

# PRAKAS

## JEE 2026

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PHYSICAL CHEMISTRY

SOLUTIONS

Lecture – 06

FAISAL RAZAQ





# Topics to be covered

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- A** Ideal and Non Ideal Solutions



Question

14

The vapour pressure in mm Hg of an ideal solution of A and B at  $25^{\circ}\text{C}$  is given by  $P_{AB} = 33x + 94$ , where as that of ideal solution of A and C at  $25^{\circ}\text{C}$  is given by  $P_{AC} = 81x + 46$ ; 'x' being the mole fraction of A in the solution. The vapour pressure of solution containing 2 mole of A, 2 mole of B and 4 mole of C will be -

A) 80

B) 90

C) 100

D) none of these

Ans - (A)



## Ideal Solution

A-A and B-B = A-B interactions

liq, A + liq, B  $\longrightarrow$  solution

A-A      B-B      A-B

Note: "When similar type of interactions are replaced by same type of interactions."

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Hydrogen bonding > Dipole-Dipole > Vander Waal's

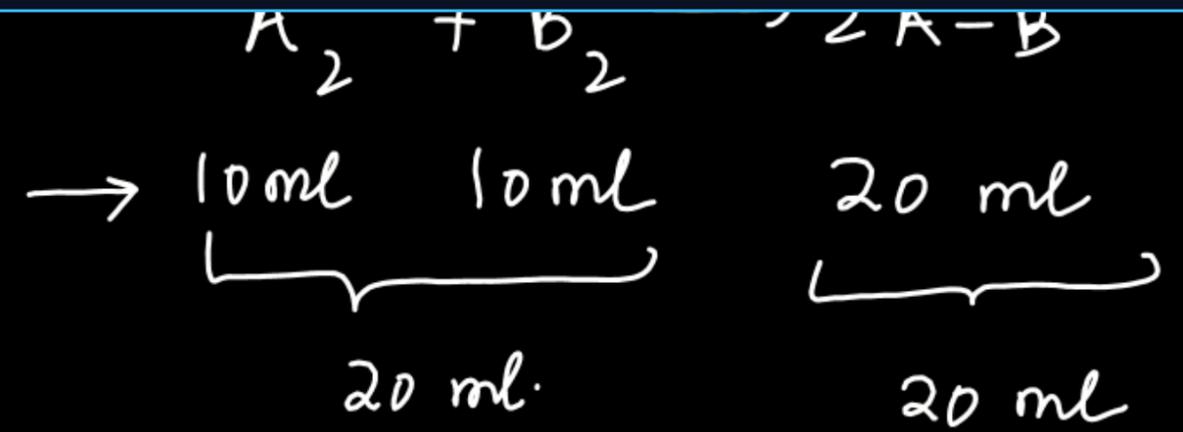
Conditions:

1)  $\Delta H_{mix} = 0$

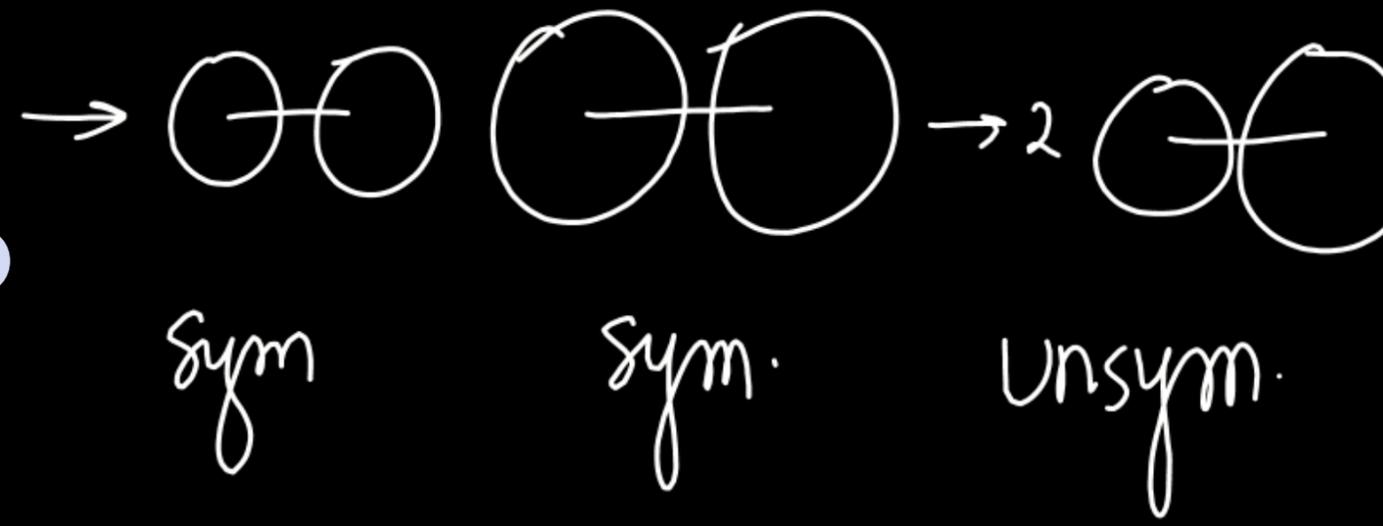
2)  $\Delta V_{mix} = 0$

3)  $\Delta S_{mix} > 0$

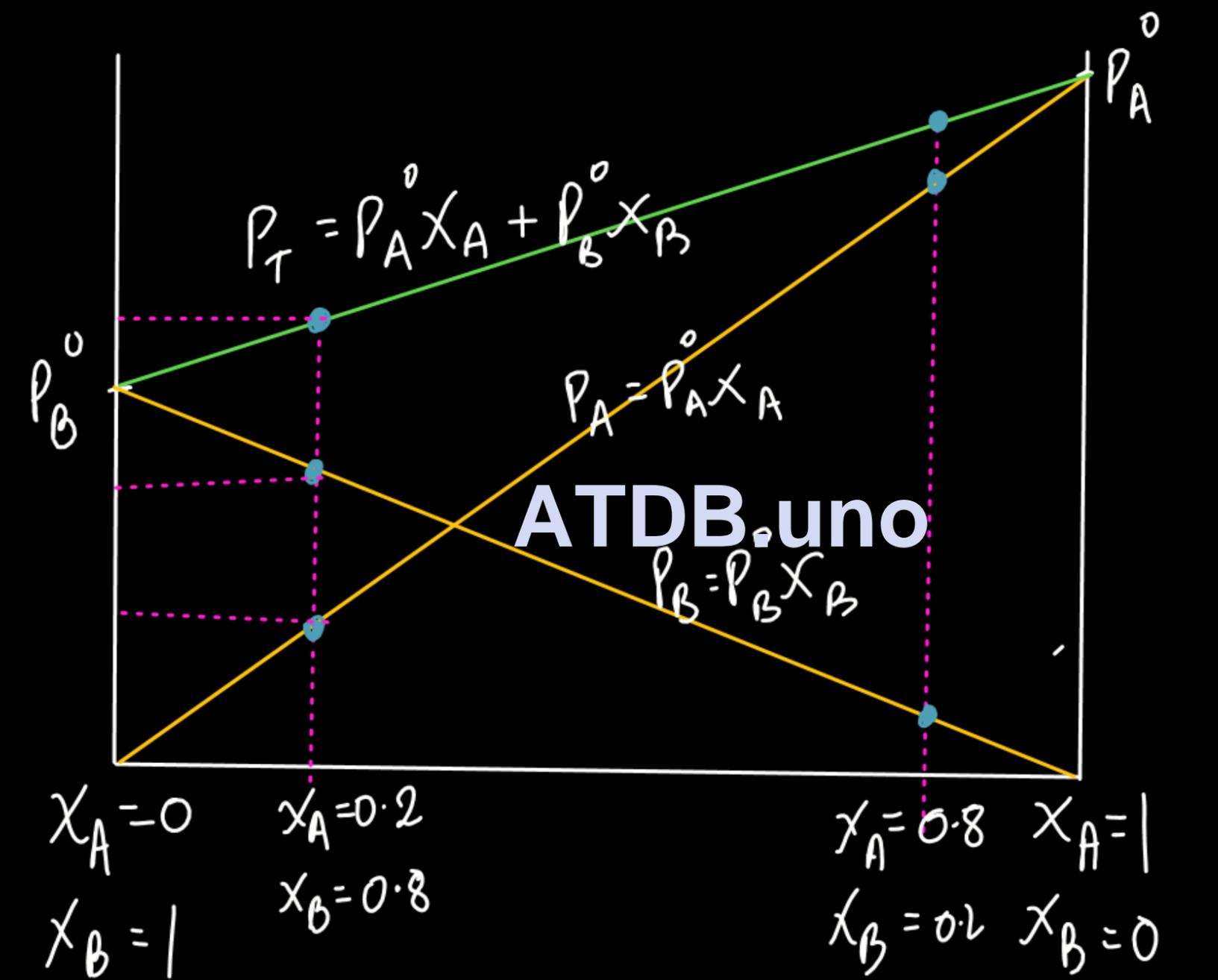
4)  $\Delta G_{mix} < 0$



$\Delta V = 0$



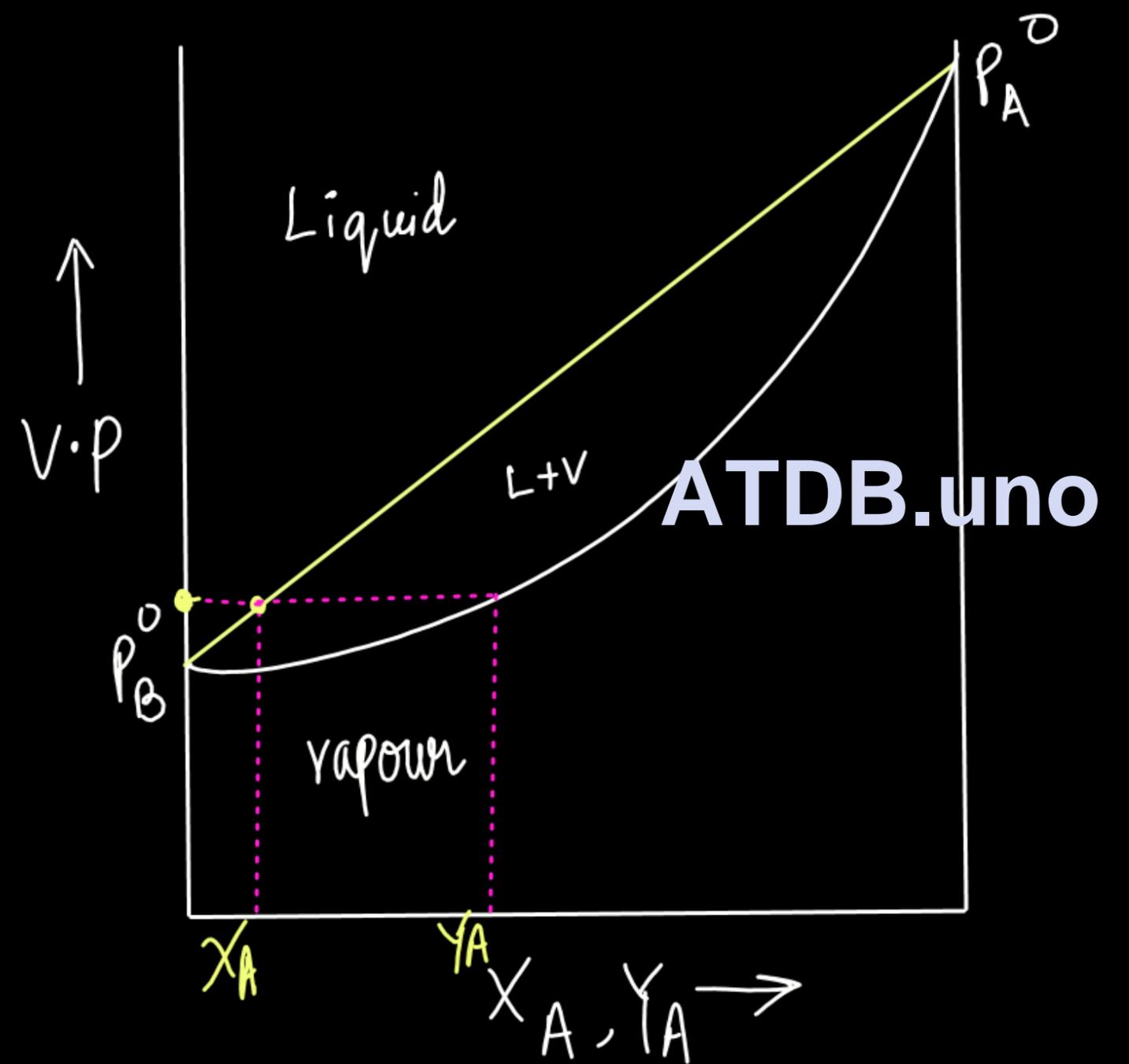
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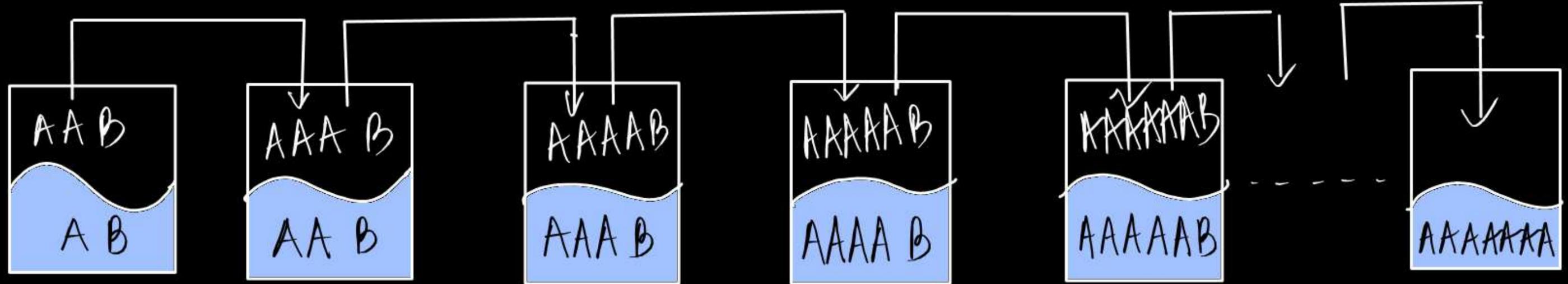
# Pressure Composition Curve for Ideal Solution



A is more volatile.

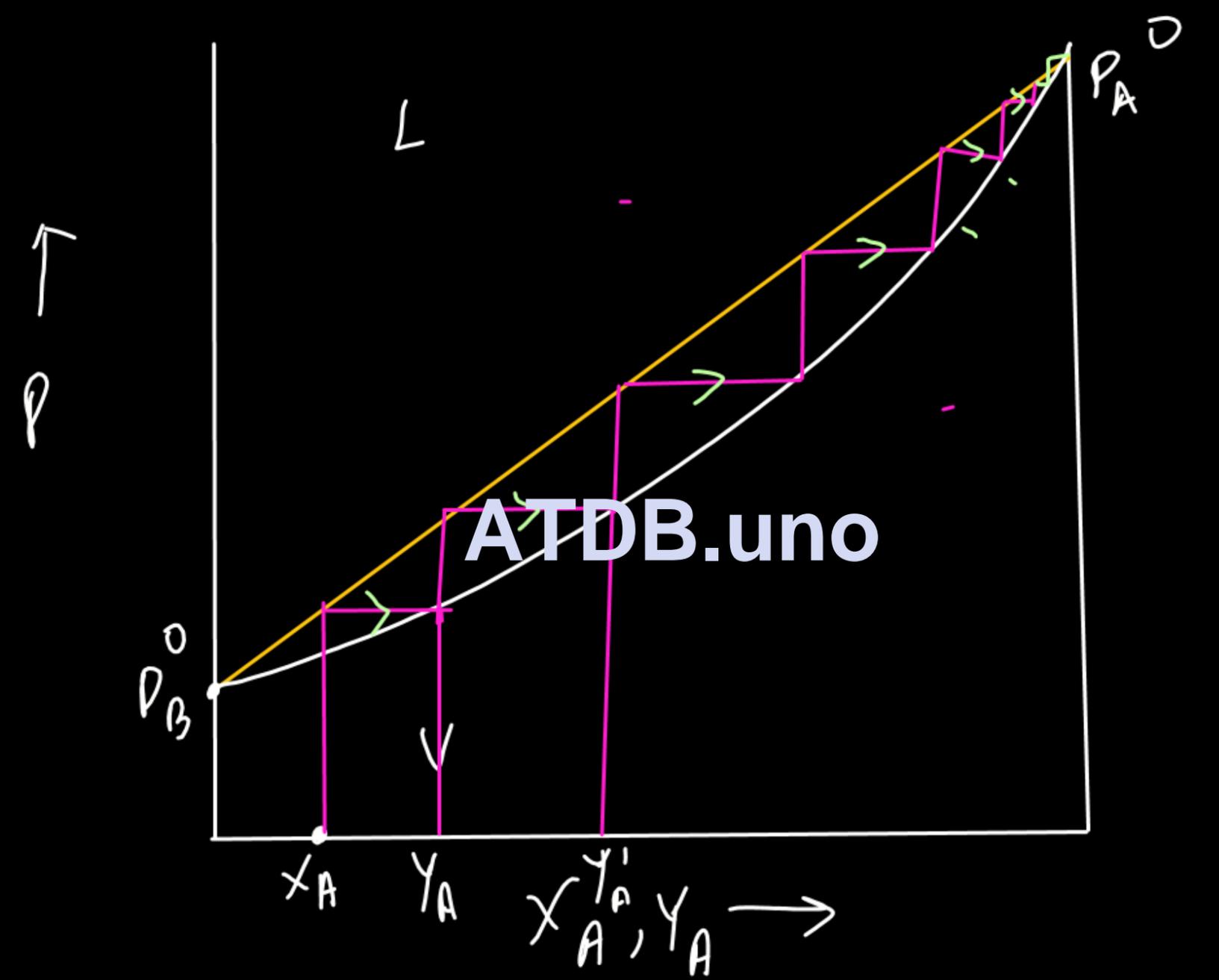


# Distillation of an ideal solution of Liq, A and Liq, B



assumption : A is more volatile.

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2) Benzene + Toluene

3) Ethyl Bromide + Ethyl Iodide

4) Bromobenzene + chlorobenzene

} ideal solution

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# Non-Ideal Solution



“Solutions which do not follow Raoult's Law on entire range of composition are non-ideal in nature.”

$$P_T = P_A^0 x_A + P_B^0 x_B \quad (\text{entire } x_A, x_B \text{ range})$$

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↳ ideal

$$P_T \neq P_A^0 x_A + P_B^0 x_B$$

↳ non ideal

# Positive Deviation

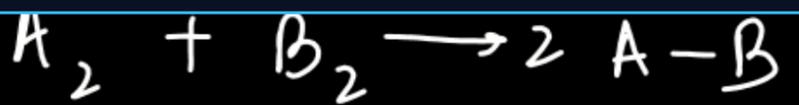


$A-B$  interactions  $<$   $A-A$  or  $B-B$  interactions

Note: "when stronger interactions are replaced by weaker interactions."

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## Conditions :



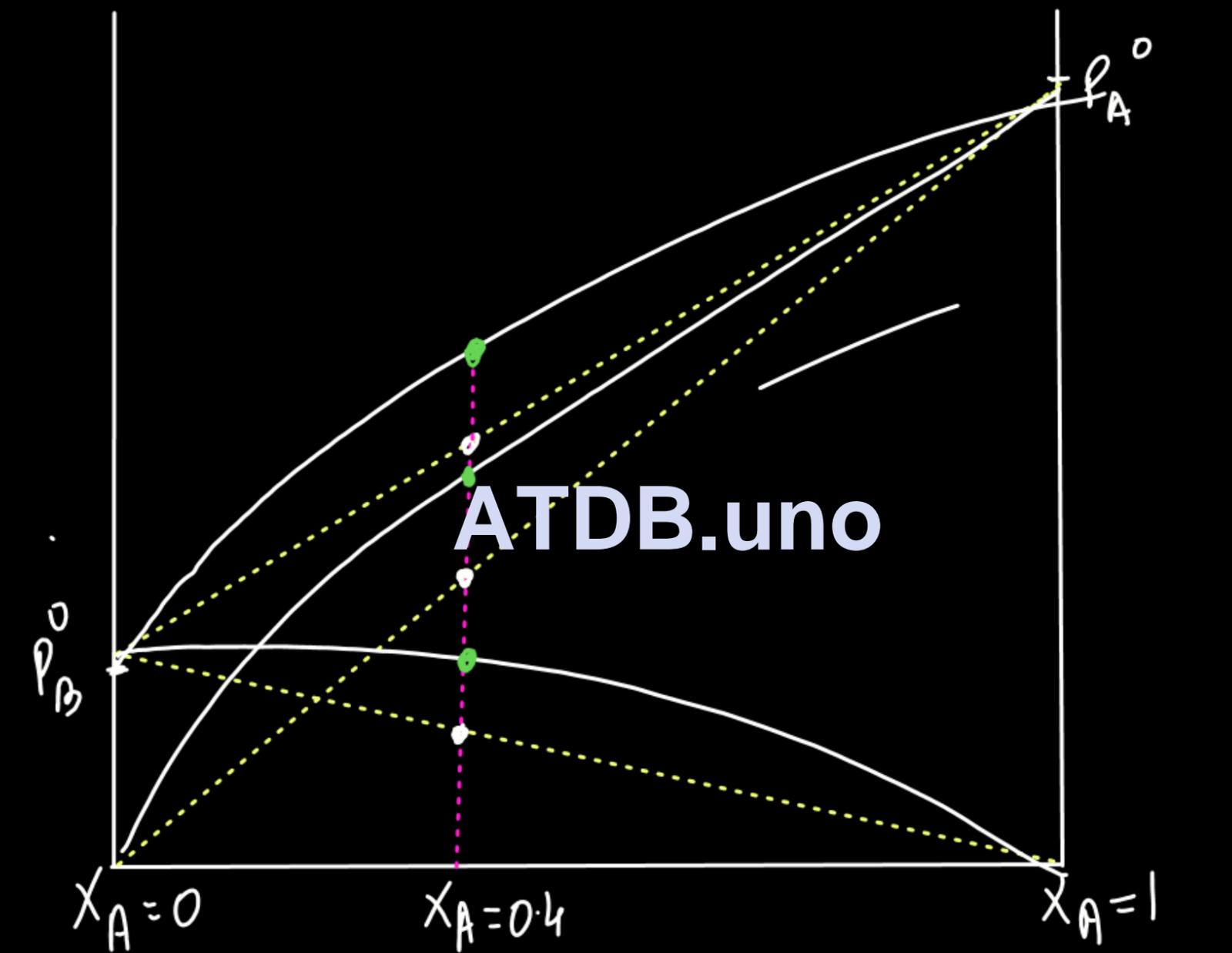
$$1) \Delta H_{\text{mix}} > 0 \text{ (endothermic)}$$

$$2) \Delta V_{\text{mix}} > 0$$

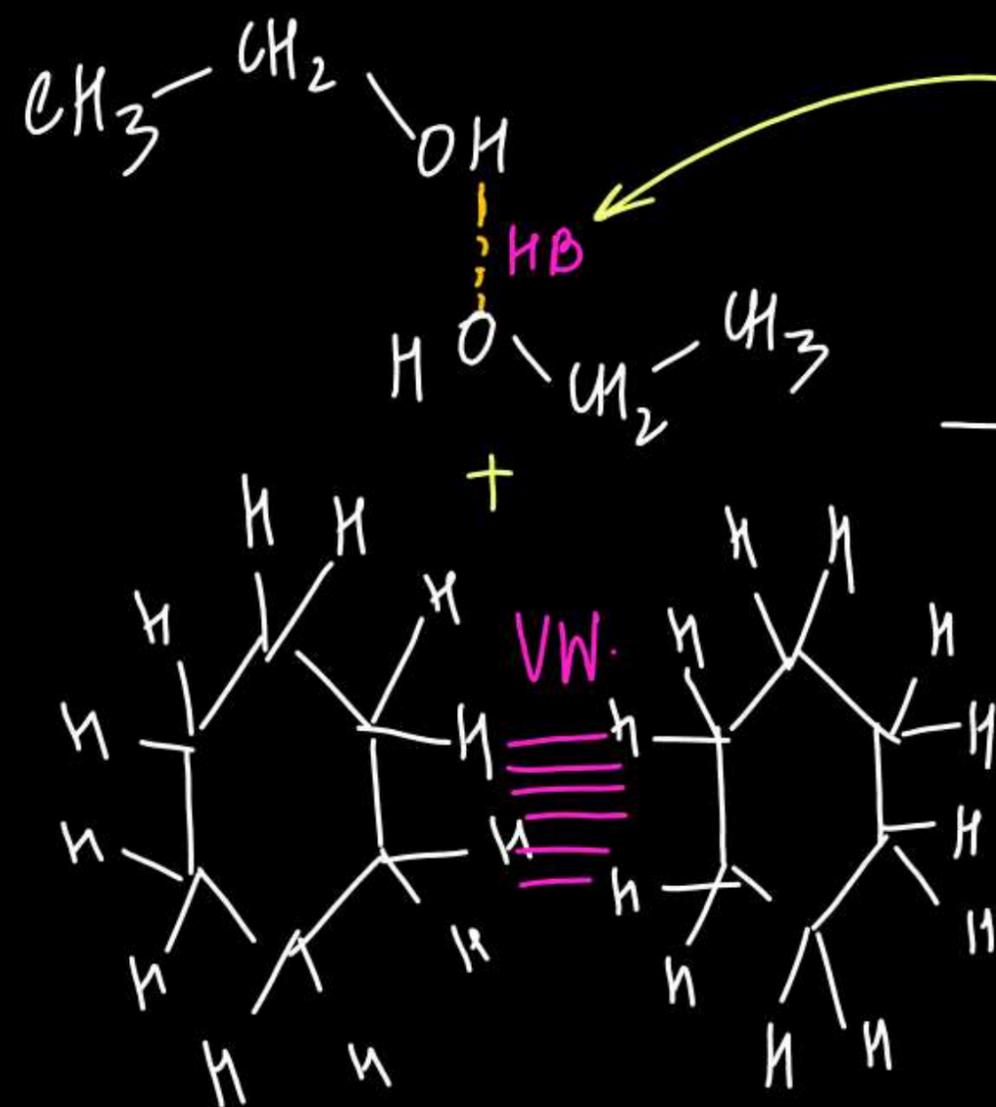
$$3) \Delta S_{\text{mix}} > 0$$

$$4) \Delta G_{\text{mix}} < 0$$

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# i) Ethanol + cyclohexane

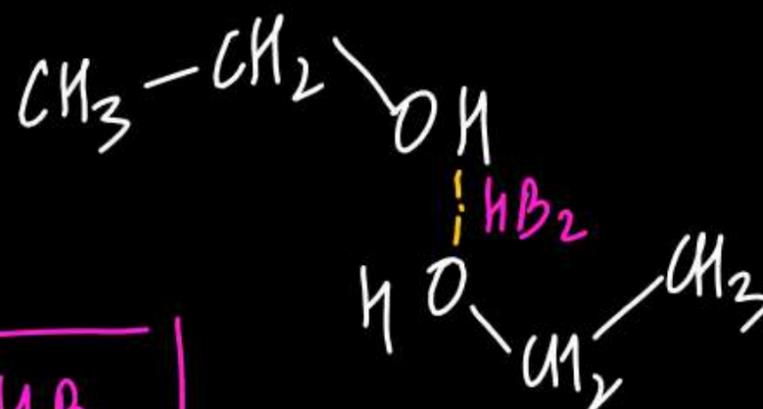


cyclohexane reduces the extent of hydrogen bonding between ethanol

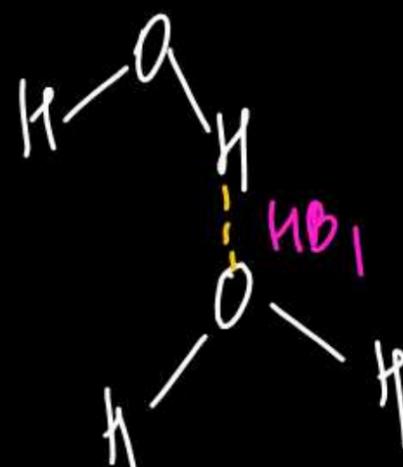
ATDB.uno leads to positively deviated system.



ii) Ethanol + water or Methanol + water

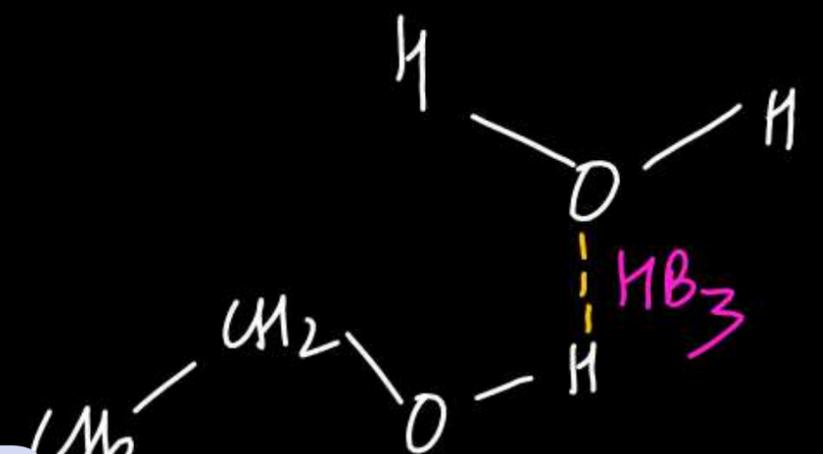


$\text{HB}_1 > \text{HB}_2$



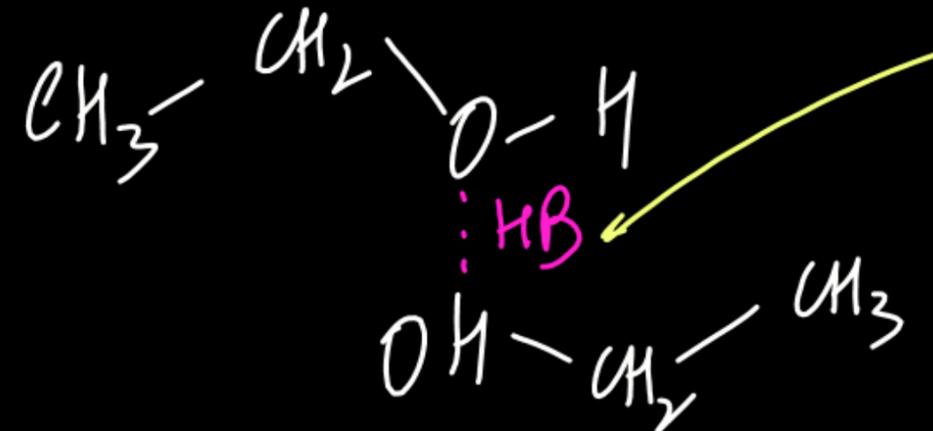
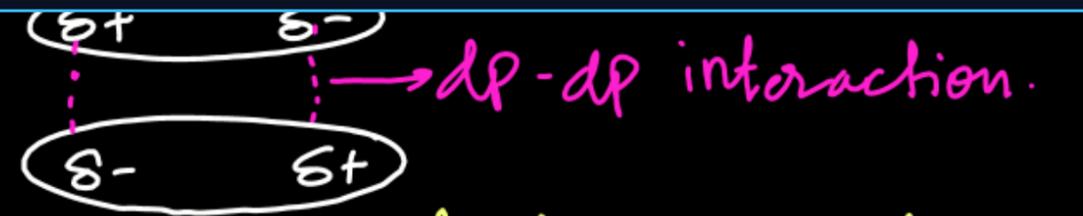
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$\text{HB}_3 > \text{HB}_2$   
 $\text{HB}_3 < \text{HB}_1$



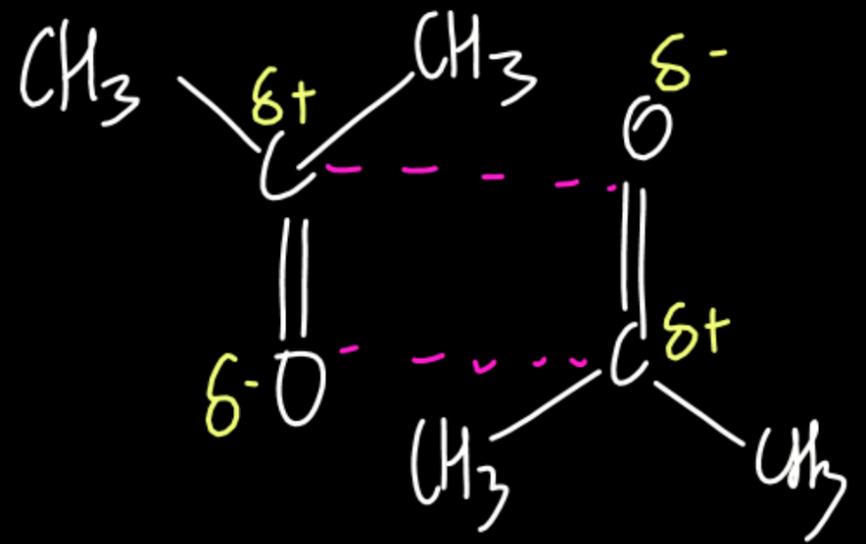


### iii) Ethanol + Acetone



Acetone reduces the extent of hydrogen bonding between ethanol molecules, leading to positive deviation.

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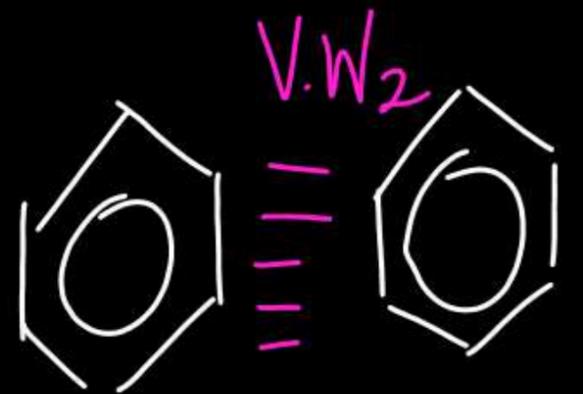
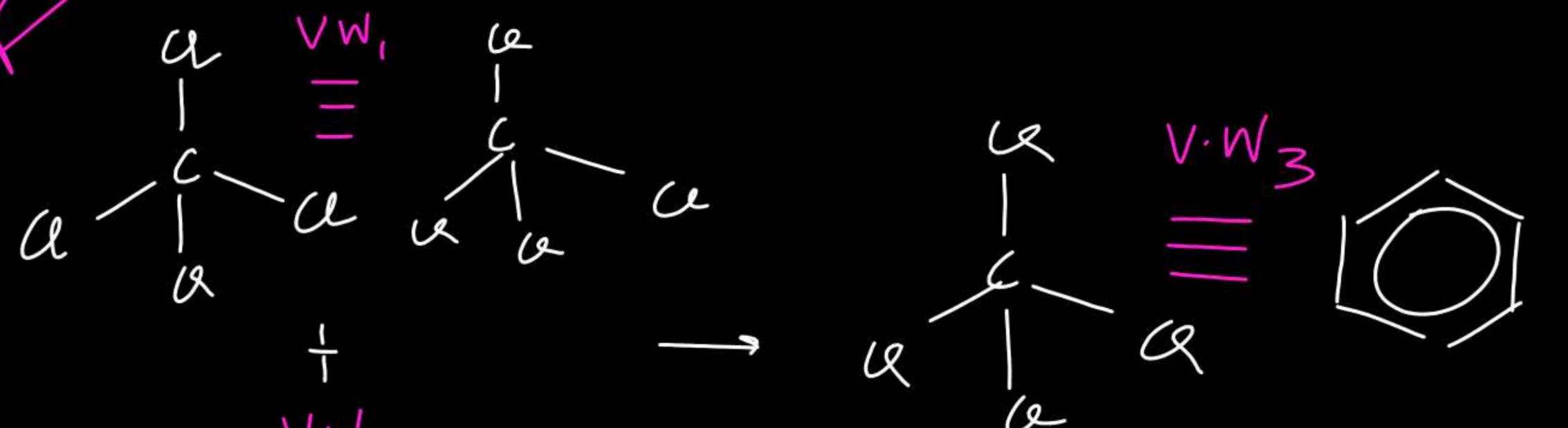


DP-DP interaction



# iv) CCl<sub>4</sub> and Benzene or CCl<sub>4</sub> and Toluene

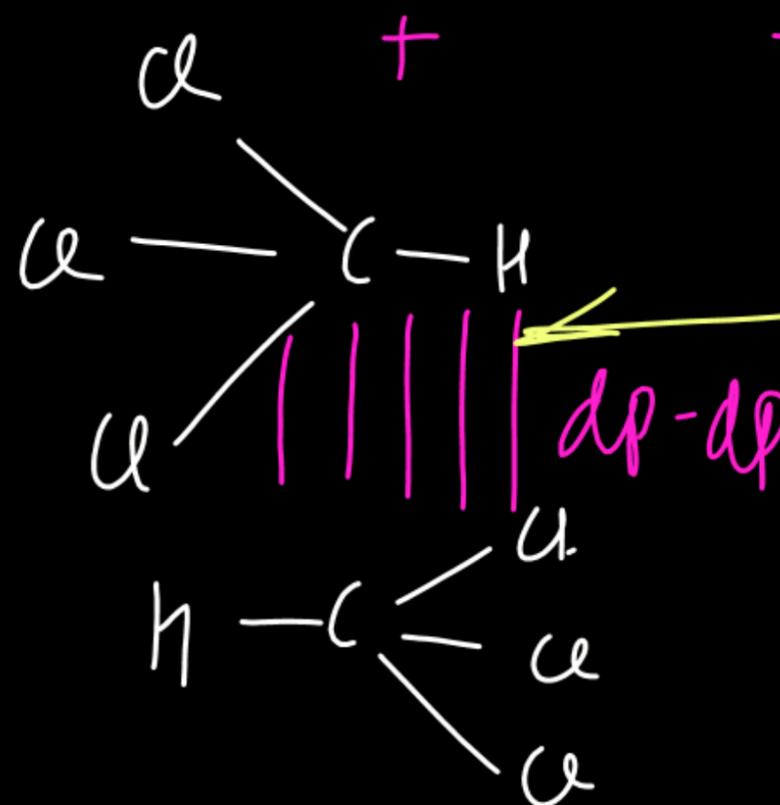
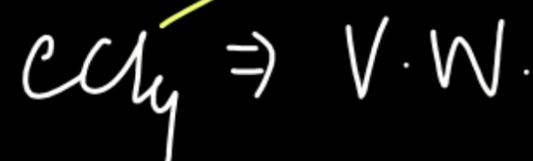
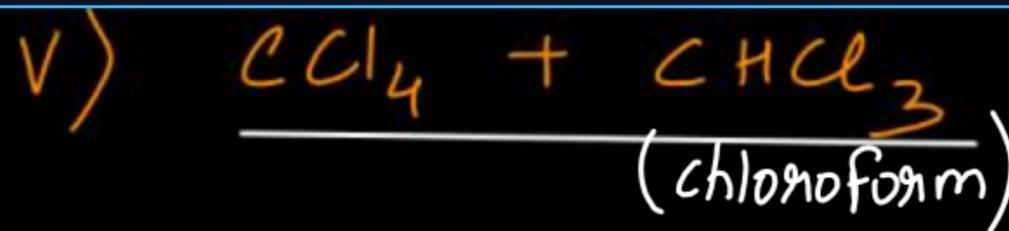
Imp



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$$\text{V.W}_3 < \text{V.W}_1$$

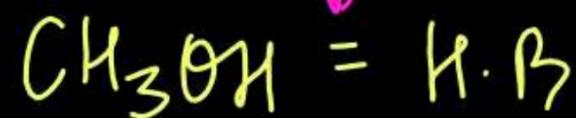
$$\text{V.W}_3 > \text{V.W}_2$$



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$CCl_4$  reduces the extent of dp-dp interactions between chloroform molecules leading to (+)ve deviation

vi)  $\text{CCl}_4 + \text{Methanol}$



→ (+)ve deviation.

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vii) Benzene + Acetone



Benzene =  $V \cdot W$   
+  
Acetone =  $\rho \cdot V - \rho \cdot V$

→ (+)ve deviation.

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viii) Acetone + CS<sub>2</sub>



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ix) Acetaldehyde and CS<sub>2</sub>



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Question

①

The vapour pressure of pure benzene is 639.70 mm of Hg and the vapour pressure of solution of a solute in benzene at the same temperature is 631.90 mm of Hg. Calculate the molality of the solution.



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Ans : 0.158 molar



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## Question

2



The vapour pressure of benzene at  $80^{\circ}\text{C}$  is lowered by 10mm by dissolving 2g of a non-volatile substance in 78g of benzene. The vapour pressure of pure benzene at  $80^{\circ}\text{C}$  is 750 mm. The molecular weight of the substance will be :

(a) 15

(b) 150

(c) 1500

(d) 148

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Ans: (D)



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Question

3

The vapour pressure of pure benzene at a certain temperature is 640 mm of Hg. A non-volatile and non-electrolyte solid weighing 2.175 g is added to 39 g benzene. The vapour pressure of solution is 600 mm Hg. What is the molecular weight of solid substance?

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Ans : 65.25 g/mol



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Question Mixture of two liquids A and B is placed in a cylinder containing piston. Piston is pulled out isothermally so that volume of liquid decreases but that of vapour increases. When negligibly small amount of liquid was remaining the mole fraction of A in vapour is 0.4. Given  $P_A^0 = 0.4 \text{ atm}$  and  $P_B^0 = 1.2 \text{ atm}$  at the experimental temperature. Calculate the total pressure at which the liquid has almost evaporated.

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Ans :  $0.66 + a/m$



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Question

5

At a given temperature, total vapour pressure in torr of a mixture of volatile components A and B is given by  $P_T = 120 - 75X_B$ , hence  $P_A^0$  and  $P_B^0$  are -

A) 120, 75

B) 120, 195

C) 120, 45

D) 75, 45

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Ans : (B)



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