

Q.1 What is solution? give its classification.

Ans - The homogeneous mixture of two or more than two substances is called solution.

Example - Sugar solution, brass (mixture of Cu and Zn)  
The solution of two compounds known as binary

Solution

Solvent : High quantity of substance in solution is called solvent.

Solute : Low quantity of substance in solution is called solute.

Classification :

On the basis of Concentration.

i) Dilute Solution :

A solution in which a relatively small amount of solute is dissolved in the solvent is called dilute solution.

ii) Concentrated Solution :

A solution in which relatively a large amount of solute dissolved in the solvent is called concentrated solution.

iii) Saturated Solution :

A solution in which no more solute can be dissolved at a given temperature is called saturated solution.

iv) unsaturated solution :

A solution in which some more solute can be dissolved at a given temperature is called an unsaturated solution.



v) Supersaturated Solution %

A solution in which excess

of solute is dissolved that can be present in a saturated solution is called supersaturated solution.

Qn.2 Define the Concentration of Solution?

Ans.  $\Rightarrow$  The amount of solute dissolved in a given amount of solvent or solution is called Concentration of Solution.

$$\text{Concentration} = \frac{\text{amount of solute}}{\text{amount of solution}}$$

Qn.3 Define the following

1) Percentage %

The percentage is expressed as the

parts of solute dissolved per 100 parts of solution by weight or volume.

i) Percentage weight by volume %

Weight of solute

(in gram) dissolved in per 100 ml of solution is called Volume Percentage. It is represented by V

$$\text{Percentage} = \frac{\text{Weight of solute}}{\text{Volume of solution (in ml)}} \times 100$$

ii) Percentage by weight %

The mass of solute dissolved

in per 100 gram of solution is known as weight/mass percentage

$$\text{Percentage} = \frac{\text{Weight of solute}}{\text{Weight of solution}} \times 100$$



example 1) Calculate the amount of NaOH in 200gm, 10% NaOH solution.

$$\text{Solution} \rightarrow \text{Percentage Concentration} = \frac{\text{mass of Solute} \times 100}{\text{mass of Solution}}$$
$$10 = \frac{\text{mass of NaOH} \times 100}{200}$$

Amount of NaOH = 20gm. Ans.

exam 2  $\Rightarrow$  Calculate percentage of  $\text{H}_2\text{SO}_4$  in a solution having 40g.  $\text{H}_2\text{SO}_4$  in 1000 ml solution.

$$\text{Solution} \rightarrow \text{Percentage} = \frac{\text{mass of Solute} \times 100}{\text{Volume of Solution}}$$

$$\text{Percentage} = \frac{40 \times 100}{1000}$$
$$= 4.0\% \text{ Ans}$$

2) Strength or Gram per litre Concentration  $\rightarrow$

The amount

of solute in gram dissolved in one litre of a solution is known as strength or gram per litre concentration. It is represented by S

$$\text{Strength} = \frac{\text{mass of Solute (in gm)}}{\text{Volume of Solution (in litre)}}$$
$$= \frac{\text{mass of Solute} \times 1000}{\text{Volume of Solution}}$$

$$S = \frac{W_B}{V} \times 1000$$



### 3) Molarity of Solution :-

The number of moles of Solute dissolve in 1 litre / 1000 ml of Solution is known as molarity of Solution. it is represented by  $M$

$$M = \frac{\text{No. of moles of Solute}}{\text{Volume of Solution (L)}}$$

$$M = \frac{\text{mass of Solute (in gram)}}{\text{molecular weight of Solute}} \times \frac{1000}{\text{Volume of Soln (in ml)}}$$

$$M = \frac{W_B}{M_B} \times \frac{1000}{V}$$

example :- 5.85 gm of NaCl is dissolved in 200 ml of water. Calculate the molarity of Solution.

Solution :- we know that

$$M = \frac{W_B \times 1000}{M_B \times V}$$

Given :-  $W_B = 5.85 \text{ gm}$ ,  $V = 200 \text{ ml}$ ,  $M_B = 58.5$

$$M = \frac{5.85 \times 1000}{58.5 \times 200}$$

$$M = \frac{1}{2} = 0.5 \text{ gm. Ans.}$$

### 4) Molality :-

The number of moles of Solute dissolved in 1 kg / 1000 gm of Solution Solvent is known as molality of Solution. it is denoted by  $m$



$$m = \frac{\text{No. of moles of Solute}}{\text{mass of Solvent (kg)}}$$

$$m = \frac{\text{mass of Solute}}{\text{molecular mass of Solute}} \times \frac{1000}{\text{mass of Solvent (in gram)}}$$

$$m = \frac{W_B \times 1000}{M_B \times W_A}$$

example :-

Calculate the molality of Solution in which 4 g NaOH is dissolved in 500 gm  $H_2O$

Solution :- We know -

$$m = \frac{W_B \times 1000}{M_B \times W_A}$$

Given :-  $W_B = 4 \text{ gm}$ ,  $W_A = 500 \text{ gm}$ ,  $M_B = 40$

$$m = \frac{4 \times 1000}{40 \times 500}$$

$$m = \frac{1}{5} = 0.2 \text{ gm. Ans.}$$

⑤ Normality :-

The number of gram equivalent of Solute dissolved in one litre / 1000 ml of Solution is called normality of Solution. it is denoted by N

$$N = \frac{\text{No. of gram equivalent of Solute}}{\text{Volume of Solution (in L)}}$$

$$N = \frac{\text{mass of Solute} \times 1000}{\text{equivalent mass of solute} \times \text{Volume of Solution (in L)}}$$



$$N = \frac{M_B}{E} \times \frac{1000}{V}$$

Note:  $\rightarrow$  Equivalent weight =  $\frac{\text{molecular weight}}{\text{valency factor (X)}}$

valency factor "X"

For acids

in case of acids  
the valency factor  
X is Basicity  
mean How many  
 $H^+$  ions donate in  
aqueous solution

For Bases

in case of Base  
the valency factor  
X is acidity mean  
How many  $OH^-$   
ions donate in  
aqueous solution

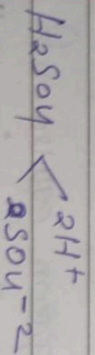
For Salts

in case of  
Salts the  
X Factor  
is no. of  
cation (+ve)  
or anion (-ve)

example  $HCl \rightarrow H^+ + Cl^-$

Basicity = 1 (X=1)

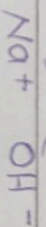
$$\text{equivalent weight} = \frac{1 + 35.5}{1} = 36.5 \text{ Ans.}$$



Basicity (X) = 2

$$\text{equivalent weight} = \frac{98}{2} = 49$$

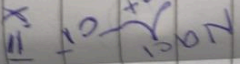
ex  $\rightarrow NaOH$



acidity (X) = 1

$$\text{equivalent weight} = 40$$

$$= 40$$



X=1

$$\text{equivalent weight} = 58.5$$

$$= 58.5$$



then  
mole fraction of Solute  $X_B = \frac{n_B}{n_A + n_B}$   
mole fraction of Solvent  $X_A = \frac{n_A}{n_A + n_B}$

Note  $\Rightarrow$  The sum of mole fraction of all Components of soln is always 1

$$X_A + X_B = 1$$

Ppm  $\Rightarrow$

Part per million is known as ppm Concentration. it may be define as -  
Number of part of Solute in one million part of Solution is known as ppm Concentration

$$P_{pm} = \frac{\text{Part (mass) of Solute}}{\text{mass of Solution}} \times 10^6$$

Qus. 4 Give the differences b/w Molarity and molality?  
Ans.

Molarity	Molality
1) No. of moles of Solute dissolved in 1 litre of Solution is called molarity	1) No of moles of Solute dissolved in 1 kg of Solvent is called molality
2) It is represented by M	it is represented by m.
3) it is change with temp.	it does not change with temp.
4) Expressed in mole per litre	expressed in mole per kg
5) $M = \frac{W_B \times 1000}{M_B \times V}$	5) $m = \frac{W_B \times 1000}{M_B \times W_A}$



Q. 5 Calculate the amount of urea ( $\text{NH}_2\text{CONH}_2$ ) which is dissolved in 250 ml solution (molarity is  $M/40$ )

Ans  $\Rightarrow$  Given :-

molarity of solution  $M = 1/40$

Volume of solution  $V = 250 \text{ ml}$

molar mass of urea  $M_B = 60$

Weight of urea  $M_B = ?$

$$\text{Molarity } M = \frac{M_B \times 1000}{M_B \times V}$$

$$\frac{1}{40} = \frac{M_B \times 1000}{60 \times 250}$$

$$\frac{1}{40} = \frac{M_B}{15}$$

$$M_B = \frac{15 \times 3}{40 \times 8}$$

$$M_B = \frac{3}{8} \text{ gm.}$$

Q. 6