JEEt Lo 2021

CHEMISTRY

VANT OFF LAW SOLUTIONS

| HARSH SIR |

Vedantu JEE

Harsh Maheshwari

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Arvind Sir

Theory Class: Tuesday & Friday (9pm)
MCQ Class: Thursday (8pm)

Harsh Sir

Theory Class: Monday & Thursday (9pm)
MCQ Class: Wednesday (8pm)

Suri Sir

Theory Class: Wednesday & Saturday (9pm)
MCQ Class: Monday (8pm)

Daily Schedule


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SOLUTIONS (Session 2)

Learning objectives:

1. Van’t Hoff Factor
2. Colligative properties

Quick Recap

1. Solution: A solution is a homogeneous mixture of two or more components.

   Eg. Common Salt in water.
2. Components of solution: a. Solvent b. Solute
3. Strength of the solution
4. Factors on which solution depends:
   a. Types of solvent.
   b. Types of solute.
   C. Amount of solute.

Properties based on the amount of solute:

The properties which depend on the amount of solute or number of particle of solute, but not on the type of solute are known as colligative properties.

These are:

1. Elevation in boiling point (ΔT_b)
2. Depression in freezing point (ΔT_f)
3. Relatively lowering of Vapour pressure ($\Delta P/P_0$)
4. Osmotic pressure (π)


LET'S GET
STARTED!

Molecular View of Solution Formation

Note :

For calculation of colligative properties, van't hoff factor needs to be calculated.

Van't Hoff factor (i)

$$i = \frac{\text{Observed colligative property}}{\text{Theoretical colligative property}}$$

$$i = \frac{\pi_{observed}}{\pi_{Theoretical}}$$

When i = 1,

$\pi_{observed} = \pi_{Theoretical}$, and

When i ≠ 1,

$\pi_{observed} \neq \pi_{Theoretical}$

Calculation of Van't Hoff Factor:

a. Dissociation.

$A \rightarrow nB$

(One particle $\rightarrow$ n particles)

$$i = 1 + (n-1)\alpha$$

$$= \frac{M_{theoretical}}{M_{Observed}}$$

Here α is the degree of dissociation.

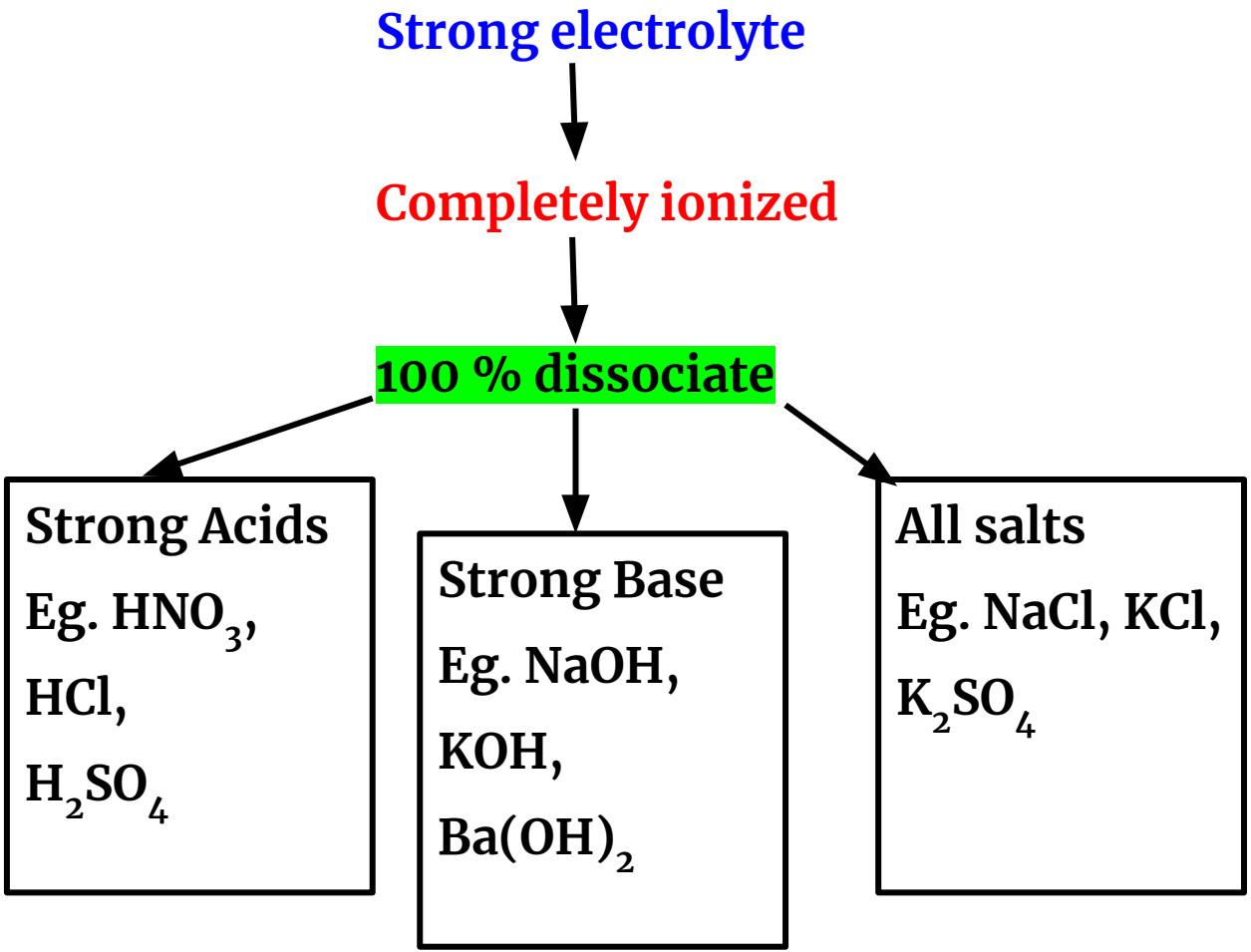
M is the molar mass

When $n > 1$,

Then $i > 1$

Therefore, $M_{th.} > M_{obs}$

Case 1:


Strong electrolyte
Completely ionized
100 % dissociate
Strong Acids
Eg. HNO_3,
HCl,
H_2SO_4
Strong Base
Eg. NaOH,
KOH,
$Ba(OH)_2$
All salts
Eg. NaCl, KCl,
K_2SO_4

$\alpha = 100\ \%$

Or, $\alpha = 1$

Here α = degree of ionization

$$i = 1 + (n-1)\alpha$$

$$i = 1 + (n-1)1$$

$$i = n$$

$A_2B \longrightarrow A_2 + B$ (Dissociation)

$A_2 \longrightarrow 2A^+ + B^-$ (ionization)

Eg. i = n (no. of ions formed)

HCl

H_2SO_4

$Ba(OH)_2$

$NaCl$

$K_4[Fe(CN)_6]$

Case 2:

Weak electrolyte ($\alpha < 100\ \%$)

($\alpha < 1$)

Weak Acid	Weak Base
Eg. CH_3COOH	Eg. NH_4OH,
HCN, H_3PO_4	$C_6H_5NH_3$

$$i = 1 + (n-1)\alpha$$

Question:

Calculate i for CH_3COOH, if it is 10 % ionized.

Question:

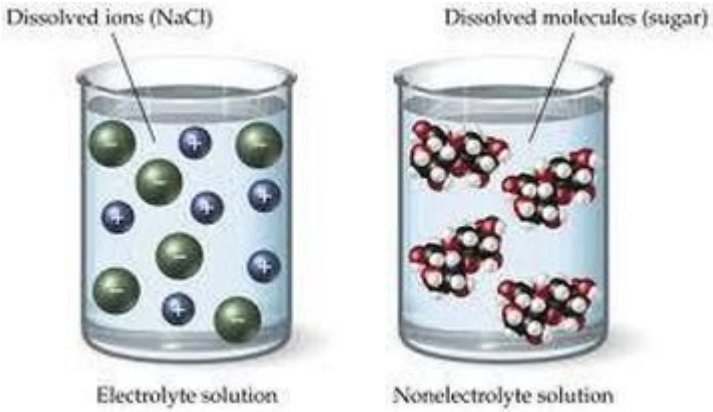
Calculate i for $K_4[Fe(CN)_6]$, if it is 90 % ionised.

b. Non electrolyte:

- It does not ionize. So $\alpha = 0$

  Therefore , $i = 1$

  Also, $M_{th.} = M_{obs.}$



- Eg. Glucose, sucrose, urea and mostly
  - organic compounds.

c. Association:

$2A \longrightarrow A_2$ (Dimer)

$3A \longrightarrow A_3$ (Trimer)

$nA \longrightarrow A_n$ (polymer)

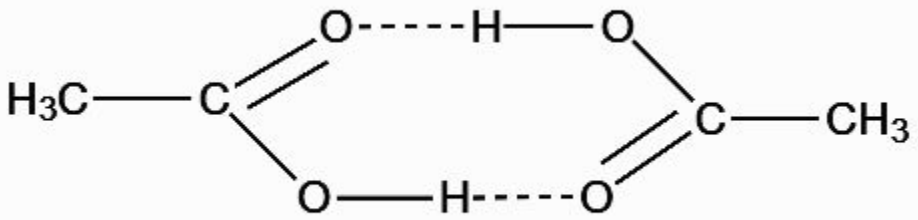
Since, $n \longrightarrow 1$

Therefore, $1 \longrightarrow \frac{1}{n}$

$$i = 1 + \left(\frac{1}{n} - 1\right)\beta < 1$$

β is the degree of dissociation.

Eg. C_6H_6 + CH_3COOH



H-Bonding

M = 120 g

$$i = 1 + \left(\frac{1}{n} - 1\right)\beta < 1$$

$$\frac{M_{theoretical}}{M_{observed}} < 1$$

Or, $M_{theoretical} < M_{observed}$

Question:

CH_3COOH is dimerised upto 20 % in benzene. Calculate i.

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Assignments

Notes

Daily Update

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