

TDC-II-P-IV Solutions

Real or non ideal solutions

- A solution obtained on mixing two liquids is said to be non ideal if the solute-solvent interactions are weaker or stronger than solute-solute or solvent-solvent interaction.
- When two volatile liquids A & B form solution in such a way that A---B interaction is more or less than the A---A or B---B interaction then solution of A & B liquids is said to be ^{non} ideal solution.
- For a non ideal solution, ~~it~~
 - (i) it does not obey Raoult's law
 - (ii) $\Delta V_{mix} \neq 0$
 - (iii) $\Delta H_{mix} \neq 0$

There are two types of non ideal solutions.

(i) Non ideal solutions showing positive deviation from Raoult's law

When a binary solution of A & B is formed by mixing of two liquid A & B such that A-B interaction is weaker than A---A & B---B interactions then solution is said to show positive deviation from ideal behaviours.

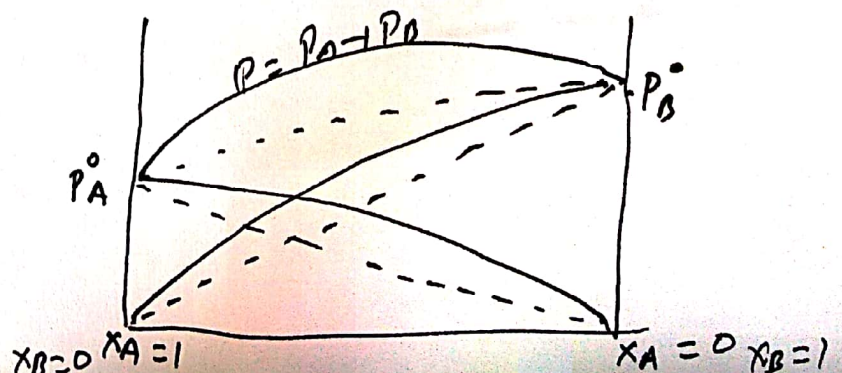
- For such solution, ΔH_{mixing} is positive as energy required to overcome the bond between molecules. hence results cooling effect $\therefore \Delta H_{\text{mix}} > 0$

- As molecules held together less tightly hence $\Delta V_{\text{mixing}} > 0$

- vapour pressure-composition curve can be shown as

$$P_A > X_A P_A^\circ$$

$$P_B > X_B P_B^\circ$$



- examples of non ideal solutions showing positive deviation

- ethyl alcohol (C_2H_5OH) + Acetone ($CH_3-C(=O)-CH_3$)

- $C_2H_5OH + H_2O$

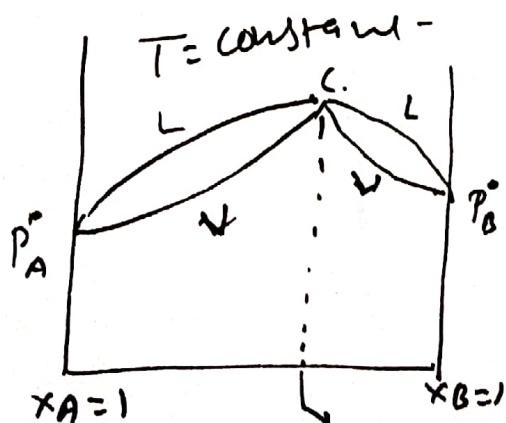
- Acetone + CS_2

- Chloroform + C_2H_5OH

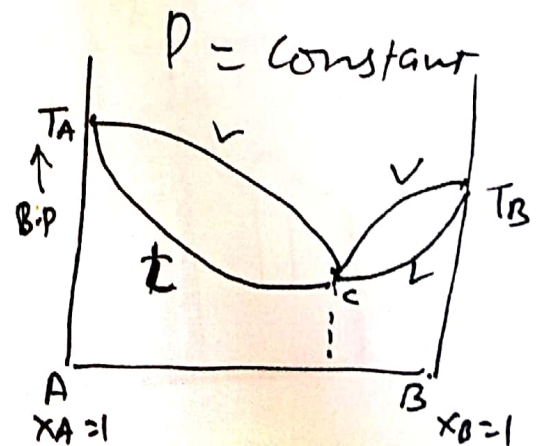
- water + Chloroform

- Such solution is said to form minimum boiling Azeotropic mixture in certain composition.

- At definite composition, solution boils at certain temperature at which total vapour pressure becomes equal to atmospheric pressure.



V.P. Versus Composition Curve



B.P. Versus Composition Curve.

① Non ideal solution showing negative deviation from ideal behaviours

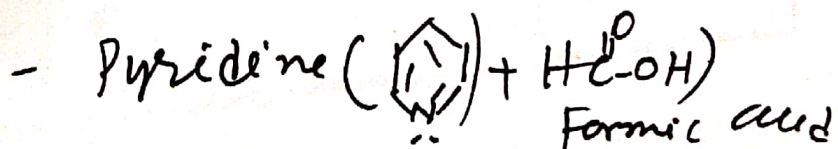
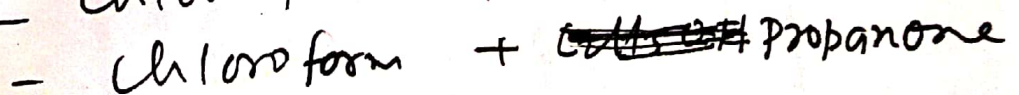
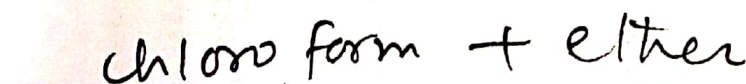
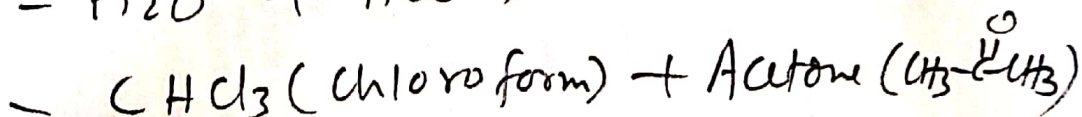
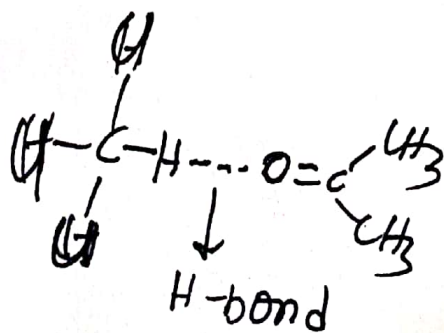
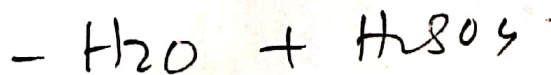
A binary solution of liquid A & B is said to show negative deviation from ideal behaviours if A...B interactions are stronger than A--A & B--B interactions.

— The total vapour pressure of this solution becomes less than the corresponding v.p. of ideal solution. & show deviation from Raoult's law

$$P_A < P_A^\circ X_A$$

$$P_B < P_B^\circ X_B$$

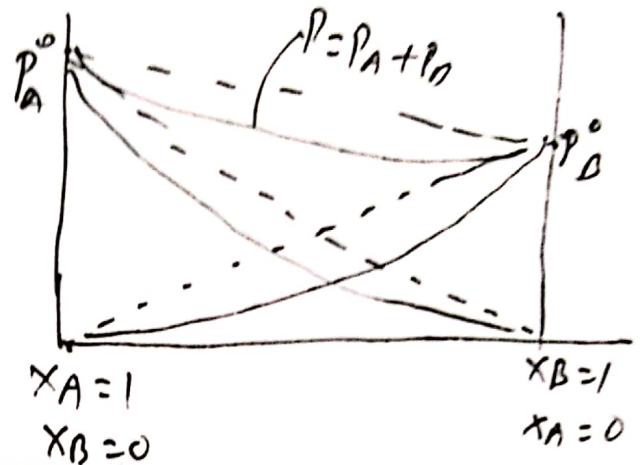
- $\Delta H_{mix} < 0$ (heating effect occurs)
- $\Delta V_{mix} < 0$ (volume contraction)
- Ex - - H₂O + HCl



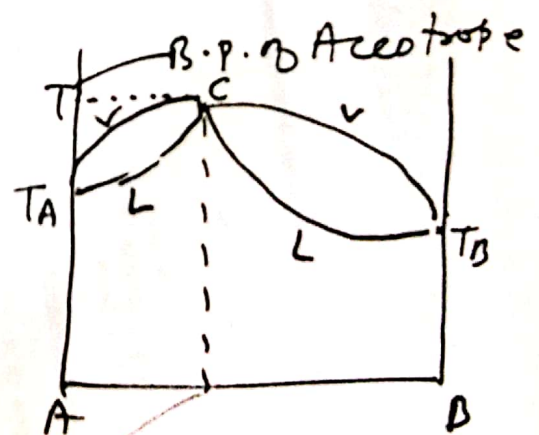
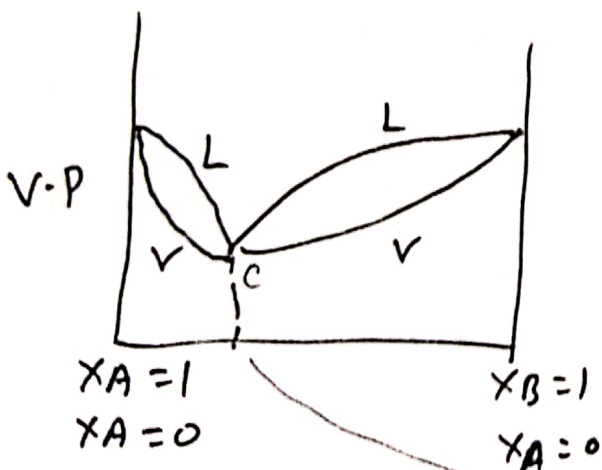
- Vapour pressure - Composition Curve for solution showing negative deviation

$$P_A < X_A P_A^\circ$$

$$P_B < X_B P_B^\circ$$



- Binary Solution showing -ve deviation form maximum boiling Azeotrope mixture in certain composition.



at certain Temp

at certain Pressure

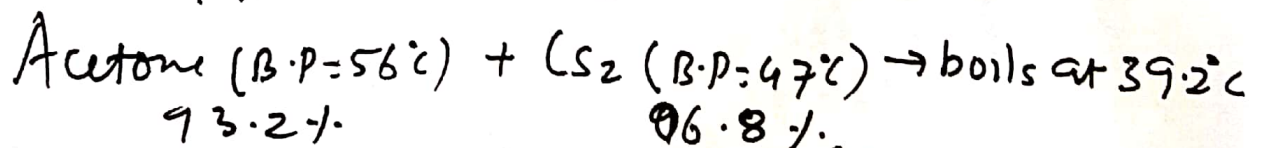
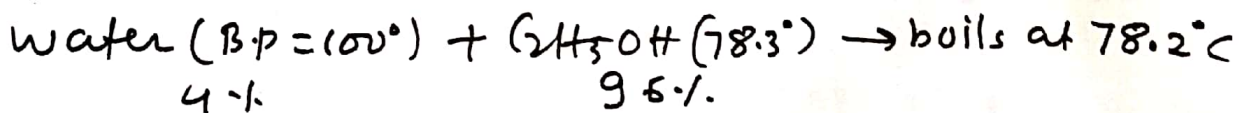
constant composition

Azeotrope mixture

A mixture of volatile liquids ~~at~~ in certain composition which like a pure component boils at constant temperature & distills over completely at the same temperature without any change in composition is known as constant boiling mixture or Azeotrope mixture.

- As Azeotrope mixture boils at certain constant Temp. hence can't be separated by Fractional distillation
- Azeotrope mixture has lower

Boiling point than any components when solution is non ideal showing positive deviation



- non ideal solution showing -ve deviation has higher B.P. than any components

