PRAYAS

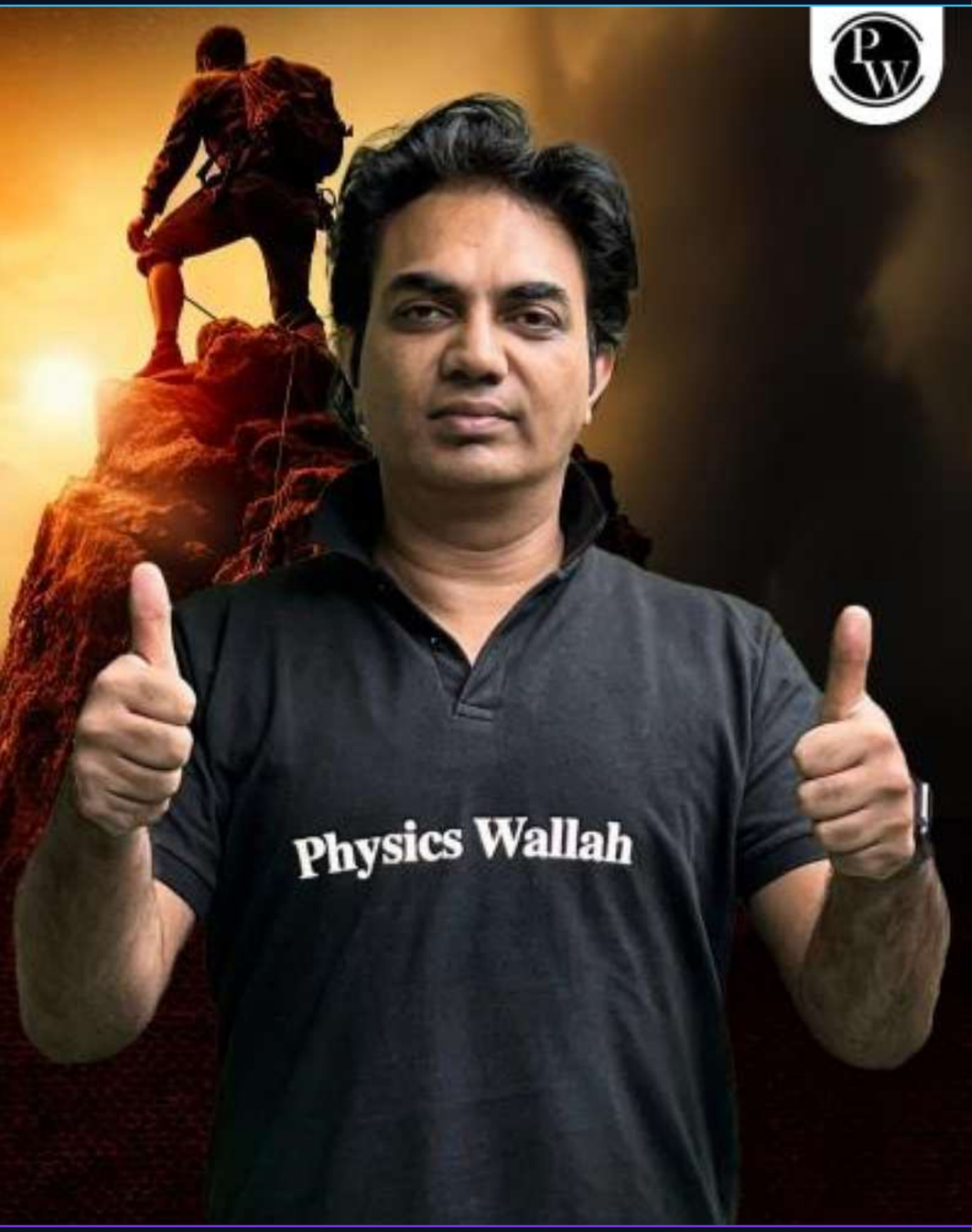
JEE 2026

PHYSICAL CHEMISTRY

SOLUTIONS

Lecture – 07

FAISAL RAZAQ



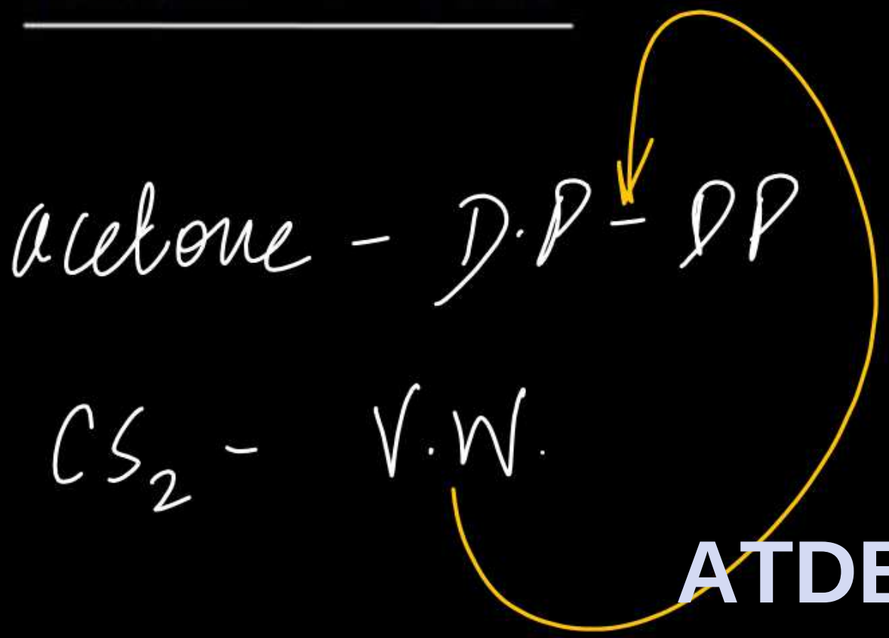
Topics to be covered

Azeotropes

ATDB.uno

viii) Acetone + CS_2

S = C = S (non polar)

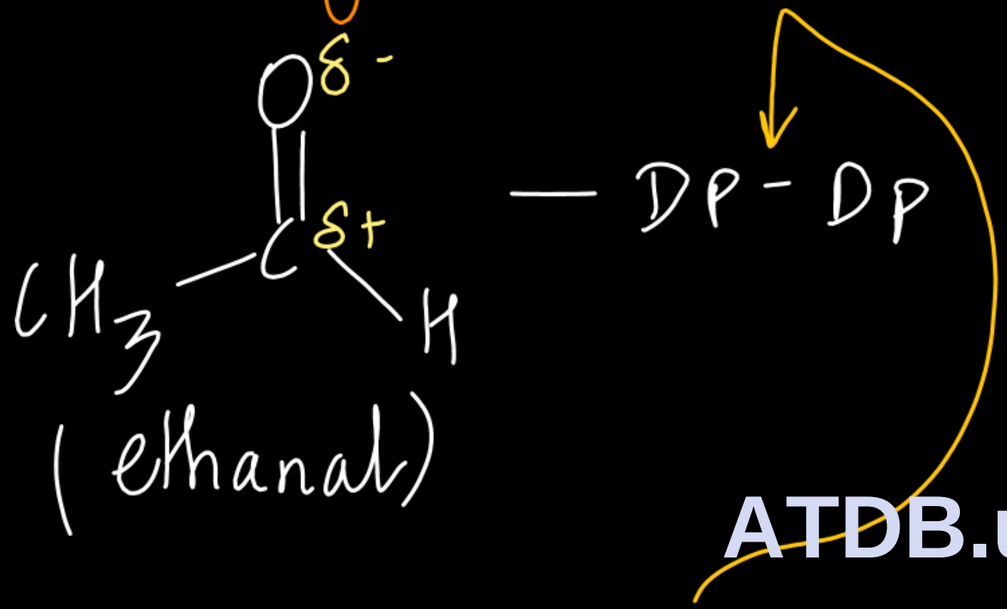


Acetone - D.P - DP

CS_2 - V.W.

(+) ve deviated.

ix) Acetaldehyde and CS_2



(+)ve deviated.

CS_2 — V.W.

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

(5)

A) 120, 75

B) 120, 195

C) 120, 45

D) 75, 45

$P_T = P_A^\circ X_A + P_B^\circ X_B$

$= P_A^\circ (1 - X_B) + P_B^\circ X_B$

$= P_A^\circ - X_B (P_A^\circ - P_B^\circ)$

$P_A^\circ = 120$;

$P_B^\circ = 45$;

$P_A^\circ - P_B^\circ = 75$

$P_B^\circ = P_A^\circ - 75$

$= 120 - 75$

$= 45$

Ans : (B) (C)

ATDB.uno

Negative Deviation

A – B interaction > A – A and B – B interactions

"when weaker interactions are replaced by stronger interaction."

Hydrogen bonding > Dp-Dp > V.W

Conditions

$A_2 + B_2 \longrightarrow 2AB$

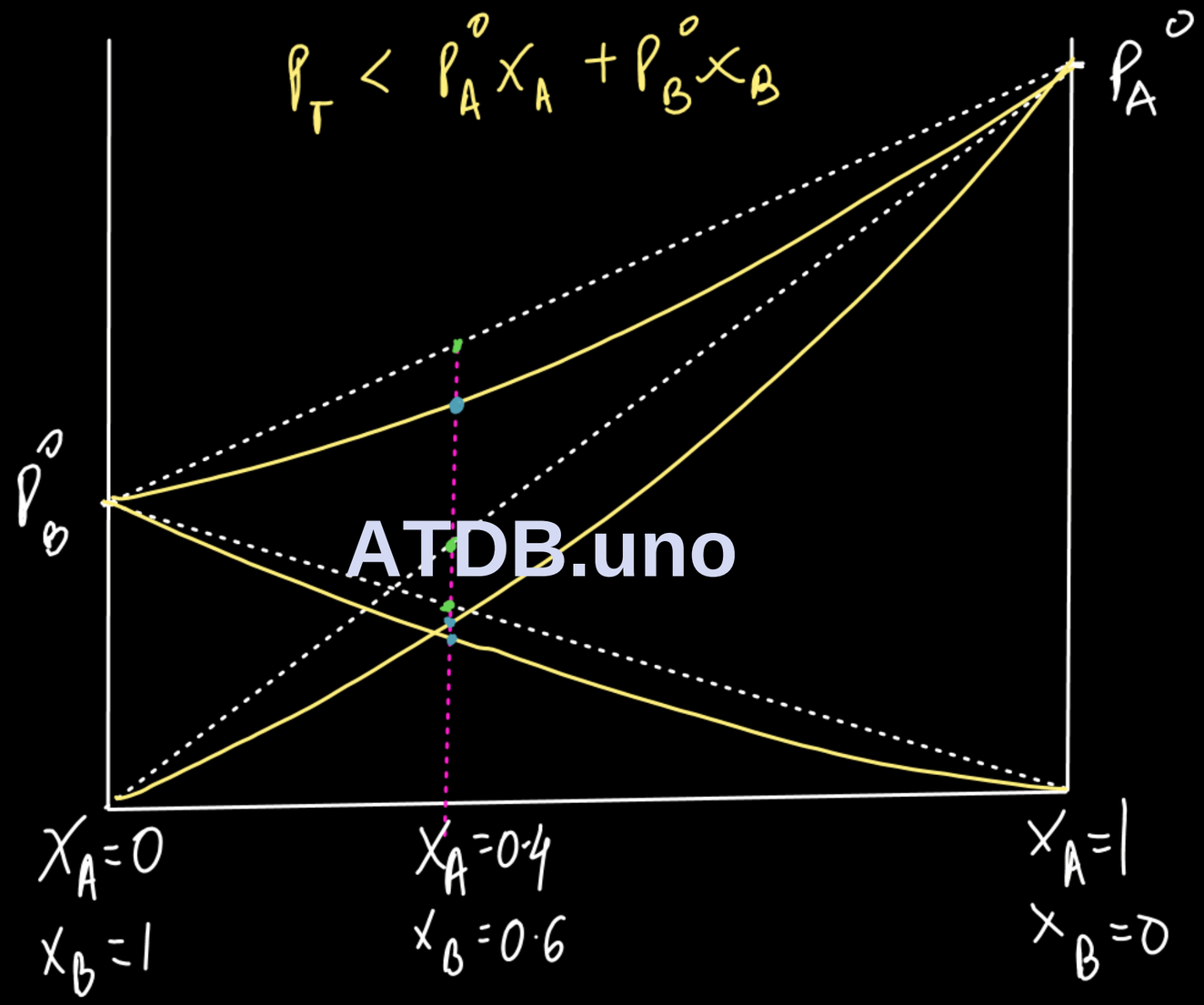
10 ml 10 ml 18 ml.

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

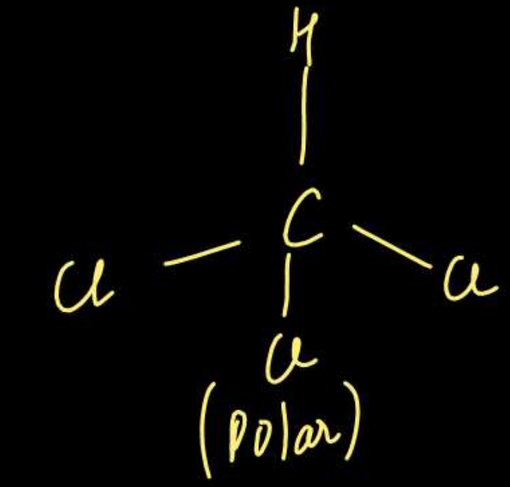
2) $\Delta V_{Mix} < 0$

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

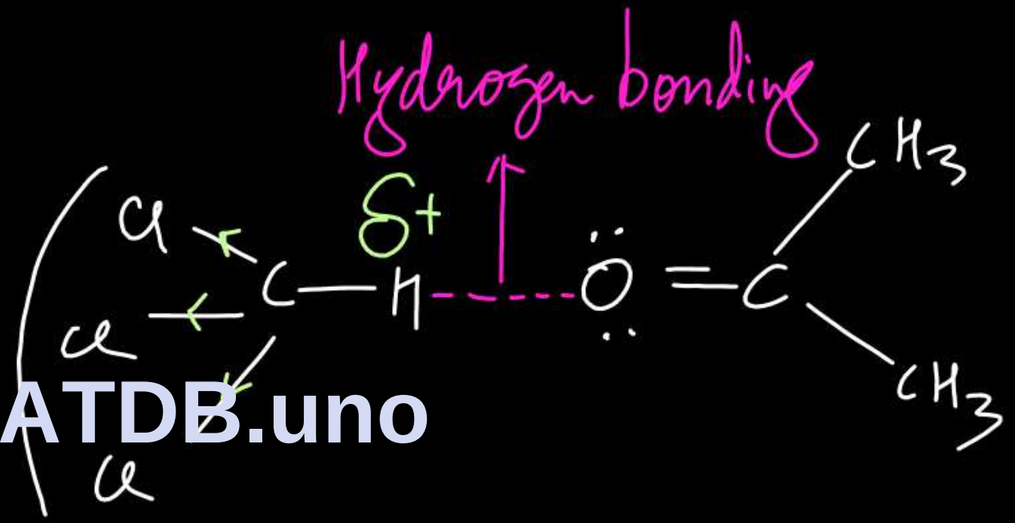
4) $\Delta G_{Mix} < 0$

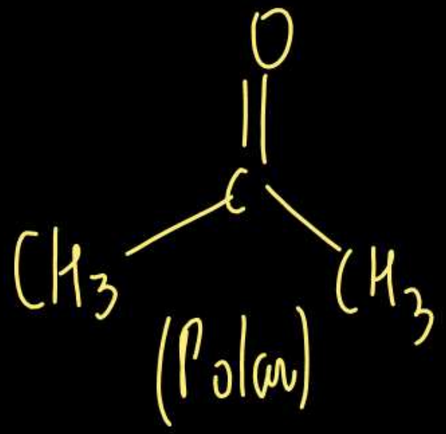


i) Chloroform ($CHCl_3$) and Acetone (CH_3COCH_3)



D-P-DP

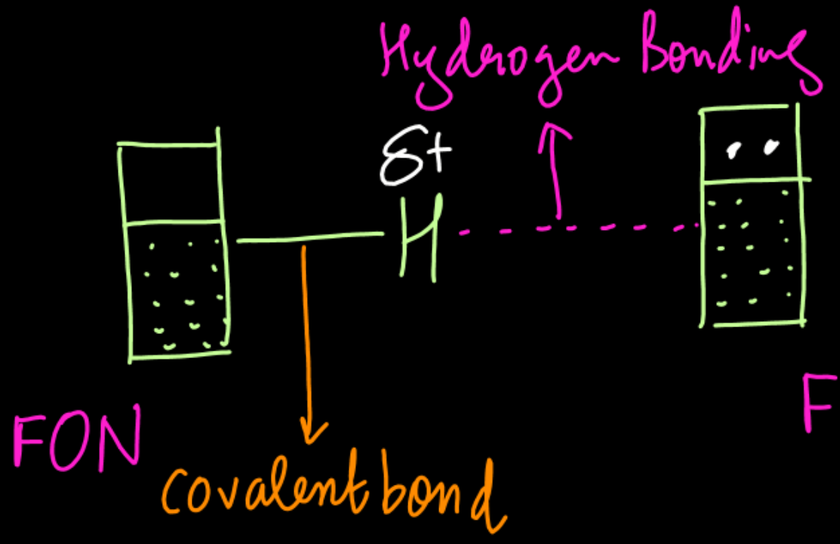




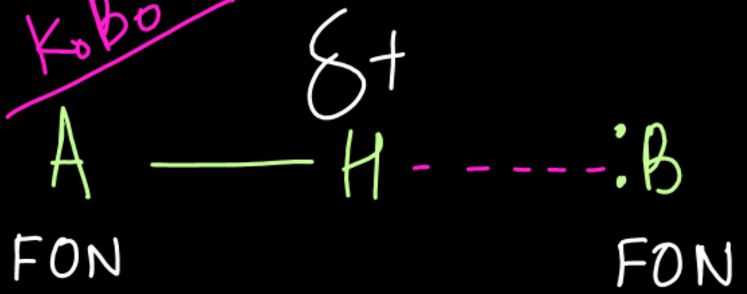
DP-DP

[(-)ve deviation]

Criteria for Hydrogen Bonding



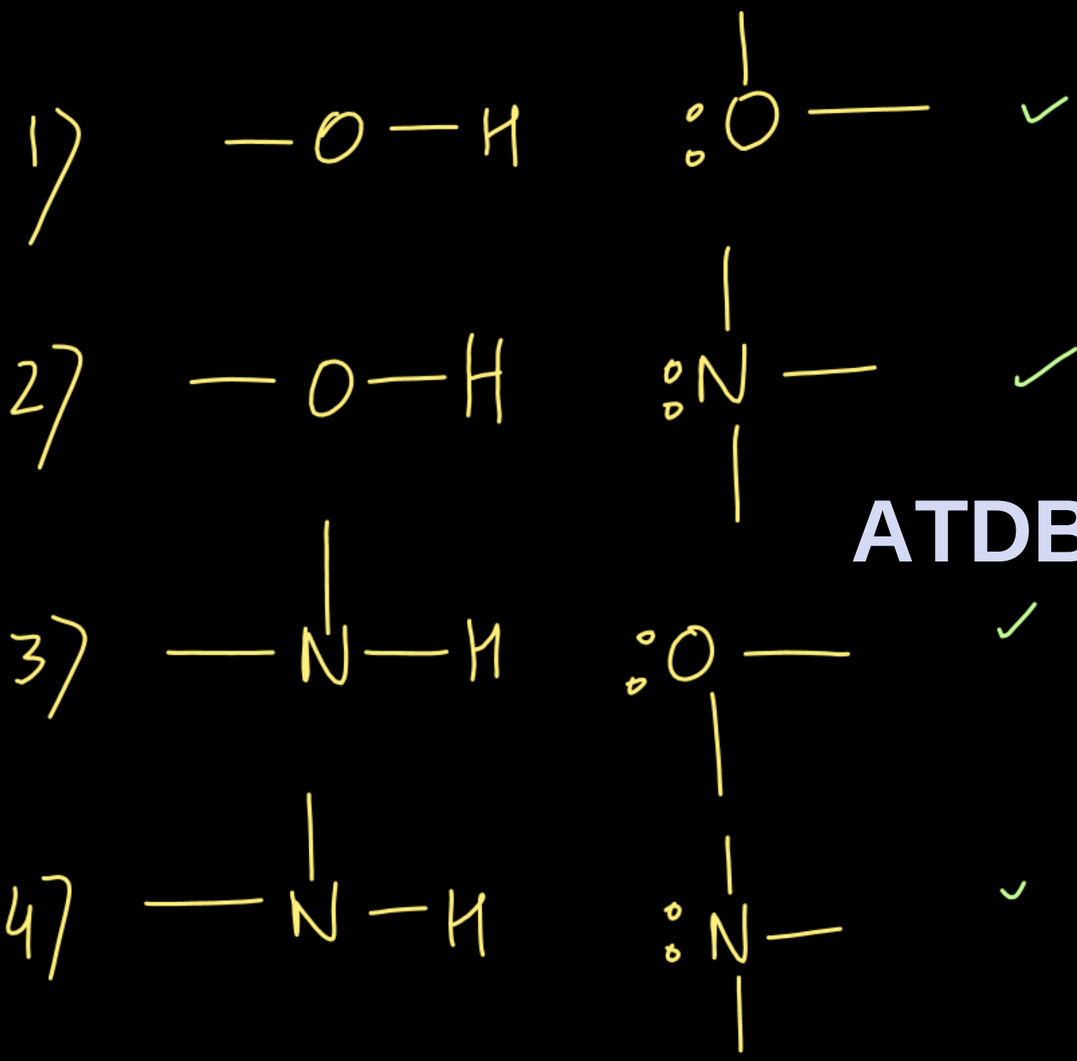
KoBo



Hydrogen bond is stronger

if $(E.N)_A > (E.N)_B$

Compare the extent of H-bonding



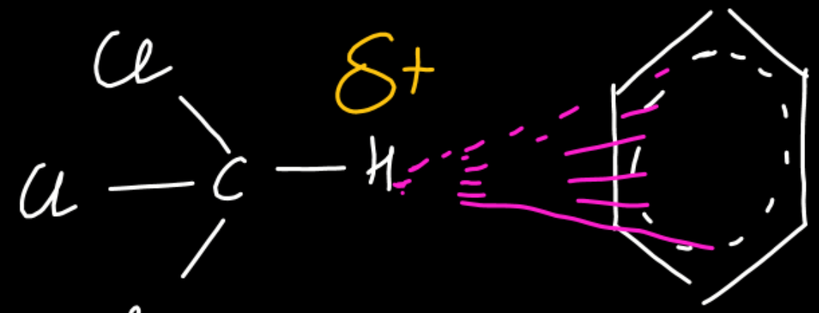
2 > 1 > 4 > 3

ii) $CHCl_3 + C_6H_6$

Imp

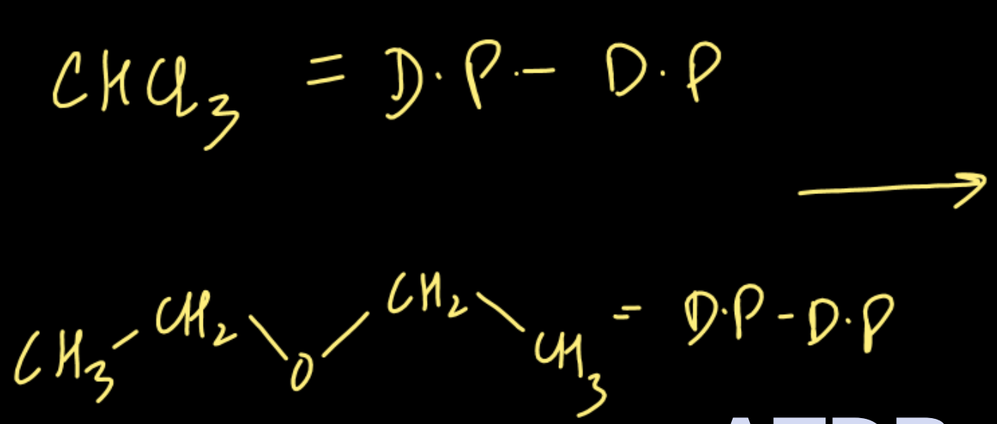
Chloroform (DP-DP)
(Polar)

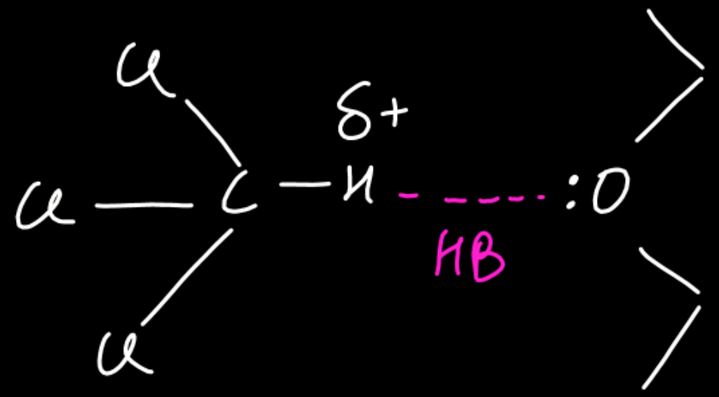
C_6H_6 (V.W)
(non-polar)



Due to interaction between Hydrogen and π-electrons of benzene, the solution shows (−)ve deviation.

iii) $CHCl_3 + CH_3CH_2OCH_2CH_3$



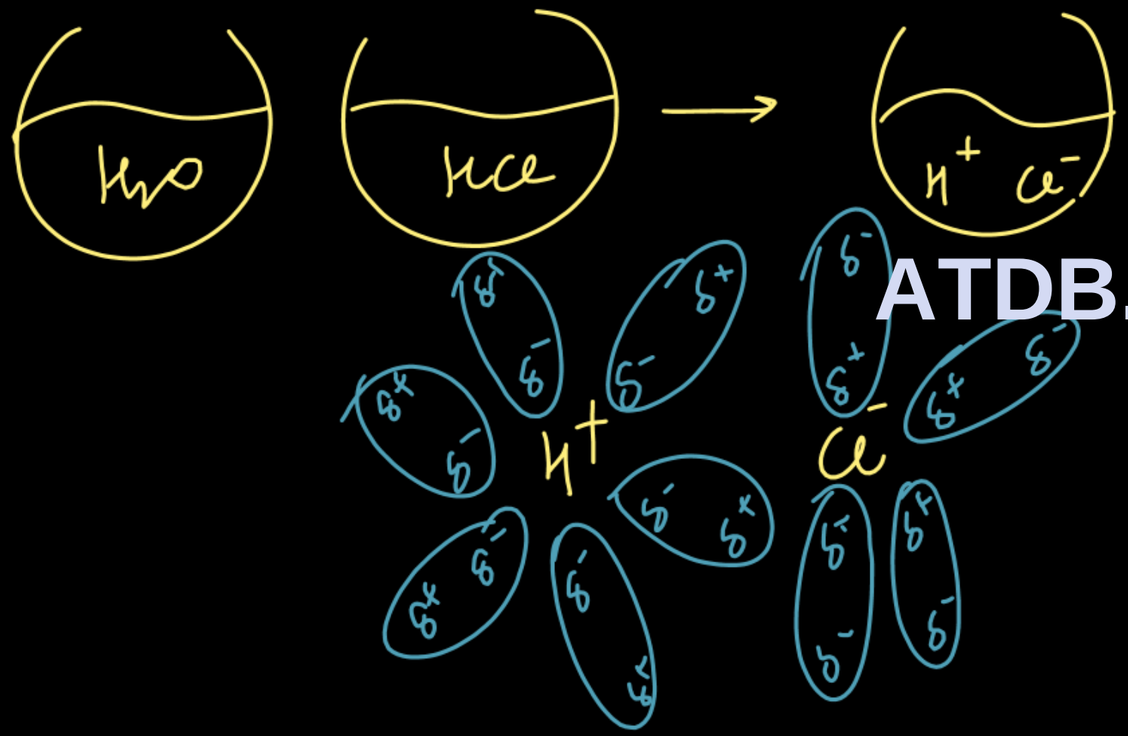


iv) $H_2O + HCl$ and $H_2O + HNO_3$

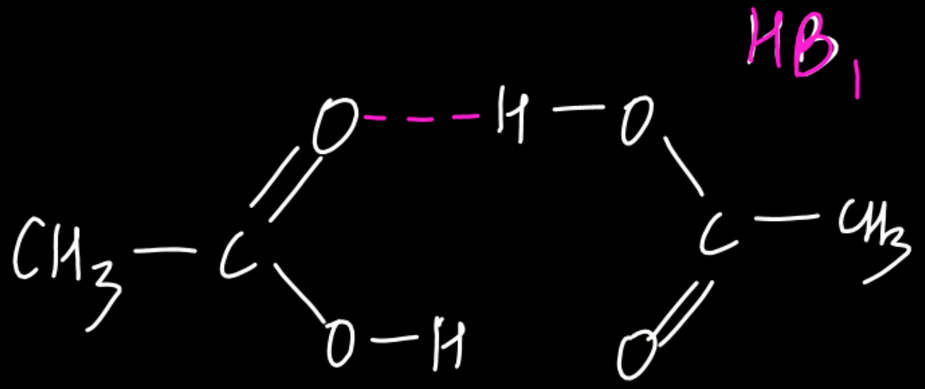
In water, $HCl \longrightarrow H^+ + Cl^-$

and ions do not evaporate.

leading to negative deviation.



v) $CH_3COOH + C_5H_5N$



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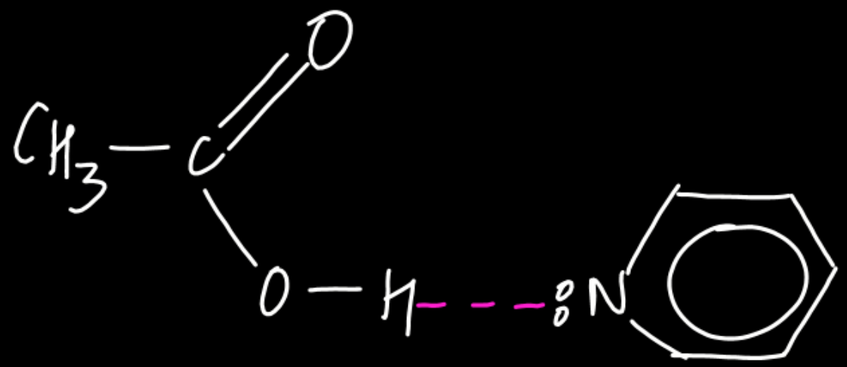
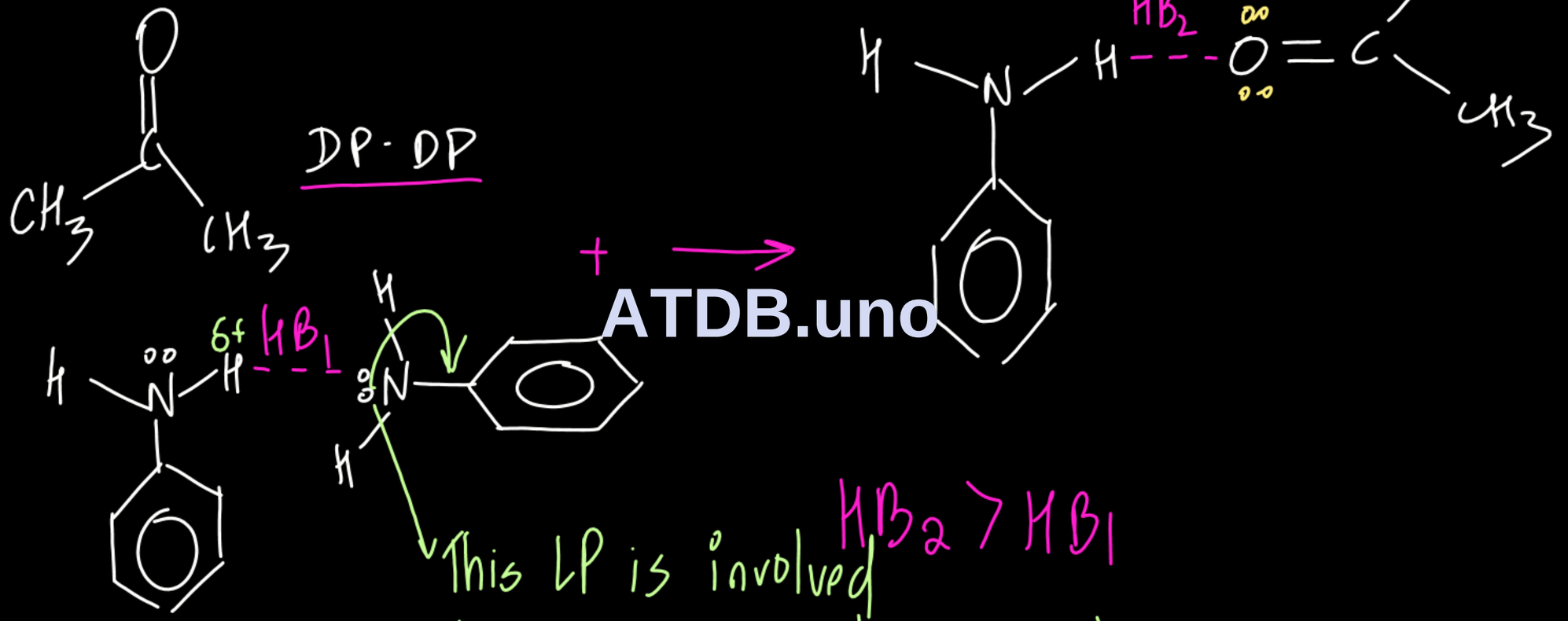


DP-DP

$HB_2 > HB_1$

$HB_2 > DP\text{-}DP$

vi) CH_3COCH_3 + aniline



This LP is involved in resonance, so less available for interaction with H.

$HB_2 > HB_1$

Question A solution of two miscible liquids showing negative deviation from Raoult's Law will have

[JEE Main - 2024]

A) increased V.P, increased B.P

B) increased V.P, decreased B.P

C) decreased V.P, decreased B.P

D) decreased V.P, increased B.P

Ans: (D)

Question

Identify the mixture that shows (+)ve deviation –

[JEE Main]

A) $(CH_3)_2CO + C_6H_5NH_2$

B) $CHCl_3 + C_6H_6$

DPDP V·W

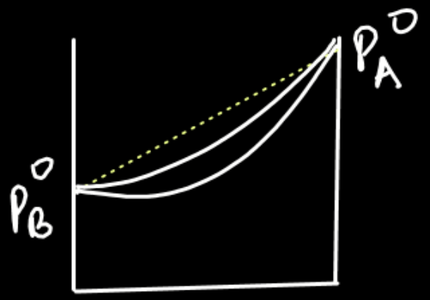
C) $CHCl_3 + (CH_3)_2CO$

~~D)~~ $(CH_3)_2CO + CS_2$

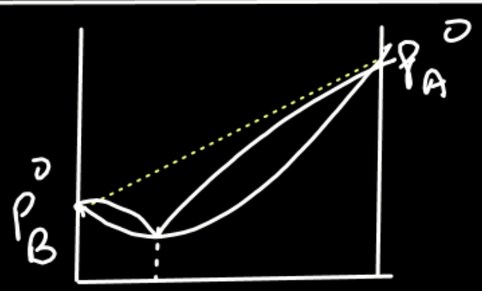
DP-DP V·W

Ans: (D)

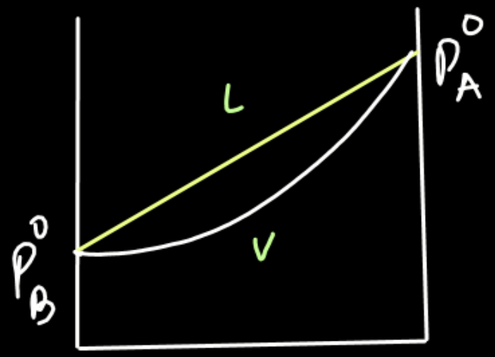
Pressure-Composition Curve for Non-Ideal Solutions



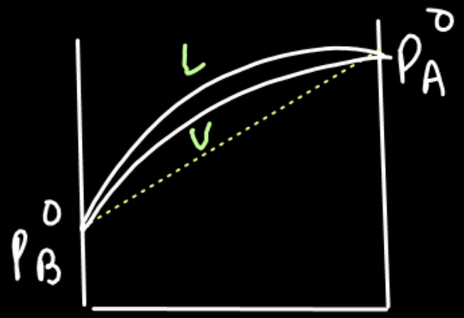
weak (−) ve



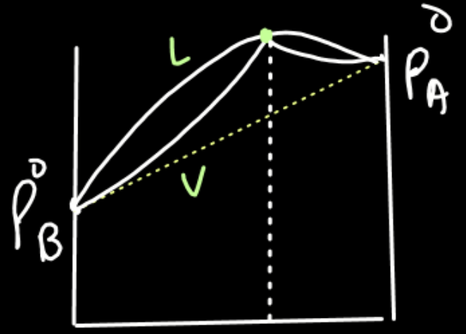
Strong (−) Ve



(Ideal)

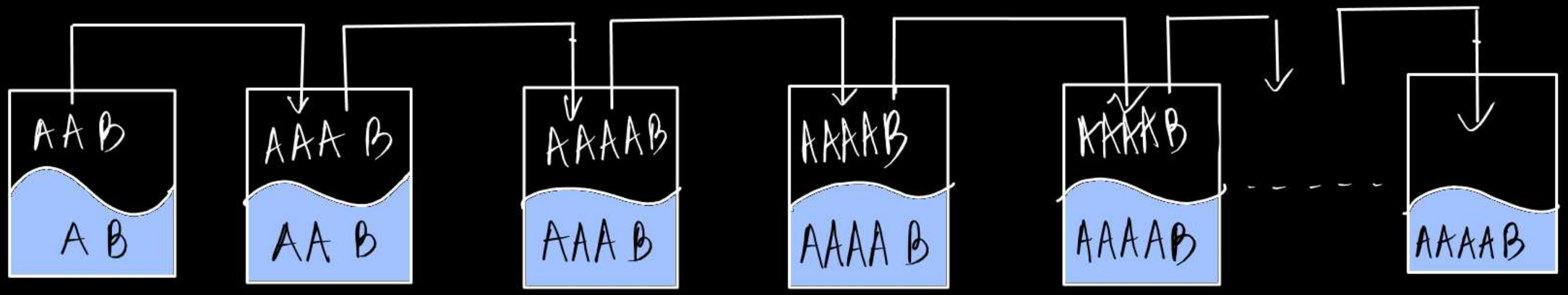


weak (+) ve

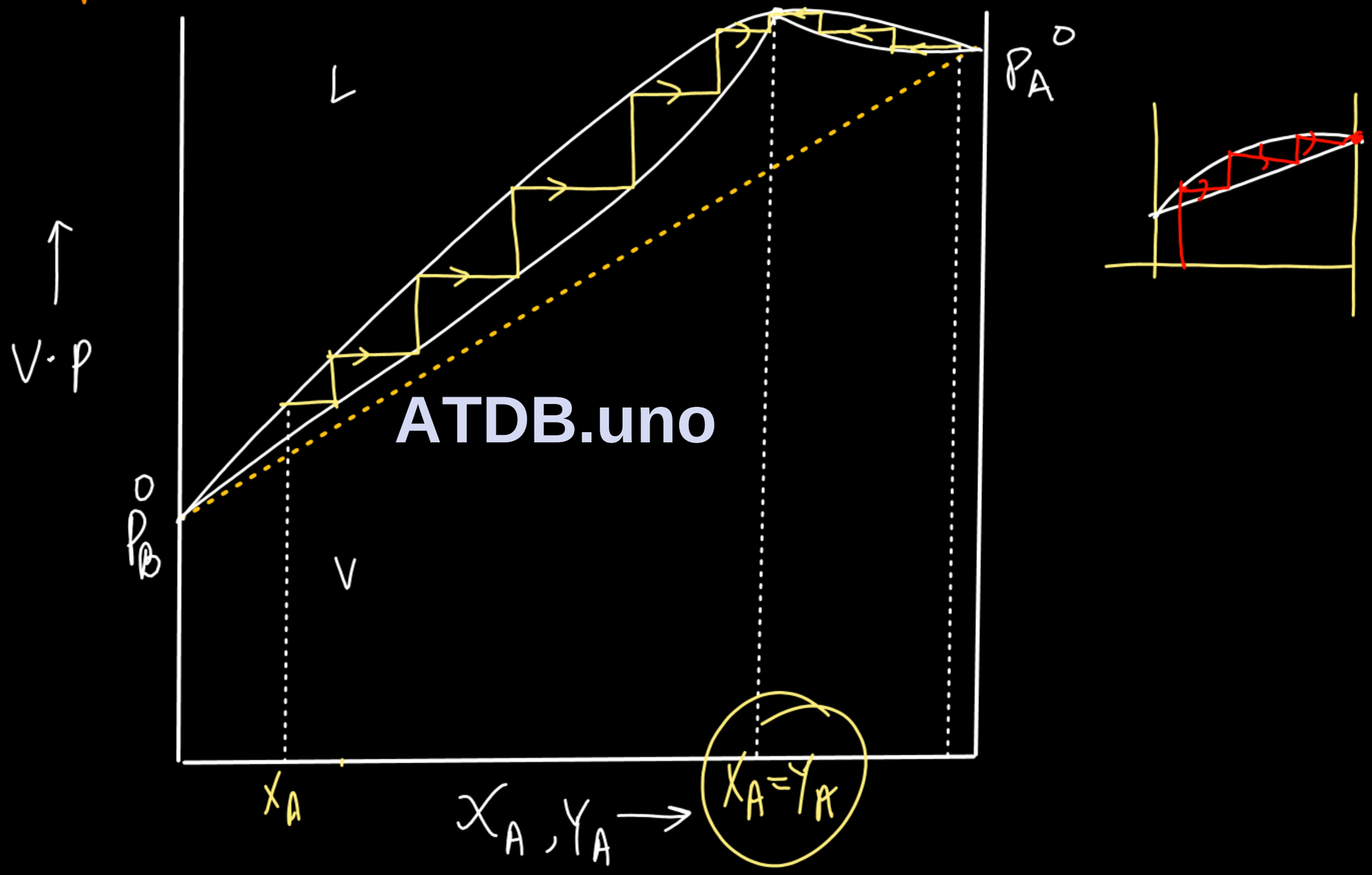


Strong (+) Ve

Distillation of a non-ideal solution of Liq. A and Liq. B

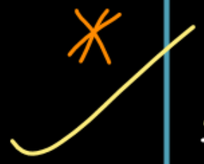


Pressure - Composition Curve for a strongly positive deviated sol"



Azeotropic Mixture

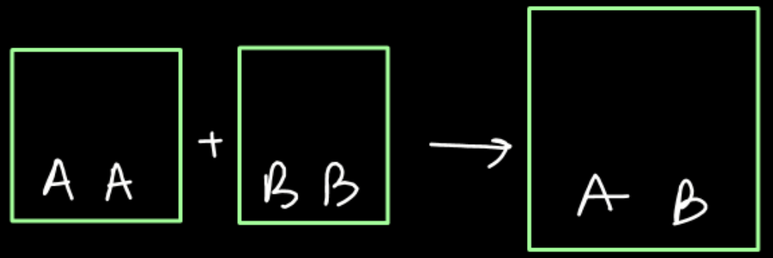
* A binary solution containing two volatile liquids in which both liquid and vapour have same composition.



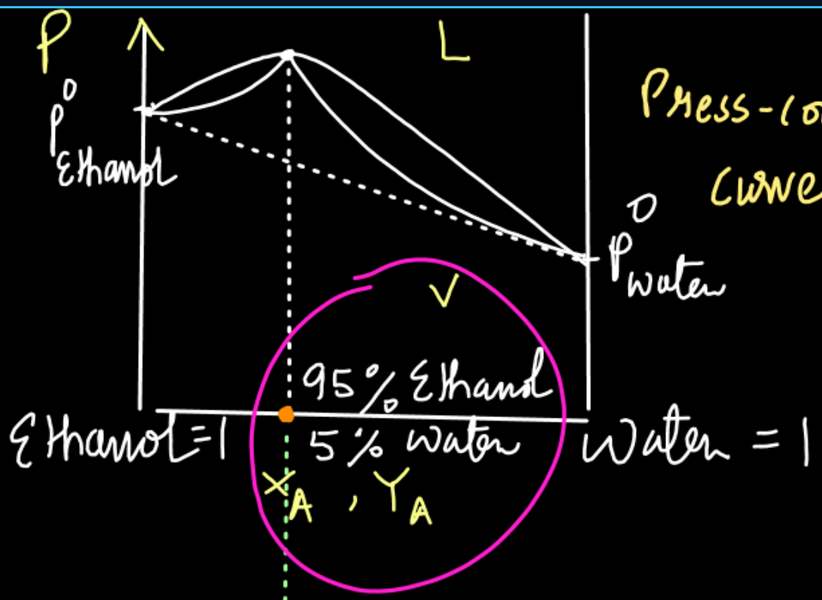
A boiling liquid mixture at the azeotropic composition produces the vapours of exactly same composition as that of liquid.

* Composition of Liquid mixtures at which distillation can not separate the two liquids because the condensate has the same composition as that of azeotropic liquid.

Minimum Boiling Azeotropes



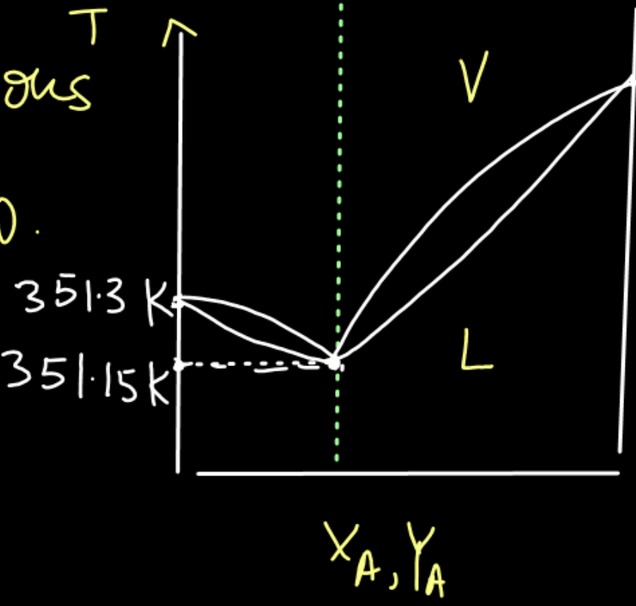
351.3K 373K 351.15K



Press-comp. curve

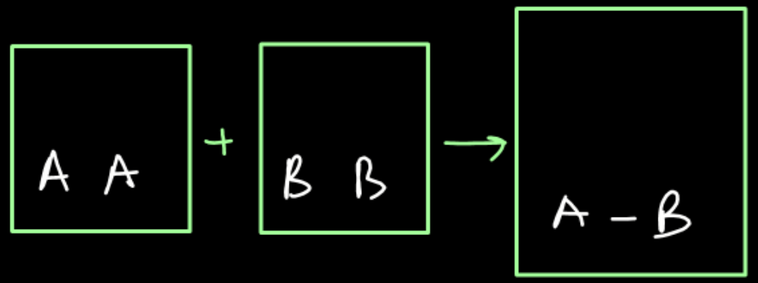
* These Azeotropes are formed by Non-Ideal solutions having large (+)ve deviation from Raoult's law.

* Boiling point of the solution is less than the B.P of either component.

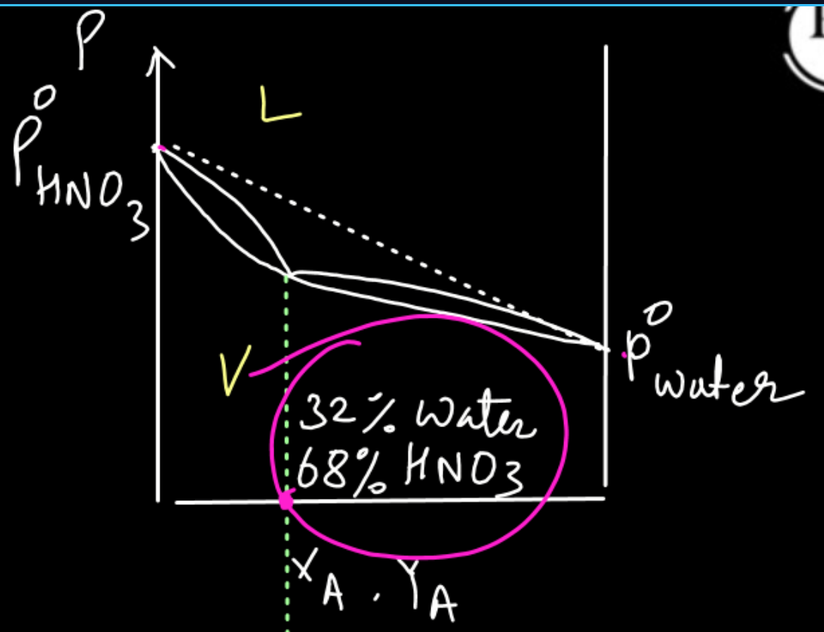


Temp-composition curve.

Maximum Boiling Azeotropes

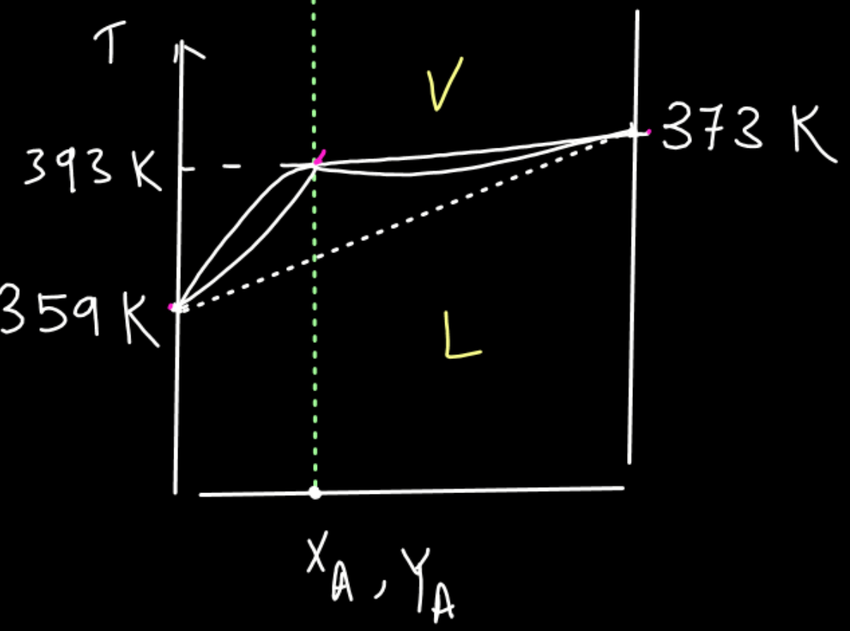


359 K 373 K 393 K



* These are formed by the solutions which show (–)ve deviation from Raoult's law.

* Boiling point of this azeotropic mixture is more than the either component.



Question

Mixture of Phenol and Aniline shows

A. Positive Deviation

B. Zero Deviation

C. Negative Deviation

D. Can't Predict

H.W.