } (X_B) = \frac{\text{No. of moles of solute } (n_B)}{\text{No. of moles of solute } (n_B) + \text{No. of moles of solvent } (n_A)}$$

$$(X_B) = \frac{n_B}{n_B + n_A} = \frac{W_B / M.W_B}{\frac{W_B}{M.W_B} + \frac{W_A}{M.W_A}}$$

where W_B = Mass of solute (B)
 M_B = Molar mass of solute (B)
 W_A = given mass of solvent (A)
 M_A = given molar mass of solvent (A)

MOLARITY

No. of moles of solute present in 1 litre of solution. ($1 \text{ l} = \text{dm}^3$)

Molarity varies with temperature due to change in volume of solution.

Formulae:

$$M = \frac{\text{No. of moles of solute}}{\text{volume of solution (litre)}}$$

$$M = \frac{\text{Mass of solute} \times 1000}{\text{Mol. wt of solute (gm)} \times \text{Vol of sol}^n \text{ (ml)}}$$

5 M or 5 molar solution (NaOH)

it means 5 moles of NaOH present in 1 litre of solution.

MOLALITY (m)

No. of moles of solute present in per kg solvent.

Formulae:

$$m = \frac{\text{Moles of solute}}{\text{Mass of solvent (kg)}} = \text{mol/kg}$$

5m or 5 molal solution (NaOH),

It means 5 moles of NaOH available in 1 kg of solvent.

QNAy

Find out the following conc. term in 4% w/w of NaOH solⁿ. (Density of solution 1.1 gm/ml)

- (a) Molarity
- (b) Molality
- (c) Mole fraction NaOH.

(a)
$$M = \frac{\text{Moles of solute} \times 1000}{\text{M. wt of solute} \times \text{vol. of soln}}$$

$$= \frac{4 \times 1000}{40 \times 100}$$

Density = 1.1 M

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

moles = 0.1

? = mass of solvent

$$d = \frac{m}{V}$$

$1.1 \times 100 \times 1.1 = m$

110 = mass of solution

106 = mass of solvent

put the values

$$= \frac{0.1 \times 1000}{106}$$

$$= \frac{100}{106} \times 50$$

$$= 0.91m$$

$$\text{Mole fraction} = \frac{n_B}{n_B + n_A}$$

$$= \frac{\text{wt}}{\text{m.wt}} \text{] solute}$$

$$\text{solute} \left[\frac{\text{wt.}}{\text{m.wt}} + \frac{\text{wt}}{\text{m.wt}} \right] \text{ solvent}$$

$$= \frac{0.1}{0.1 + \frac{106}{18}} = \frac{4}{40}$$

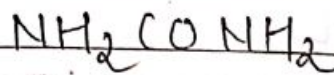
$$= \frac{1.8 + 106}{18} = \frac{40 + \frac{106}{18}}{180}$$

$$= \frac{52 + 4240}{720}$$

$$= \frac{4292}{720}$$

$$=$$

0.01 m = molality \rightarrow 18 \rightarrow m.wt of
 Find = mole fraction solvent
 wrea



$$X = \frac{n_B}{n_B + n_A}$$

$$\text{wrea} \quad n_B + n_A$$

$$= \frac{0.01}{0.01 + \frac{1000}{18}}$$

$$= \frac{0.01}{0.01 + 55.5}$$

$$= \frac{0.01}{55.5} = \frac{1 \times 100}{555 \times 100} = 0.016$$