## Types

### Gaseous

Gas Gas → Mixture of $O_2$ and $N_2$

Liquid Gas → Chloroform with $N_2$

Solid Gas → Camphor in $N_2$

### Liquid

Gas Liquid → $O_2$ dissolved in water

Liquid Liquid → Ethanol dissolved in water

Solid Liquid → Glucose dissolved in water

### Solid

Gas Solid → $O_2$ in Pd

Liquid Solid → Amalgam of Hg with Na

Solid Solid → Cu dissolved in gold

## Solubility

### Solid in liquid

#### Effect of Temperature

Endothermic $\Delta_{sol} H > O$, Solubility Increases

Exothermic $\Delta_{sol} H < O$, Solubility Decreases

#### Effect of Pressure

Not significant

### Gas in Liquid

#### Effect of Temperature

Increases with decrease in temperature

#### Effect of Pressure

Increases with increase in pressure

#### Henry's Law

Partial pressure of gas in vapour phase is proportional to the mole fraction of gas in the solution.

$p = K_H x$

## Raoult's Law

For any solution, the partial vapour pressure of each volatile component is directly proportional to its mole fraction.

| Obey | Do not obey |
|---|---|
| Ideal solution | Non-Ideal solution |
| (n-hexane and n-heptane) | (Mixture of chloroform and acetone) |

**Positive deviation**

$\Delta V_{mix}$ = positive

$\Delta H_{mix}$ = positive

Maximum boiling Azeotrope

**Negative deviation**

$\Delta V_{mix}$ = negative

$\Delta H_{mix}$ = negative

Maximum boiling Azeotrope

## Colligative Properties

Osmotic pressure ⟶ $\pi = CRT$

Depression in freezing point ⟶ $\Delta T_f = \dfrac{K_f \times W_2 \times 1000}{M_2 \times W_1}$

Elevation of boiling point ⟶ $\Delta T_b = \dfrac{K_b \times W_2 \times 1000}{M_2 \times W_1}$

Realtive lowering of vapour pressure ⟶ $\dfrac{W_2 \times M_1}{M_2 \times W_1} = \dfrac{P^o{}_1 \times P^o{}_1}{P^o{}_1}$

## Abnormal Molecular Mass

**Molecular mass differnet form expected value**

Van't Hoff Factor = $\dfrac{\text{Normal molar mass}}{\text{Abnormal molar mass}}$

## Concentration of Solutions

**Mass by volume percentage (w/v)**

$\dfrac{\text{Mass of Solute}}{\text{Volume of Solution}} \times 100$

**Volume percentage (v/v)**

$\dfrac{\text{Volume of Component}}{\text{Total volume of Solution}} \times 100$

**Mass percentage (w/w)**

$\dfrac{\text{Mass of Component in Solution}}{\text{Total mass of Solution}} \times 100$

**Parts per million: for trace quantities**

$\dfrac{\text{No. of parts of Component} \times 10^6}{\text{Total no. parts of components of Solution}}$

**Molarity**: Number of gram equivalents of the solute dissolved in one litre of solution

$\dfrac{\text{No.of moles of Solute}}{\text{Volume of Solution}} \times 100$

**Molality**: Number of moles of solute per kilogram of the solvent

$\dfrac{\text{No. of moles of Solute}}{\text{Mass of Solution}} \times 100$

**Normality**: Number of gram equivalents of the solute dissolved in one litre of solution

$\dfrac{\text{No. of grams equivalentof Solute}}{\text{Volume of Solution}} \times 100$

Gram equivalent of Solute

$\dfrac{\text{Mass of solute}}{\text{Equivalent weight}}$

Equivalent weight= $\dfrac{\text{Molecular mass}}{\text{Valency}}$

**Mole Fraction**

$\dfrac{\text{No. of Moles of Component}}{\text{Total no. moles of all components}}$