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Dep-I(H) - Solution

Topics - Deviation of Non-ideal Solution from ideality & Colligative property

Non-ideal Solution:-

The solution which do not obey Raoult's law & are accompanied by change in enthalpy & change in volume.

For a non-ideal binary solution, none of the component follows Raoult's law. They are further classified into two types.

(A) Solution Showing Positive Deviation

Total vapour pressure of such solution is higher than expected. The deviation is shown by liquid pairs in which addition of one liquid decrease the molecular attraction force acting among the molecules of other liquid.

In such solution, solvent-solvent attraction & solute-solute interaction are stronger than solvent-solute interaction.

Such solution have following features

(1) Partial vapour pressure of each component is higher than expected

from Raoult's law:

$$P_A > P_A^0 \cdot X_A, \quad P_B > P_B^0 \cdot X_B$$

(2) Total V.P. of solution is higher than expected from Raoult's law

$$P_s > (P_A + P_B)$$

(3) Therefore boiling point of such solution is lower than expected value.

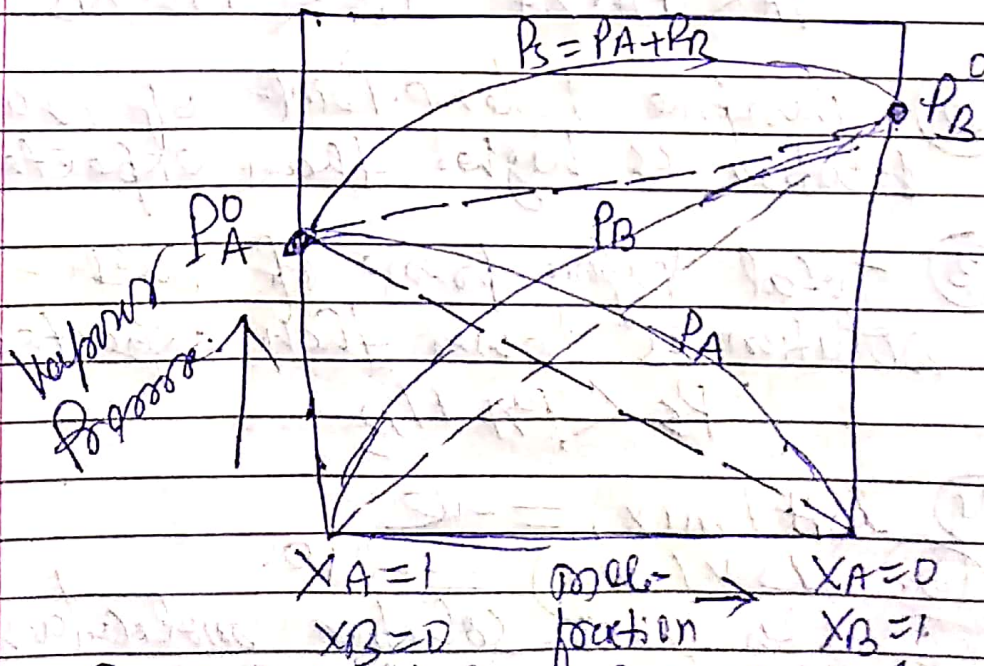
(4) $\Delta H(\text{mixing})$ is +ve.

Energy is required to break A-A or B-B attractive force.

(5) $\Delta V(\text{mixing})$ is +ve. After mixing increase in volume due to decreasing attractive force.

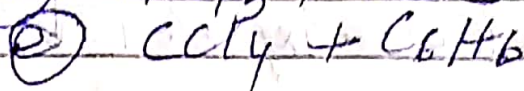
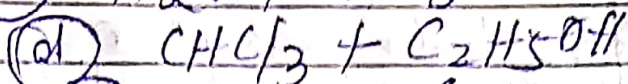
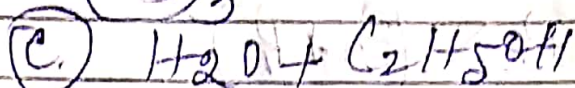
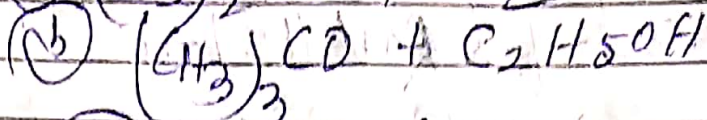
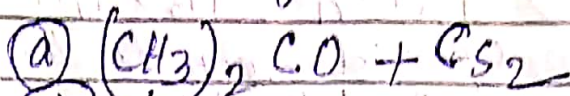
Graphical Representation

Curves showing positive



Deviation from Raoult's law.

Examples of -ve Deviation :-



Negative Deviation from Raoult's law

Following are the characteristics of non-ideal showing negative deviation

- (1) Partial Vapour-Press^r of each-Component is lower than expected.

$$P_A < P_A^0 \cdot X_A, \quad P_B < P_B^0 \cdot X_B$$

- (2) Therefore boiling-Point of such solution is higher than expected.

- (3) Total vapour-press^r of such-solution is lower than expected.

$$P_s < P_A + P_B$$

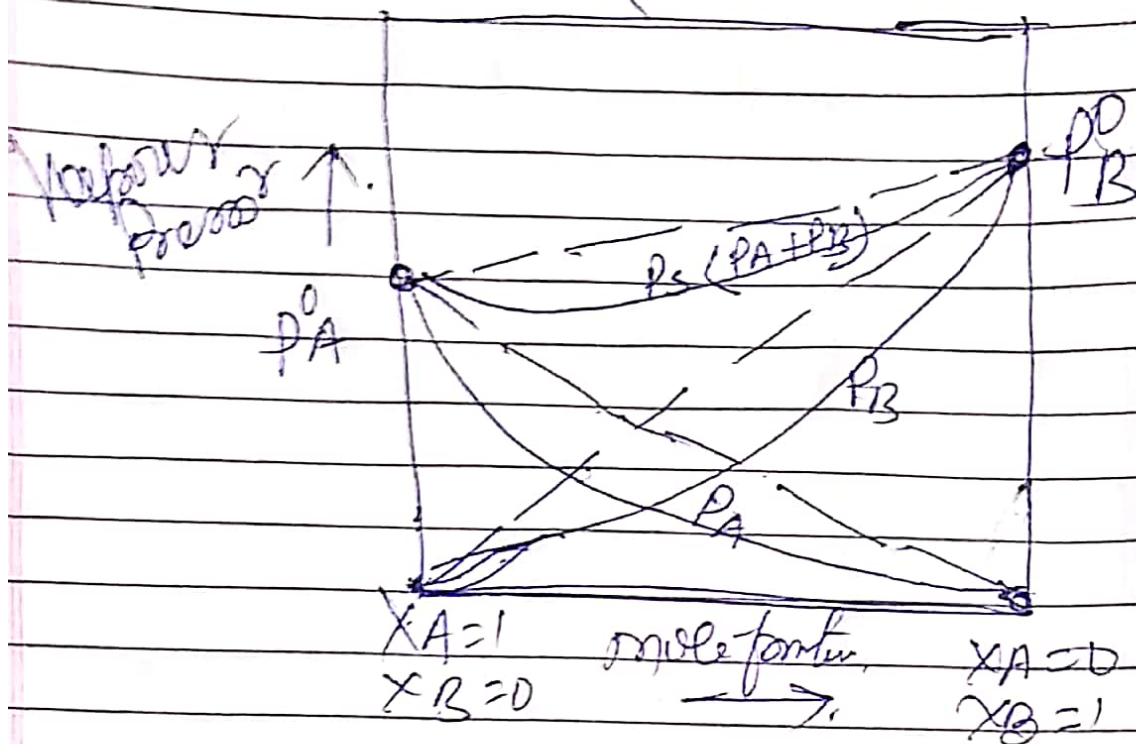
- (4) $\Delta H(\text{mix}) = -ve$

- (5) $\Delta V(\text{mix}) = -ve$

- (6) In such-solution molecular attraction of A-A & B-B is

Weaker than A-B.

Graphical Representation
Curves showing negative deviation from Raoult's law.



Examples of Negative Deviation

- (a) $\text{CH}_3\text{COOH} + \text{C}_6\text{H}_5\text{N}$ (Pyridine)
- (b) $\text{CHCl}_3 + (\text{CH}_3)_2\text{CO}$
- (c) $\text{H}_2\text{O} + \text{HCl}$
- (d) $\text{H}_2\text{O} + \text{HNO}_3$
- (e) $\text{CHCl}_3 + \text{C}_6\text{H}_6$

————— X ————— X —————