:ABNORMAL MOLAR MASS:

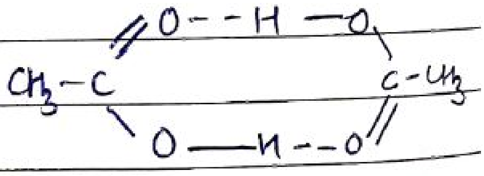
- Molar mass that is either lower or higher than expected or normal molar mass called abnormal molarmass.

- It can occurs due to following reasons.

I. Association of molecules:
- Higher M.mass are observed in case of association of molecules.

★ example:
- CH_3COOH is dissolved in Benzene it forms dimmer due to association of molecules hence it show molar mass $\boxed{120 \text{ (normal} = 60)}$
- Hence no of solute particles become nearly half of the initial no of solute

$2CH_3COOH \rightleftharpoons (CH_3COOH)_2$ or



II. Dissociation of molecules:
- Lower values of molar mass are observed in case of dissociation of molecules.

★ example:
- dissociation of KCl in water into K^+ & Cl^-

$\boxed{\text{m.mass} \Rightarrow 37.25 \left(\frac{74.5}{2}\right)}$

$$KCl \rightleftharpoons K^+ + Cl^-$$

- These observed values are corrected by multiplying with Vant's Haff's Factor ⓘ.

: VANT'S HAFF'S FACTOR : — (i)

(Practical)

- The ratio of observed colligative property to the calculated colligative property. known as van't haff's factor.

$$i = \frac{\text{Normal molar mass}}{\text{Abnormal molar mass}}$$

[when no association or dissociation)

$$i = \frac{\text{observed colligative property}}{\text{calculated colligative property}}$$

$$i = \frac{\text{Total no. of moles of particles}}{\text{No. of moles of particles}}$$

[After dissociation or association]

[Before dissociation or association]

- Actually, abnormal molar masses are experimently determined when association or dissociation takes place.

Now, there may be 3 cases.

a. - For a solute which don't undergo any dissociation or association.

$\boxed{i = 1,}$

- so observed colligative property is equal to calculated colligative property.

- ex: glucose, urea, sucrose when dissolved in water.

b. - For a solute undergoes dissociation,

no. of solute particles in solution increases and therfor

$\boxed{i > 1}$

- means observed colligative property is higher than calculated colligative property

- example: complete dissociation occurs when,

$i = 2$ KCl, $NaNO_3$ $i = 3$ $CaCl_2$, $Mg(NO_3)_2$, Na_2SO

c. - For a solute which undergoes association, no of solute particles decreases

$\boxed{i < 1}$

- means observed colligative property is lower than calculated colligative property.

example: $i = \frac{1}{2}$ CH_3COOH, C_6H_5OH, $HCOOH$

||PYQ||

$$K_4[Fe(CN)_6] \longrightarrow 4K^+ + [Fe(CN_6)]^{-4}$$

$$i = 5$$

Friday
29-03-024

:MODIFIED FORM OF C.PROPERTIES:

- To correct the observed value of m.mass van't haff factor must be included in diff. expression of colligative property.

a. Relative lowering in vapour pressure of solvent $= \frac{P_1^\circ - P_1}{P_1^\circ} = i.\frac{n_B}{n_A}$

b. elevation of boiling point : $\Delta T_b = i.k_b.M$

c. Depression of freezing point : $\Delta T_f = i.K_f.M$

d. osmotic pressure of solution :
$$\pi = \frac{i.n_B.R.T}{v}$$

R/N BETWEEN α & i :

(Vant Hoff factor & degree of dissociation)

- if one molecule of substance A get dissociated into n particles or molecule nP, the degree of dissociation can be find out as :

$$A \longrightarrow nP$$

Initially : 1n   0

Equillibrium : $1-\alpha$ $n\alpha$

Total no. of moles at equillibrium :

$$= 1-\alpha+n\alpha$$

∴ n = no of particles (product) after dissociation

$$i = \frac{\text{Total no. of moles of particle After dissociation}}{\text{Total no. of moles of particle Before dissociation}}$$

$$i = \frac{1-\alpha+n\alpha}{1}$$

$$\alpha = \frac{i-1}{n-1}$$

findout the vant Haff factor for NaCl aq. sol^n :

if α = 100 % $\boxed{0.01}$

if α = 70 % $\boxed{0.7}$

ⓐ $\alpha = \frac{i-1}{2-1}$

$1 = \frac{i-1}{1}$

$1+1 = i$

$\boxed{2 = i}$

ⓑ $\alpha = \frac{i-1}{2-1}$

$0.7 = \frac{i-1}{1}$

$0.7+1 = i$

$\boxed{1.7 = i}$

—: **R/N B/W α & i** :—

[Degree of association & Van't Hoff factor]

$$\alpha = \frac{1-i}{1-\frac{1}{n}}$$

Question में mention हो (%) α of dissociation
or association then i = 1
or salt के लिए we have to find it = i
or carbohydrate mainly sugars ke liye
always i = 1 consider करना होता है।

:IMP. FORMULAE:

Page No.
Date

I. $\% \, w/w = \frac{\text{wt of solute (gm)}}{\text{vol. of solution (gm)}} \times 100$

100

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

III. $\% \, v/v = \frac{\text{wt. of solute (ml)}}{\text{vol. of solution (ml)}} \times 100$

IV. $\text{ppm} = \frac{\text{w.t of solute (gm)}}{\text{vol. of solution (ml)}} \times 10^{6}$

V. Mole fraction (X) $= \frac{n_B}{n_B + n_A}$ $\frac{\text{moles of solute}}{\text{moles of solute + solvent}}$

A → solvent
B → solute

VI. $X_A + X_B - - - - - - + X_n = 1$

VII. $\text{Molarity (M)} = \frac{n_B}{\text{volume of sol}^n \text{ (ml)}} \times 1000$

VIII. $\text{Molality (m)} = \frac{n_B}{\text{wt of solvent (gm)}} \times 1000$

IX. Henry law

$P = K_h X_S$

$P_g = K_h \times X_g$

$\frac{25 \times 10^{4}}{10^{4}}$

Rault's law:

$$PT = P_1 + P_2 \qquad P_1 + P_2 = 1$$

$$PT = P^\circ_1 X_1 + P^\circ_2 X_2 \qquad P_1 = 1 - P_2$$

$$PT = [1 - P_2^\circ].X_1 + P_2^\circ X_2$$

X in v.phase =

$$X_A = \frac{nA}{nA + nB} \qquad Y_A = \frac{PA}{PA + PB}$$

$$X_2 = \frac{P_{total} - P_1^\circ}{P_1^\circ}$$

Relative lowering in vapour pressure $= \frac{P^\circ A - PA}{P^\circ A} = XB$

$$= \frac{P^\circ A - PA}{P^\circ A} = \frac{nB}{nB + nA}$$

For dilute solⁿ:

$$MB = \frac{WB}{WA} \times MA \times \frac{PA}{(P^\circ A - PA)}$$

elevation in B.P =

$$\Delta Tb = Kb \times m$$

$$MB = \frac{Kb \times WB \times 1000}{\Delta Tb \times WA}$$

Δ B.P for solvent $= \frac{RT b^{\circ 2}}{1000 \times l\,vap.}$

Depression in freezing point =

$$MF = \frac{Kf \times WB \times 1000}{\Delta Tf \times WA}$$

ΔT_F for solvent $= \frac{RT^\circ F^2}{1000 \times l.fusion}$

XIV. $\pi = \frac{W_B \times RT}{M.wt_B \times \text{Volume}}$

XV. $i = \frac{\text{Total no. of moles of particles After dissociation}}{\text{Total no. of moles of particles before dissociation}}$

XVI. $R.L.V.P = i.\frac{n_B}{n_A}$

XVII. $\Delta T_b = i.K_b.M$ M = molarity

XVIII. $\Delta T_F = i.K_f.M$

XIX. $\pi = i\frac{n_B.R.T}{V}$

Q. (gm/c)3 Insulin is dissolved in suitable solvent and osmotic pressure (π) of sol^n of various concen. C is measured at 20°C. The slopplot of π against C is found to be 4.65×10^{-3}. mwt of Insulin

sol^n: $\pi = CRT$ $\pi/C = C = gm/c^3$ $c^3 = ml$

$$\pi = \frac{wt \times RT \times 1000}{mwt \times V}$$

$$mwt = \frac{\boxed{wt} \times R \times T \times 1000}{\boxed{\pi} \times \boxed{V}}$$

$$= \frac{0.0821 \times 293 \times 1000}{4.65 \times 10^{-3}}$$

$$= \frac{0.0821 \times 293}{4.65}$$