PRAYAS

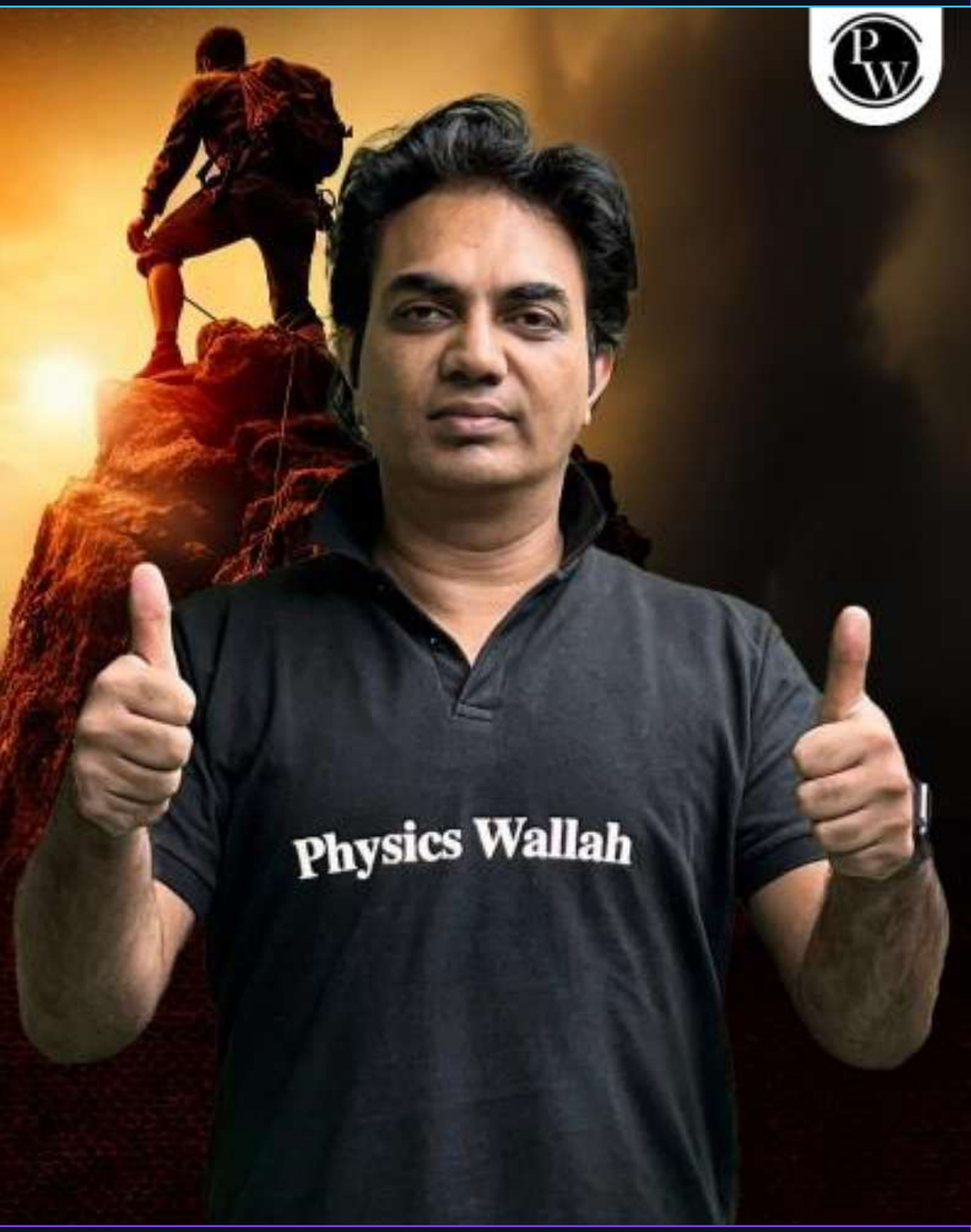
JEE 2026

PHYSICAL CHEMISTRY

SOLUTIONS

Lecture – 06

FAISAL RAZAQ



Topics to be covered

ATDB.uno

A Ideal and Non Ideal Solutions

Question

14

The vapour pressure in mm Hg of an ideal solution of A and B at 25°C is given by $P_{AB} = 33x + 94$, where as that of ideal solution of A and C at 25°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, [illegible] 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 ⟶ solution

A - A B - B A — B

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

Hydrogen bonding > Dipole-Dipole > Vander Waal's

Conditions:

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

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

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

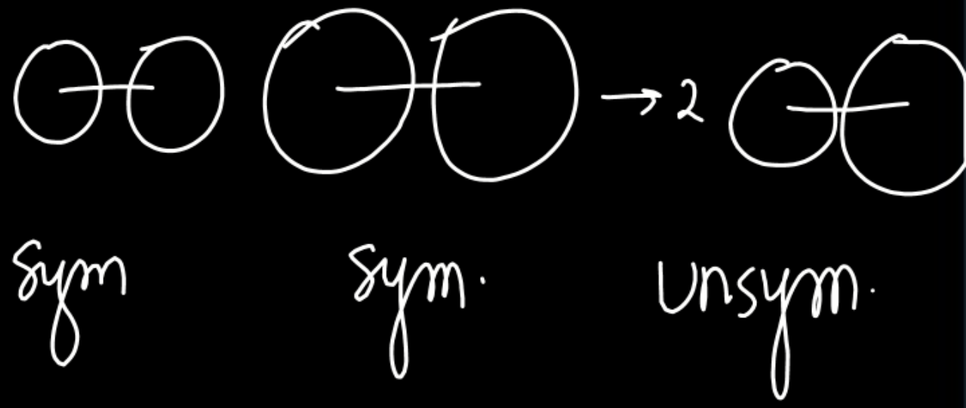
4) $\Delta G_{Mix} < 0$

$A_2 + B_2 \rightarrow 2A-B$

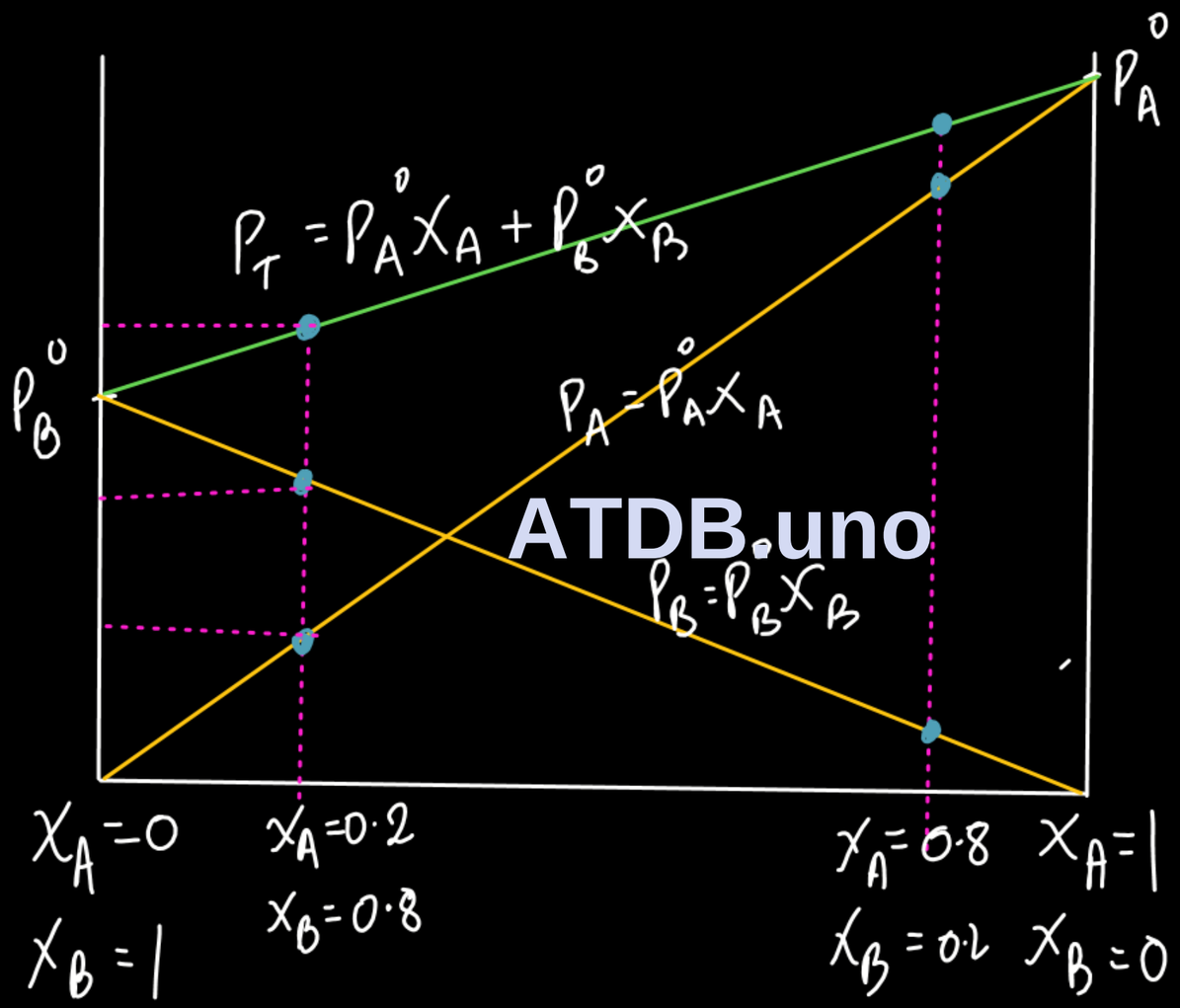
→ 10 ml 10 ml 20 ml

20 ml. 20 ml

$\Delta V = 0$

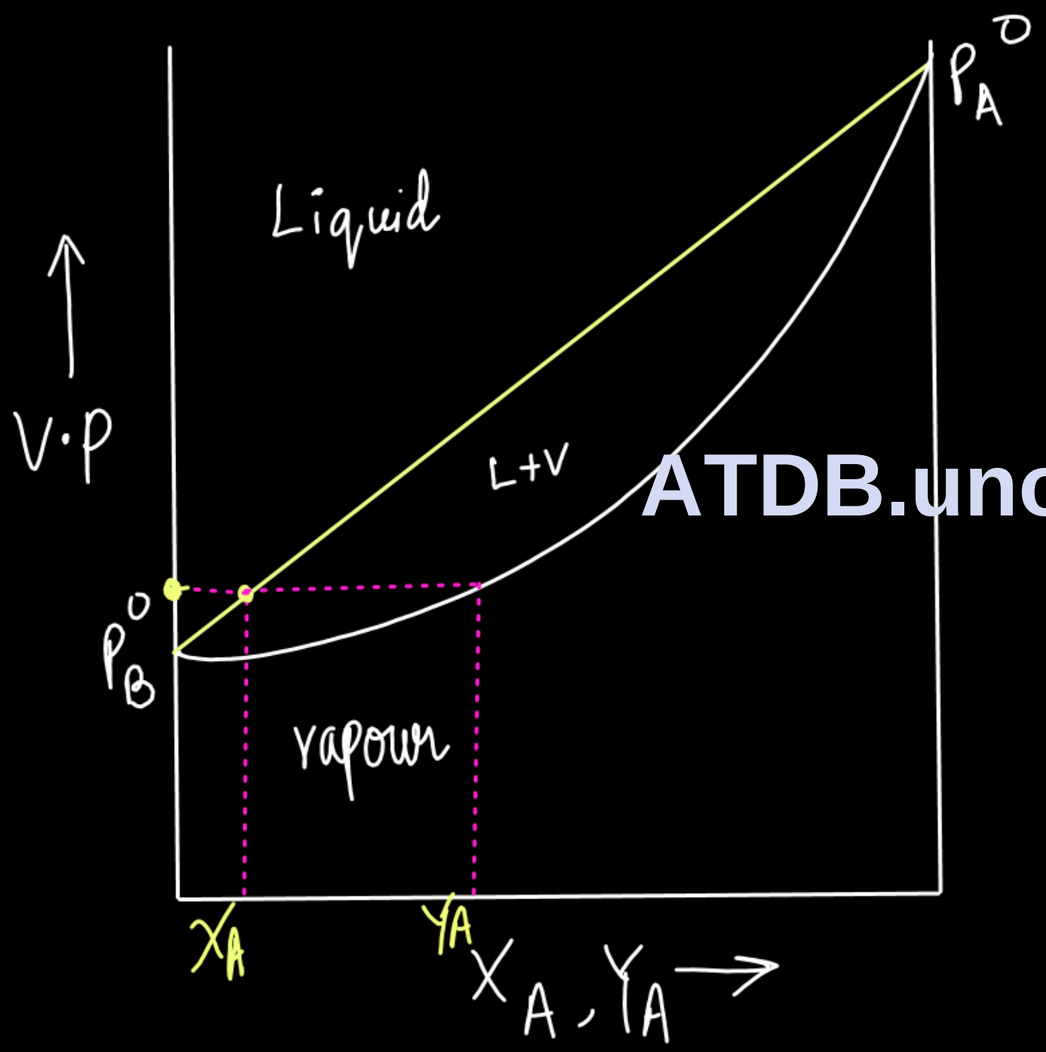
→  → 2

Sym Sym. Unsym.

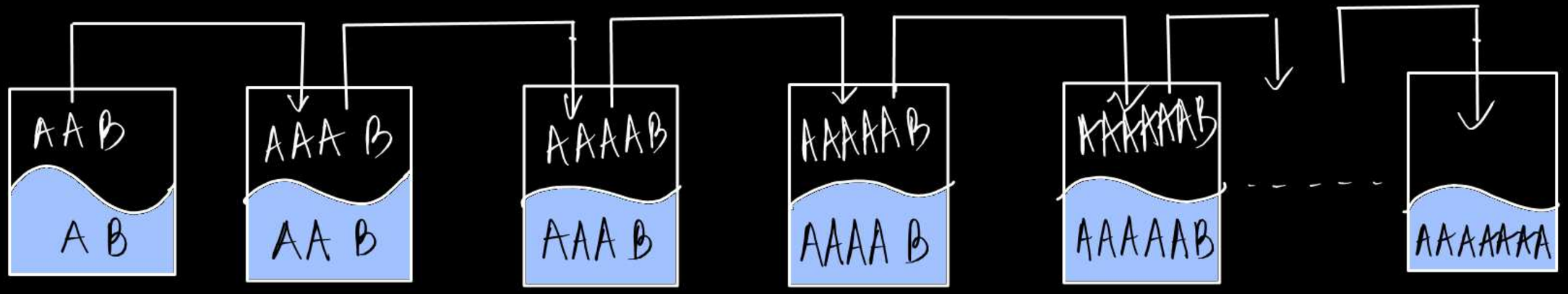


Pressure Composition Curve for Ideal Solution

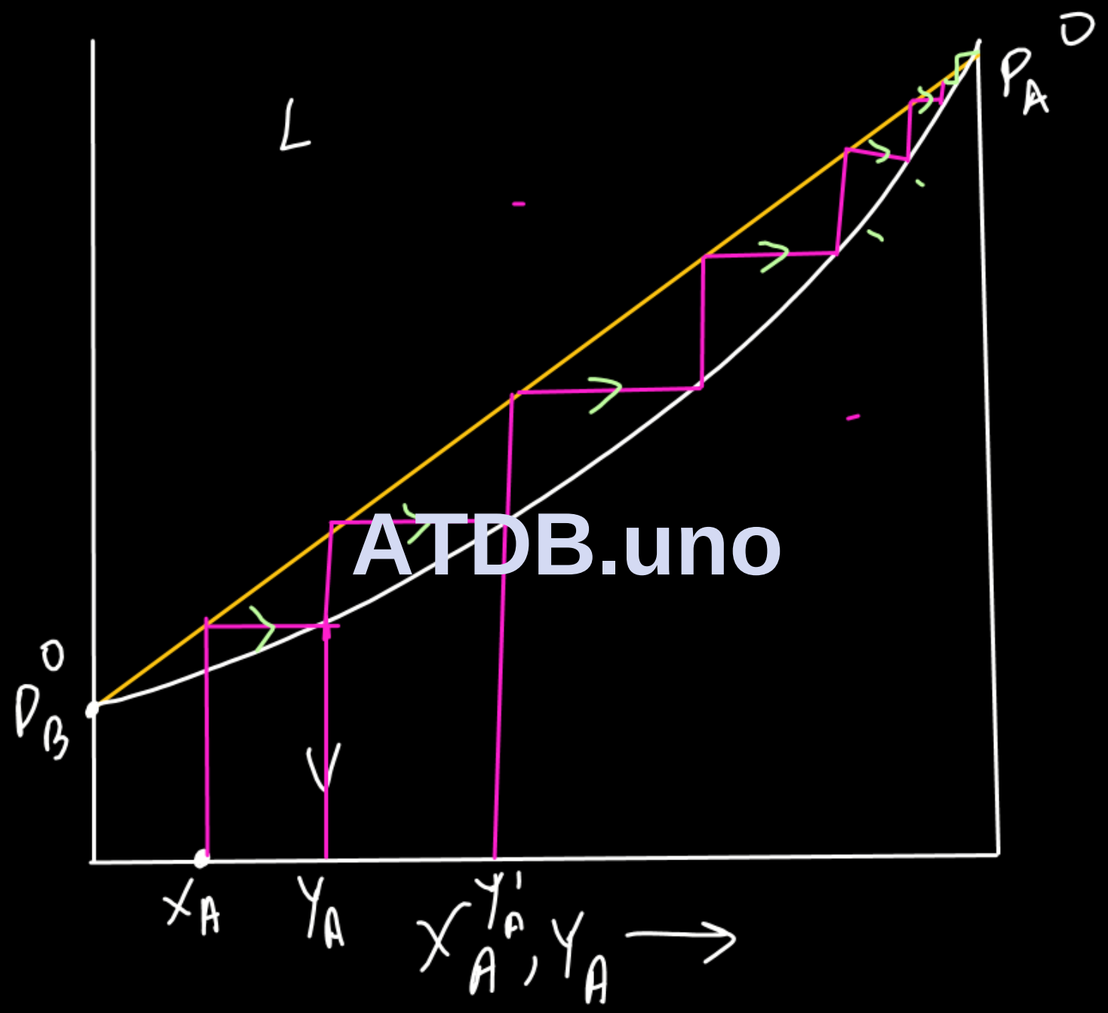
A is more volatile.



Distillation of an ideal Solution of Liq. A and Liq. B

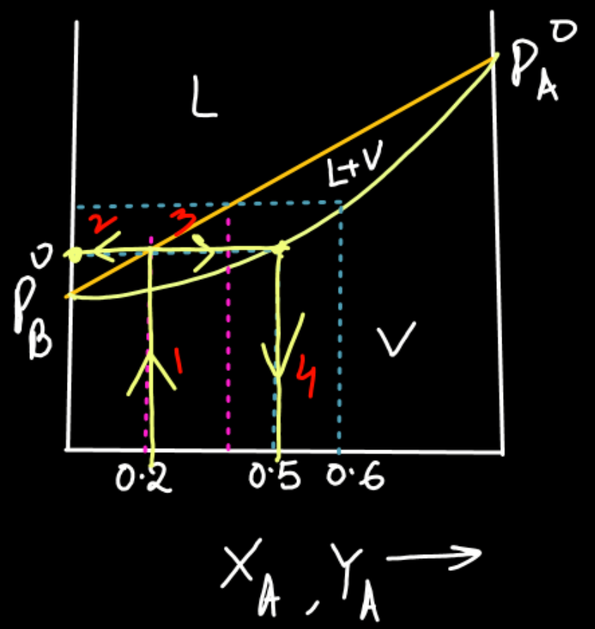


assumption: A is more volatile.



Question

Find out the composition of the vapour when the liquid phase composition was $X_A = 0.2$.



A) 0.2

B) 0.5

C) 0.6

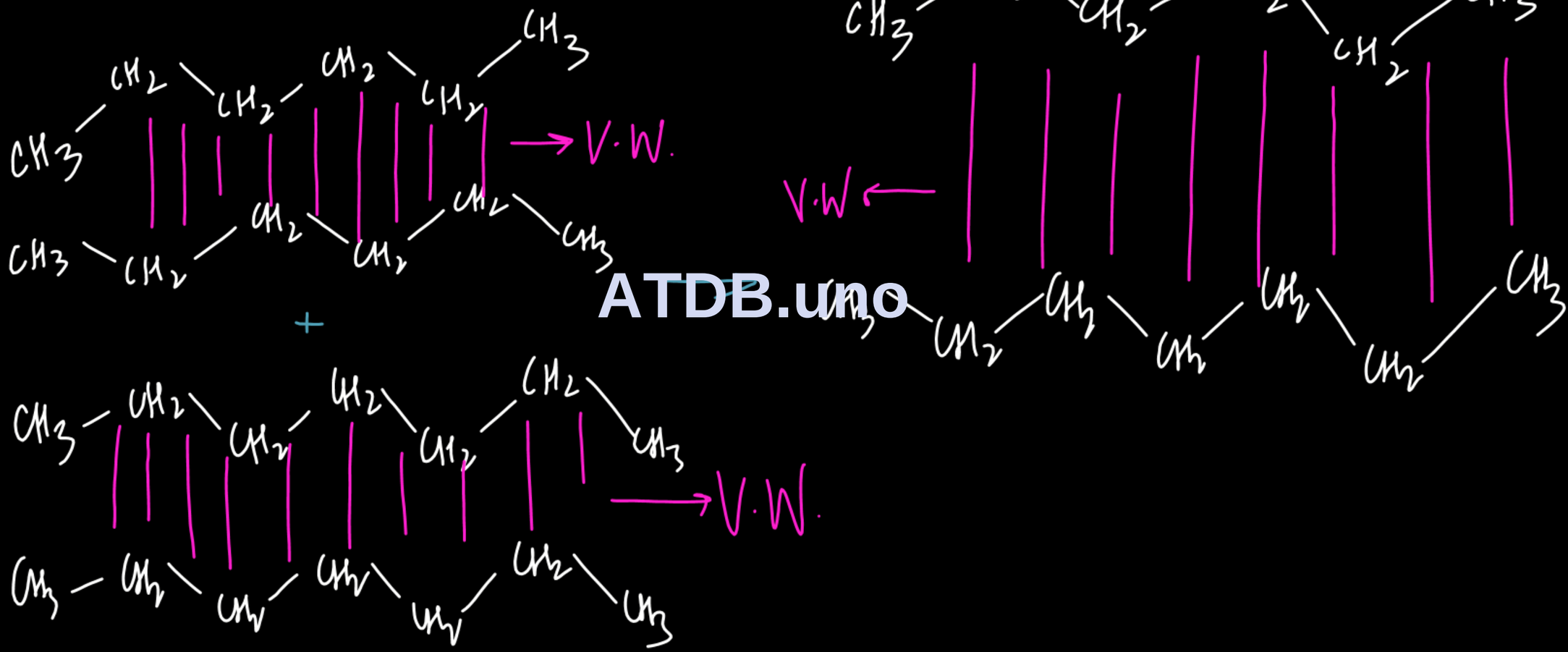
D) 0.7

1 → 2 → 3 → 4

X_A Y_A

Examples of Ideal Solutions

i) Hexane + Heptane



2) Benzene + Toluene

3) Ethyl Bromide + Ethyl Iodide

4) Bromobenzene + chlorobenzene

} ideal solution

Non - Ideal Solution

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

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

→ ideal

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

→ non ideal

Positive Deviation

A – B interactions < A – A or B – B interactions

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

Conditions :

$A_2 + B_2 \longrightarrow 2\,A-B$

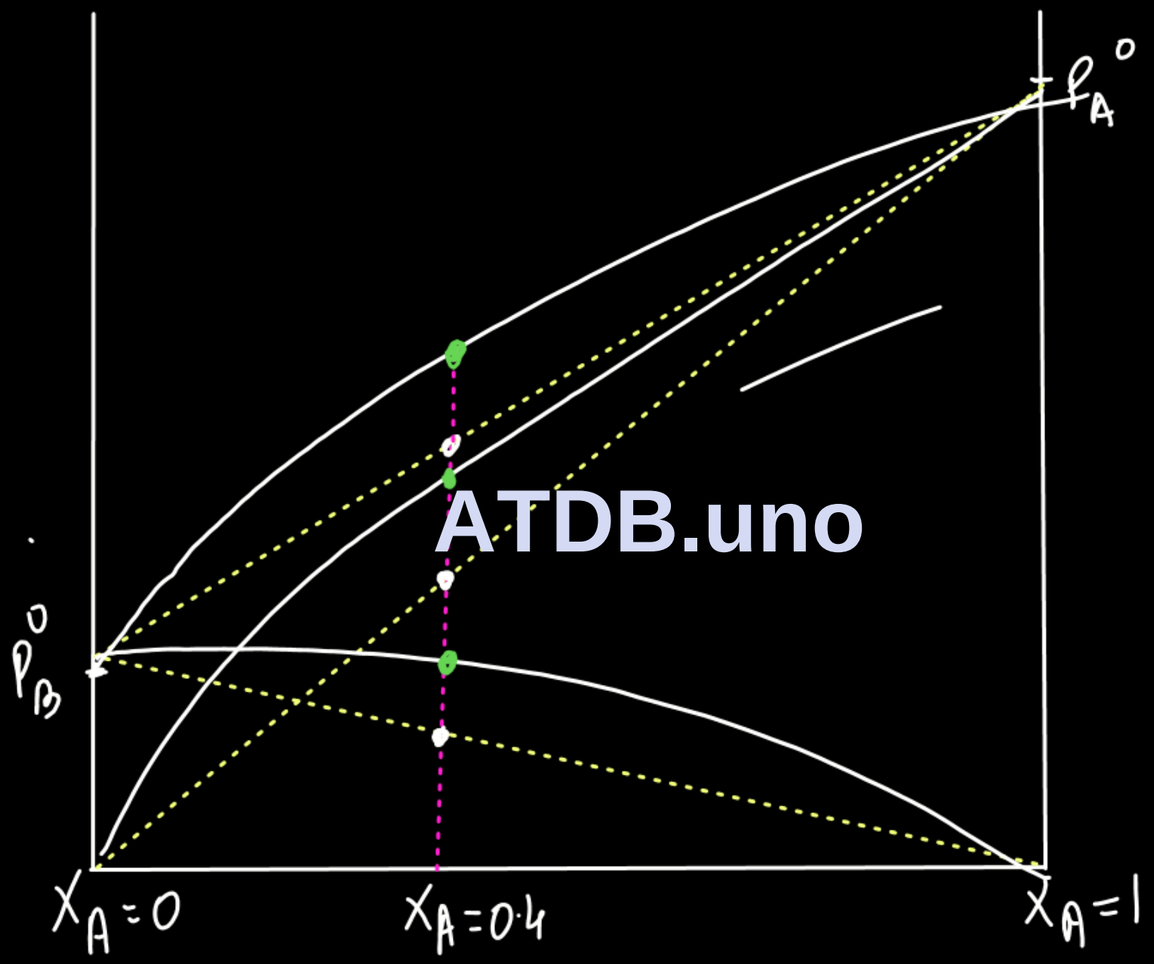
10 mL 10 mL 22 mL

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

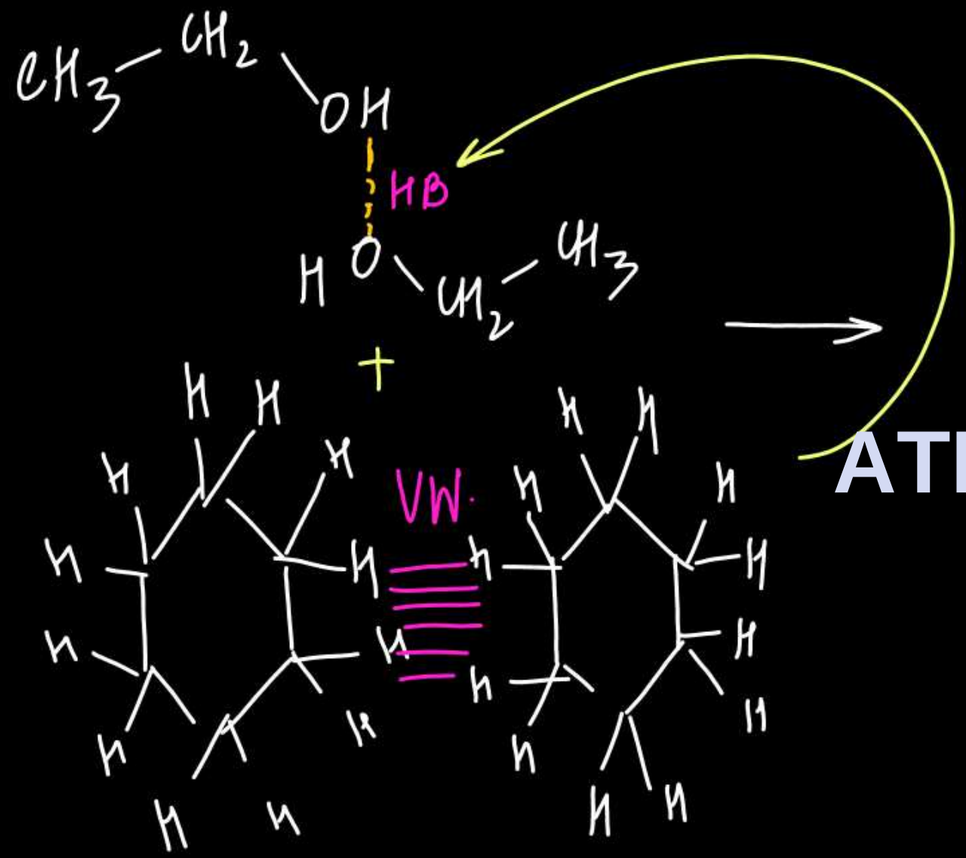
2) $\Delta V_{Mix} > 0$

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

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

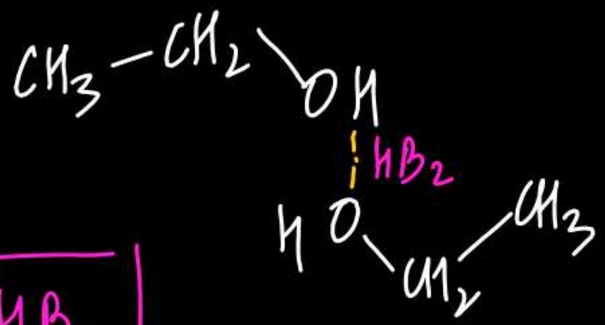


i) Ethanol + cyclohexane

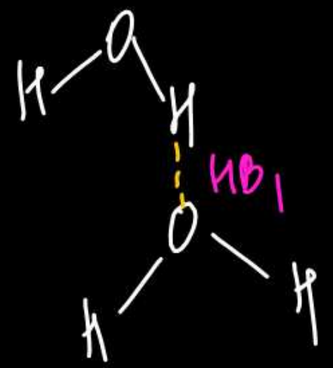


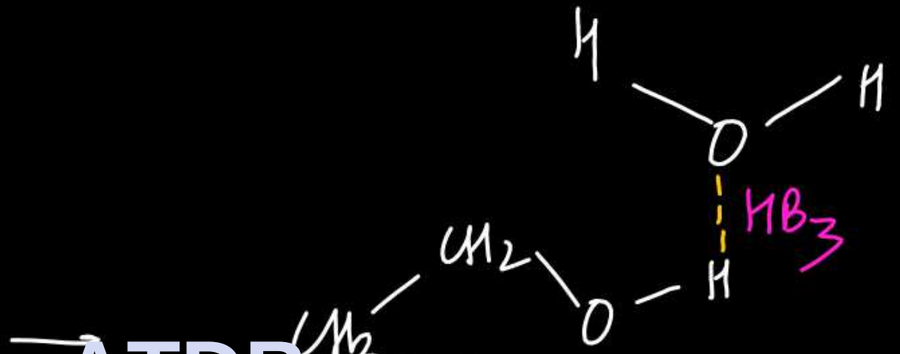
cyclohexane reduces the extent of hydrogen bonding between ethanol molecules leads to positively deviated system.

ii) Ethanol + water or Methanol + water



$HB_1 > HB_2$



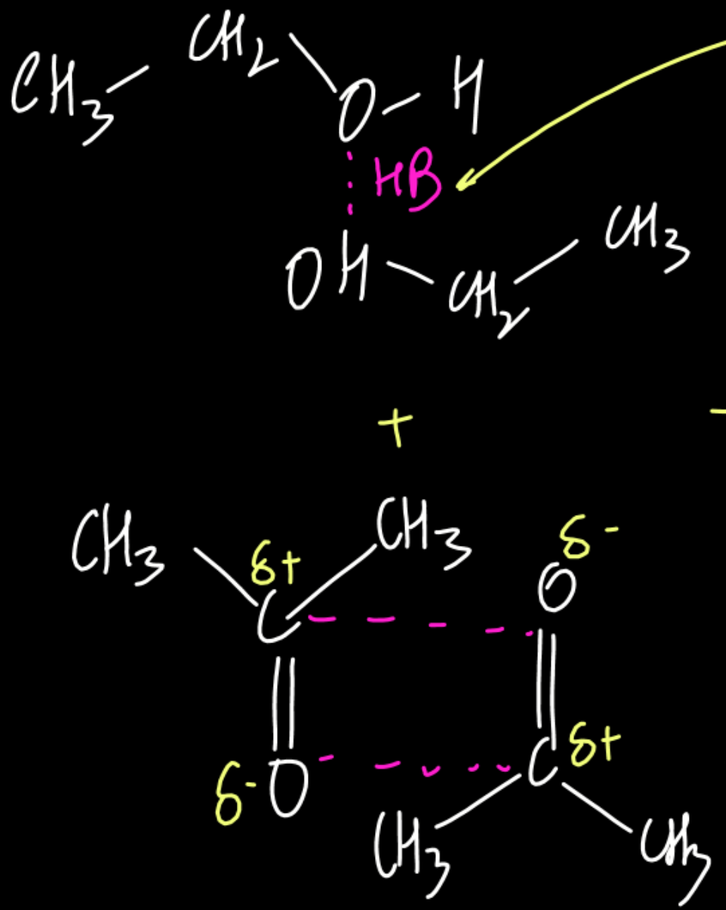


$HB_3 > HB_2$

$HB_3 < HB_1$

iii) Ethanol + Acetone

→ dp-dp interaction.

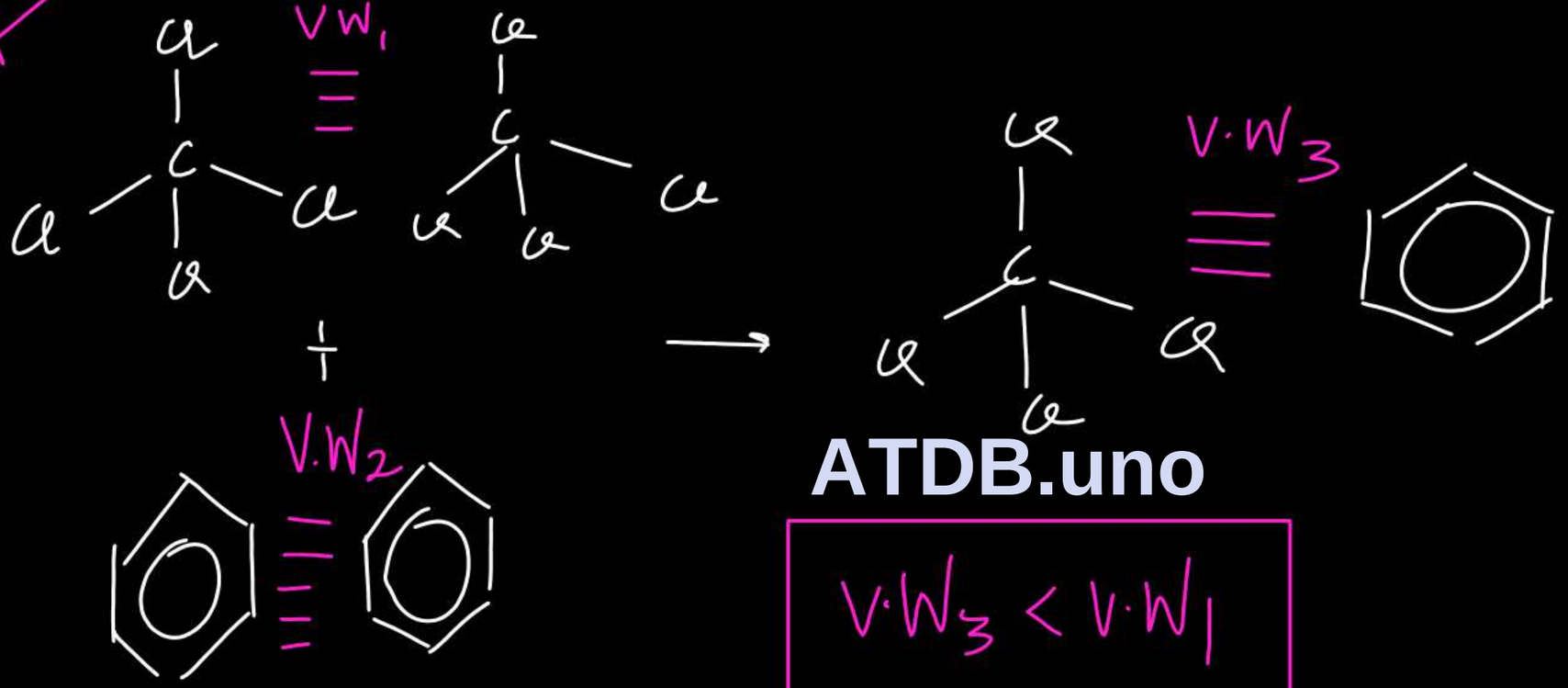


DP-DP interaction

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

iv) CCl_4 and Benzene or CCl_4 and Toluene

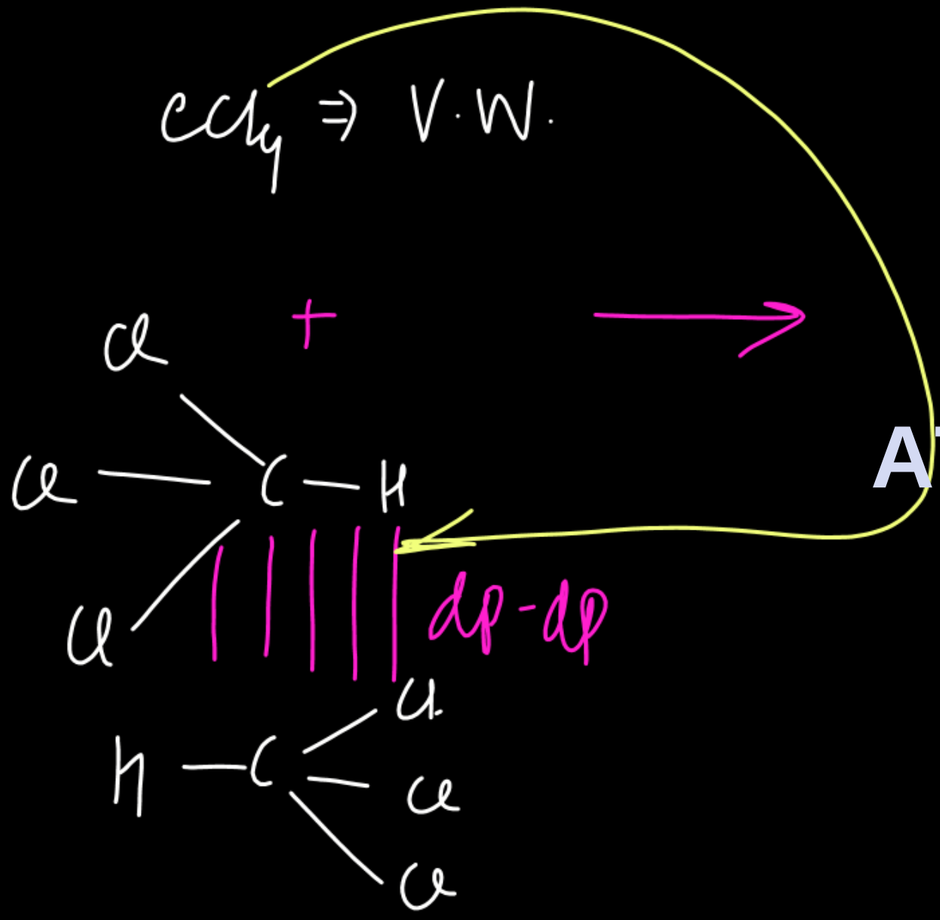
Imp



$V \cdot W_3 < V \cdot W_1$

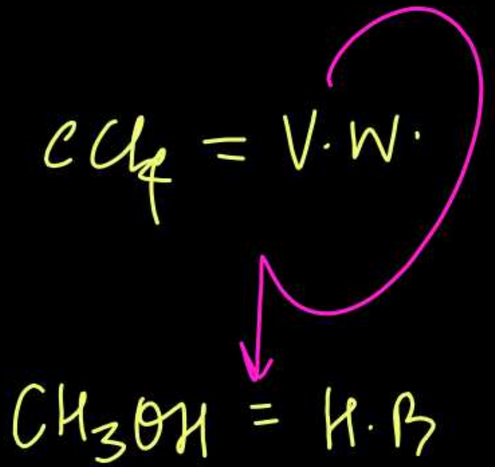
$V \cdot W_3 > V \cdot W_2$

V) $CCl_4 + CHCl_3$ (chloroform)



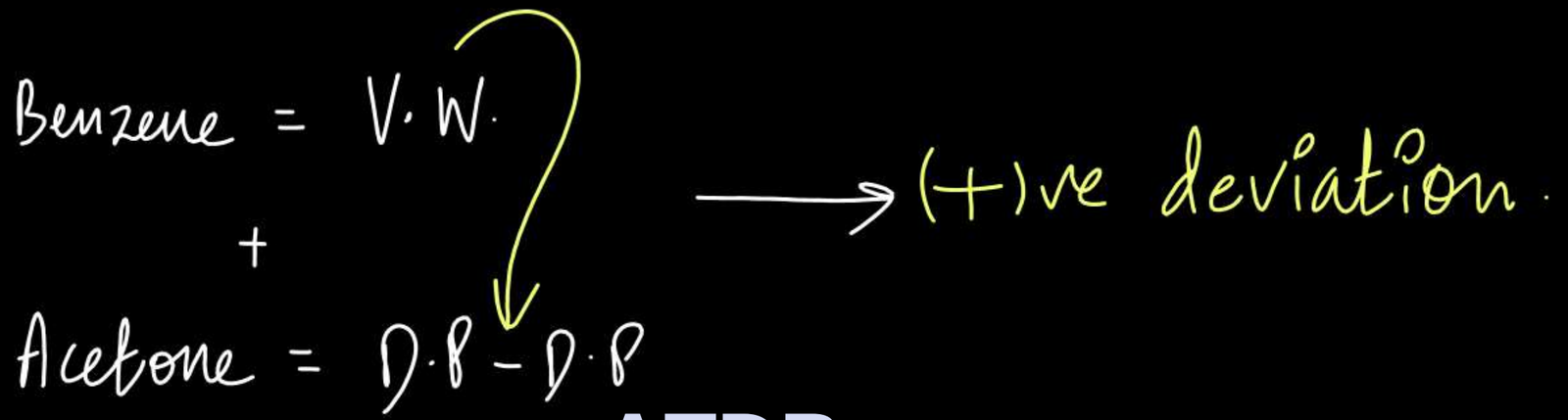
CCl_4 reduces the extent of dp-dp interactions between chloroform molecules leading to (+)ve deviated

vi) CCl_4 + Methanol



→ (+)ve deviation.

vii) Benzene + Acetone



viii) Acetone + CS_2

ix) Acetaldehyde and CS_2

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.

Ans : 0.158 molal

Question (2)

The vapour pressure of benzene at 80°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°C is 750 mm. The molecular weight of the substance will be :

(a) 15 (b) 150 (c) 1500 (d) 148

Ans: (D)

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?

Ans : 65.25 g/mol

Question

(4) Mixture of two liquids A and B is placed in 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 $P_A^\circ = 0.4$ atm and $P_B^\circ = 1.2$ atm at the experimental temperature. Calculate the total pressure at which the liquid has almost evaporated.

Ans : 0·66 f ahm

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° and P_B° are -

A) 120, 75

B) 120, 195

C) 120, 45

D) 75, 45

Ans : (B)