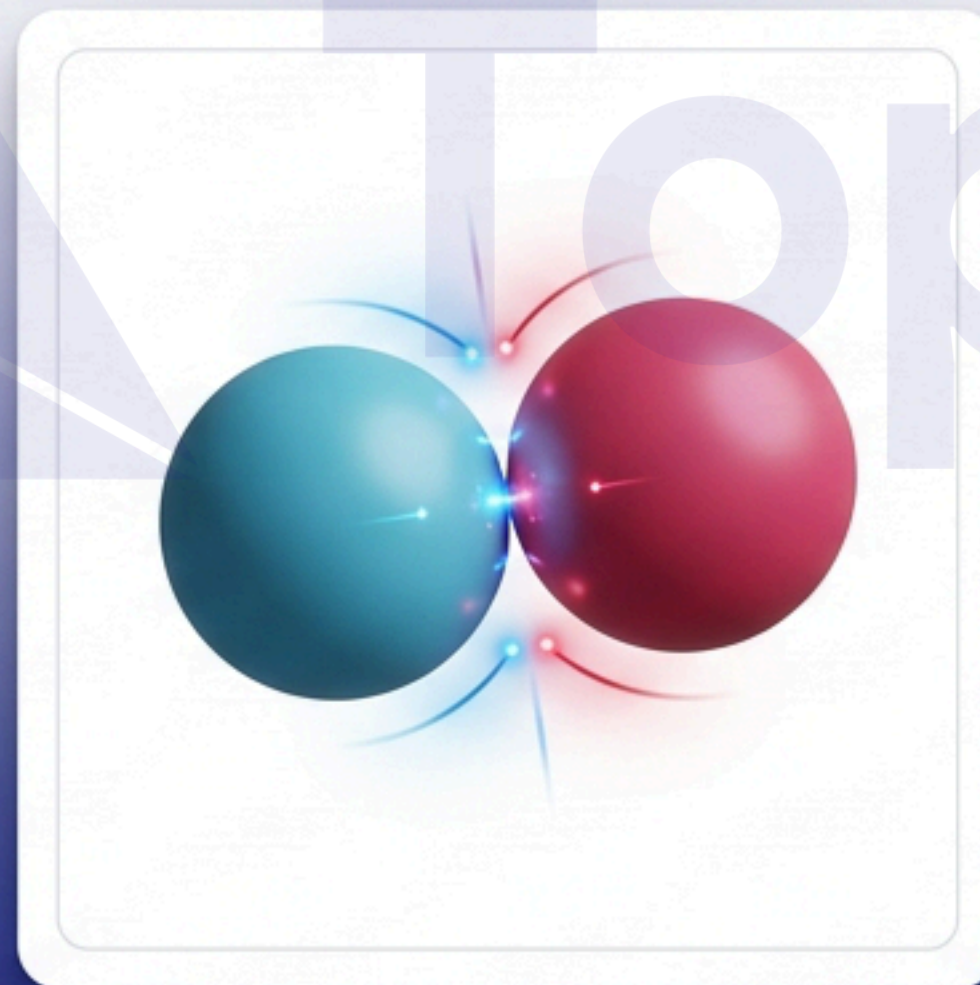


1.5.2 Non-ideal Solutions

Understanding how molecular interaction imbalances drive deviations from Raoult's Law.



The Molecular Imbalance

Ideal solutions assume all molecules interact with equal force. In reality, the attractive forces between different molecules often disrupt this perfect balance.

Ideal Behavior

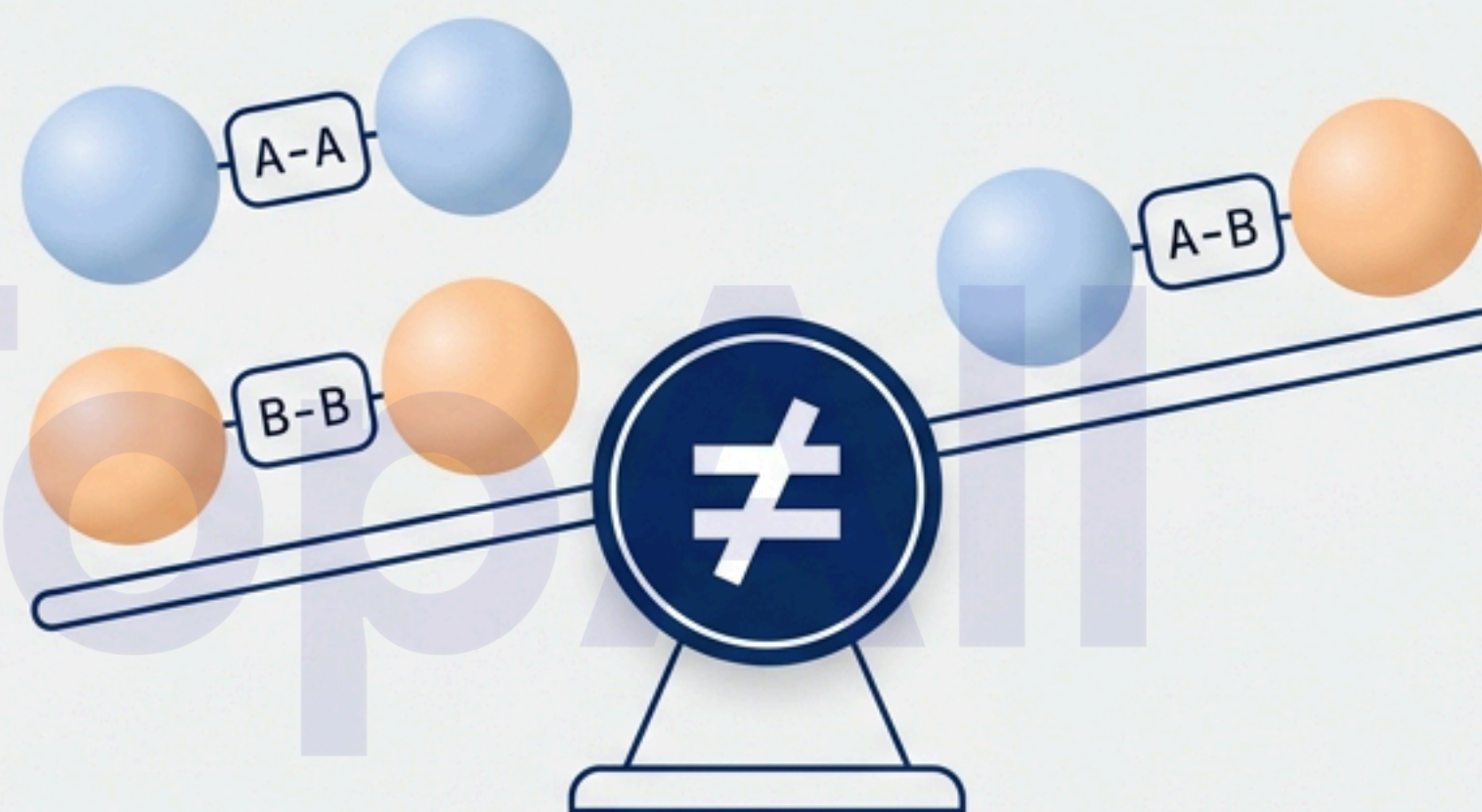
A-A and B-B interactions are exactly equal to A-B interactions. Obeys Raoult's Law at all concentrations.

$$\Delta_{\text{mix}}H = 0$$

$$\Delta_{\text{mix}}V = 0$$

Non-Ideal Behavior

The intermolecular attractive forces between solute and solvent are unequal to the pure components. Vapour pressure diverges from Raoult's predictions.



Increased Escaping Tendency

Positive Deviation

Weaker Bonds

A-B interactions are weaker than pure A-A or B-B interactions.

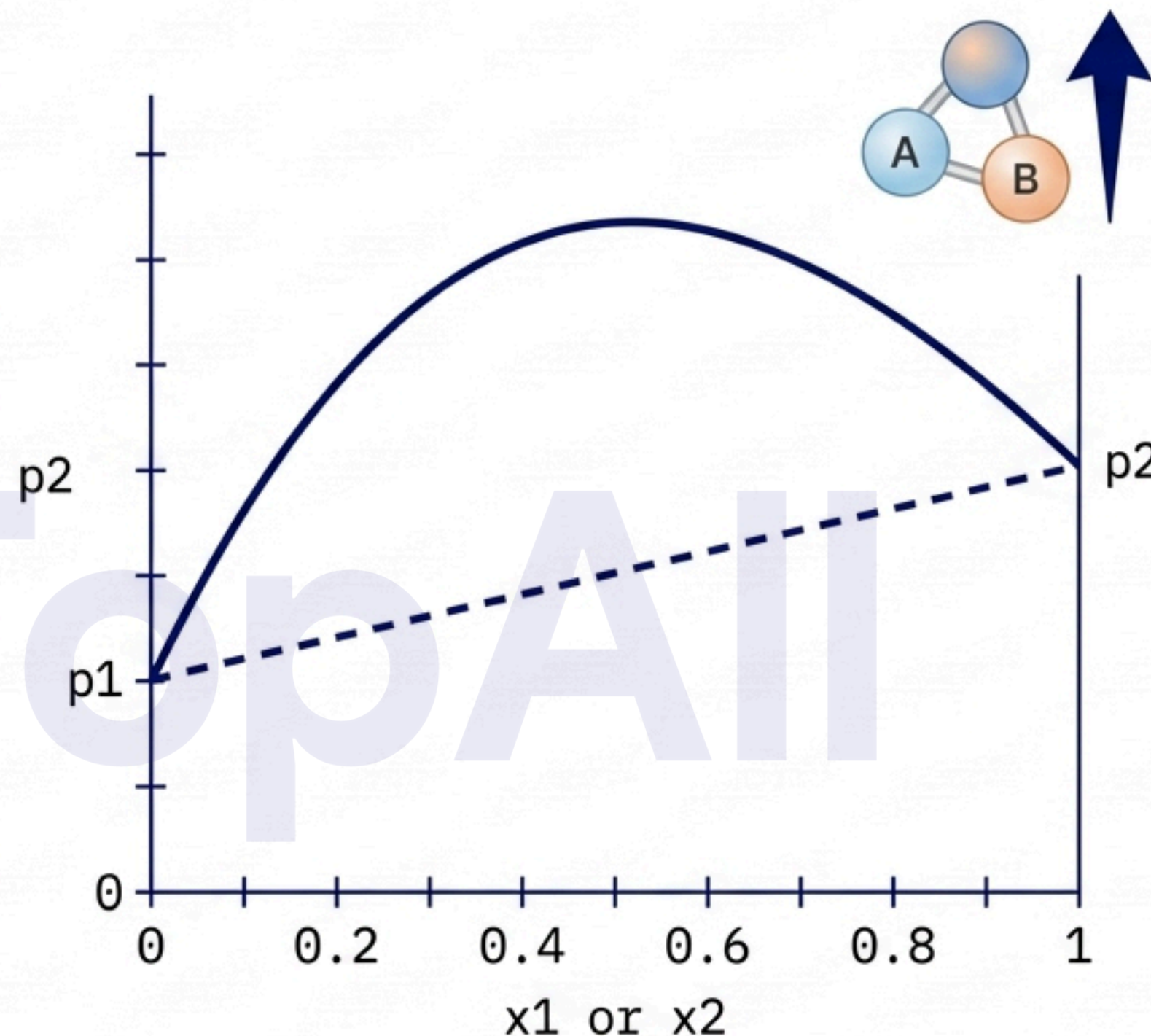
The Result

Molecules find it easier to escape the liquid phase. This leads to a higher total vapour pressure than predicted.

↑ High Vapour Pressure

$\Delta_{\text{mix}}H > 0$ (Endothermic)

$\Delta_{\text{mix}}V > 0$ (Expansion)



Vapour pressure of solution is **HIGHER** than Raoult's Law prediction. $p_i > p_i^0 x_i$



**You've Learned the Theory.
Let's Test Them Now.**

$$E=mc^2$$



Turn theory into marks with **unlimited MCQs, smart analysis, and focused revision.**

Practice Now



At prep.topall.app

Key Highlights

- » Free Study Material, Videos & Infographics
- » Push Your Limits with Level-Based Challenges
- » Climb the Leaderboard Among Fellow Aspirants
- » Practice Unlimited MCQs for NEET & JEE
- » Get Clear Explanations, Not Just Marks
- » Track Your Performance Smarter



Decreased Escaping Tendency

Negative Deviation

Stronger Bonds

A-B interactions are stronger than pure A-A or B-B interactions.

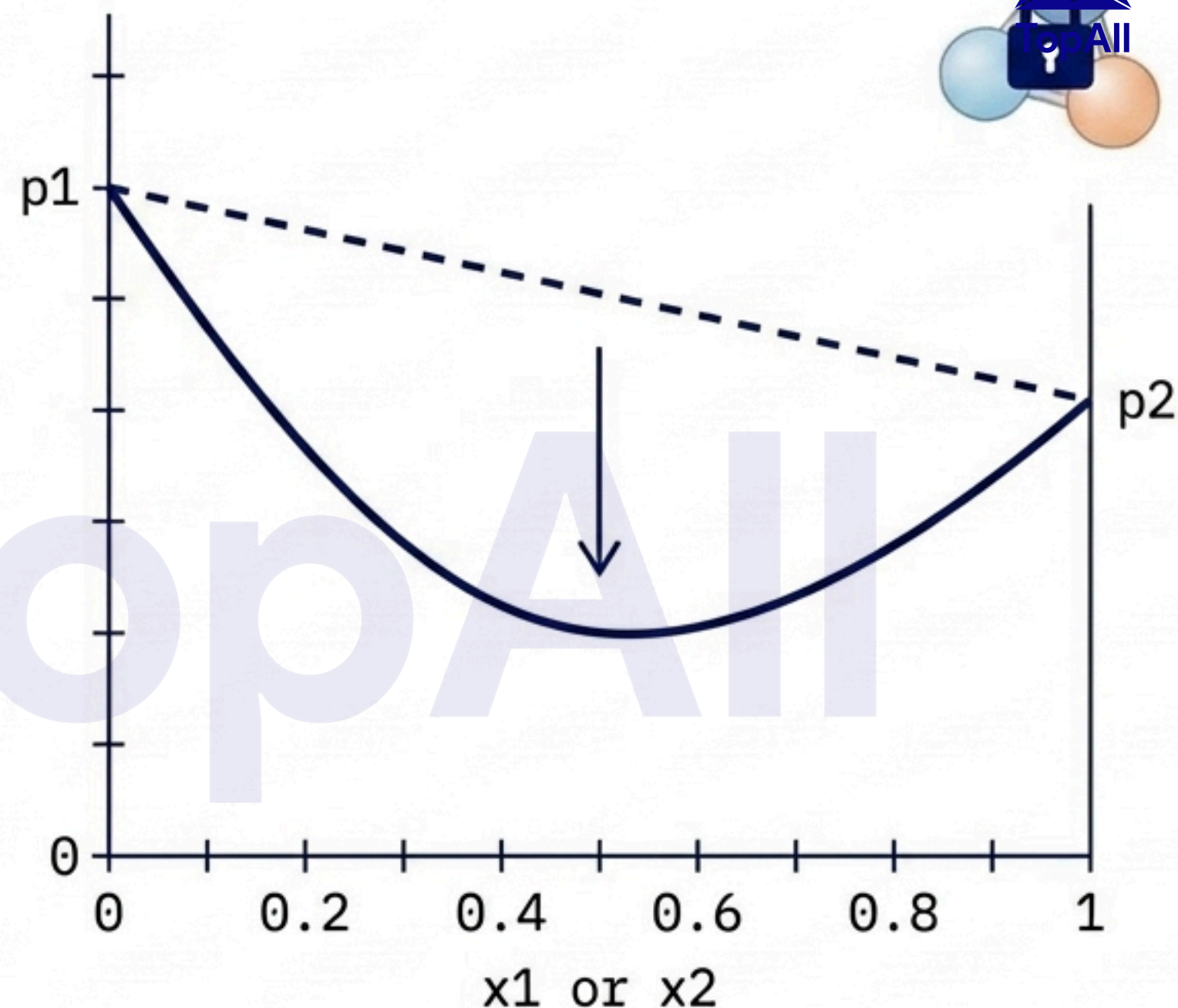
The Result

Molecules are trapped in the liquid phase, decreasing their escaping tendency. Total vapour pressure drops.

↓ Low Vapour Pressure

$\Delta_{\text{mix}}H < 0$ (Exothermic)

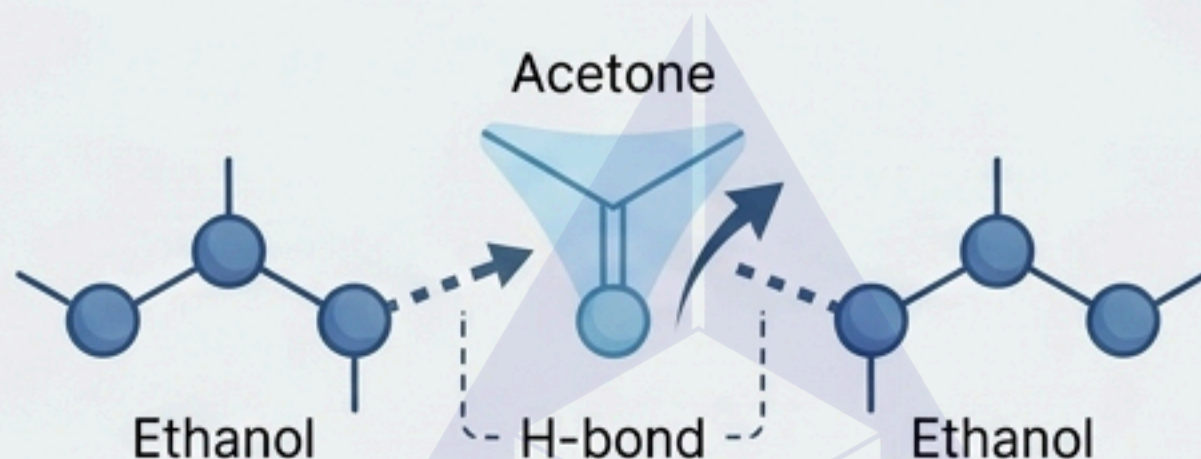
$\Delta_{\text{mix}}V < 0$ (Contraction)



Vapour pressure of solution is **LOWER** than Raoult's Law prediction. $p_i < p_i^0 x_i$

Real-World Chemical Deviations

Positive Deviation (Breaking Bonds)



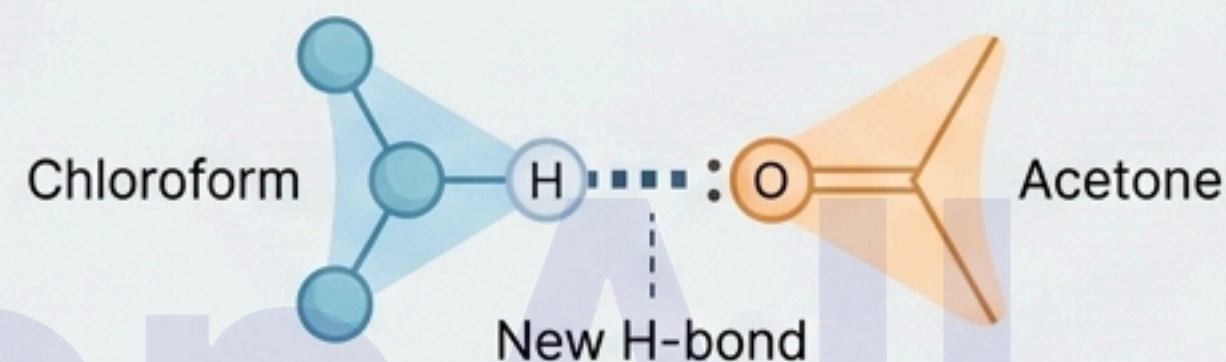
Ethanol + Acetone

Pure ethanol is held tightly by hydrogen bonds. Acetone molecules squeeze between them, breaking the host's H-bonds. Interactions weaken → Vapour pressure rises.

Carbon Disulphide + Acetone

Dipolar interactions in the mixture are weaker than those in the pure components.

Negative Deviation (Forming Bonds)



Phenol + Aniline

Forms strong intermolecular H-bonds between the phenolic proton and the nitrogen lone pair.

Chloroform + Acetone

Chloroform forms a new H-bond with acetone. Interactions strengthen → Vapour pressure drops.

Azeotropes (Constant Boiling Mixtures)



Binary mixtures that have the exact same composition in liquid and vapour phases. They boil at a constant temperature and cannot be separated by fractional distillation.

Large Positive Deviation

Minimum Boiling Azeotrope



Because vapour pressure is extremely high, boiling point is lowered.

Ethanol (95%) + Water (5%)

Large Negative Deviation

Maximum Boiling Azeotrope



Because vapour pressure is extremely low, a higher temperature is needed to boil.

Nitric Acid (68%) + Water (32%)

Boils at 393.5 K

The Interaction Imbalance

	Ideal Solutions	Positive Deviation	Negative Deviation
Interactions	$A-B = A-A = B-B$	$A-B < A-A, B-B$ (Weaker)	$A-B > A-A, B-B$ (Stronger)
Raoult's Law	$P_t = p_1 + p_2$	$P_t > p_1 + p_2$	$P_t < p_1 + p_2$
Enthalpy / Volume	$\Delta H_{mix} = 0, \Delta V_{mix} = 0$	$\Delta H_{mix} > 0, \Delta V_{mix} > 0$	$\Delta H_{mix} < 0, \Delta V_{mix} < 0$
Azeotrope	-	Minimum Boiling	Maximum Boiling

Core Principle: Escaping tendency is entirely dictated by the comparative strength of molecular interactions.



You've Learned the Theory.

Now Let's Test It.

Reading notes gets you knowledge.

Practicing MCQs gets you marks.

That's exactly what TopAll Pro is built for.

Try TopAll Pro Now

What TopAll Pro Does Differently

-  **Stuck? Snap it. Solve it. — Doubts AI**
Photo → step-by-step solution in seconds, 24/7
-  **Your AI Coach finds your blind spots**
Concept-level weakness detection — not just chapter-level
-  **4.5 Lakh+ questions. Never run out.**
13× more content than any other prep app in India
-  **Build your own test in 60 seconds**
Pick a chapter, set difficulty — AI does the rest instantly.
-  **AI Recommendation that helps you improve**
AI Recommendation Analysis your Tests and tell you where you need to improve.



Practice the moment you finish studying
Jump in while the concept is still fresh in your head

4.5L+
MCQs

1.5L+
Students

AI Powered
In-Depth Analysis