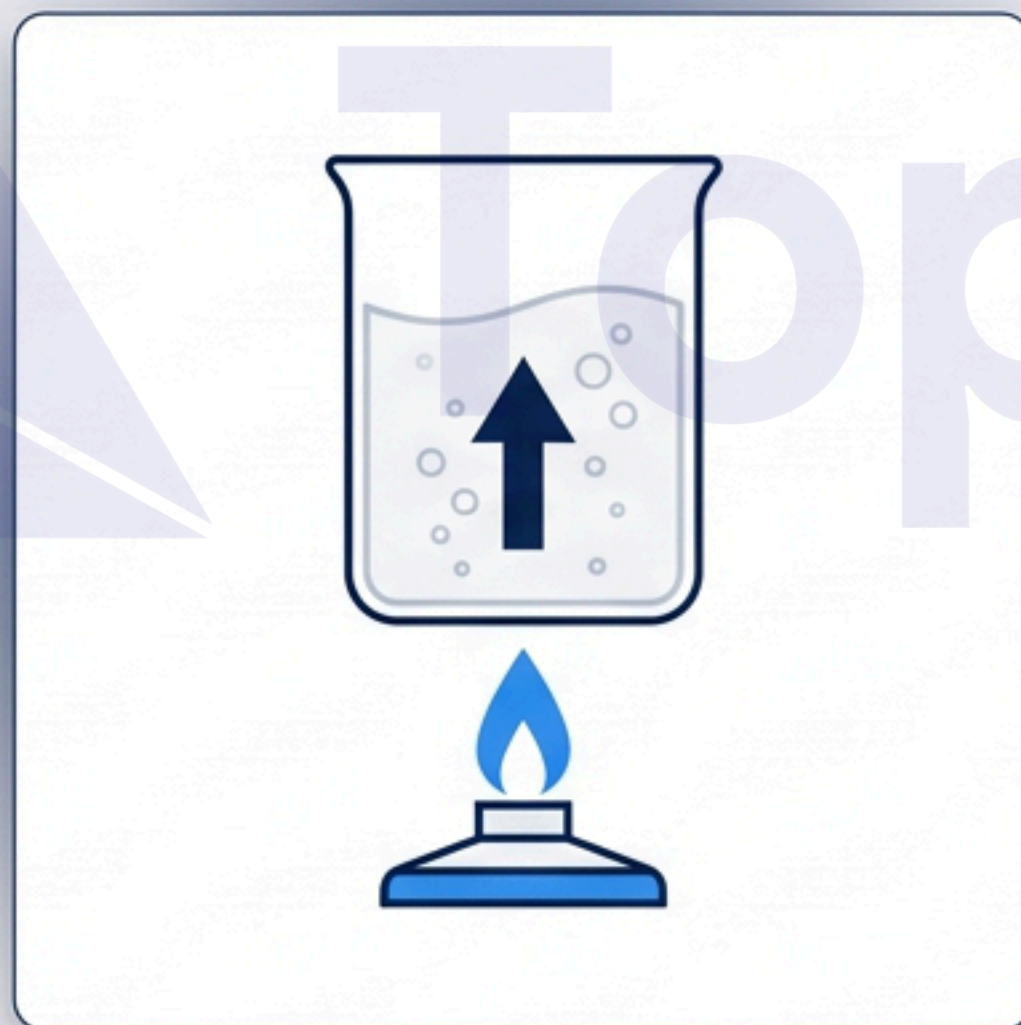


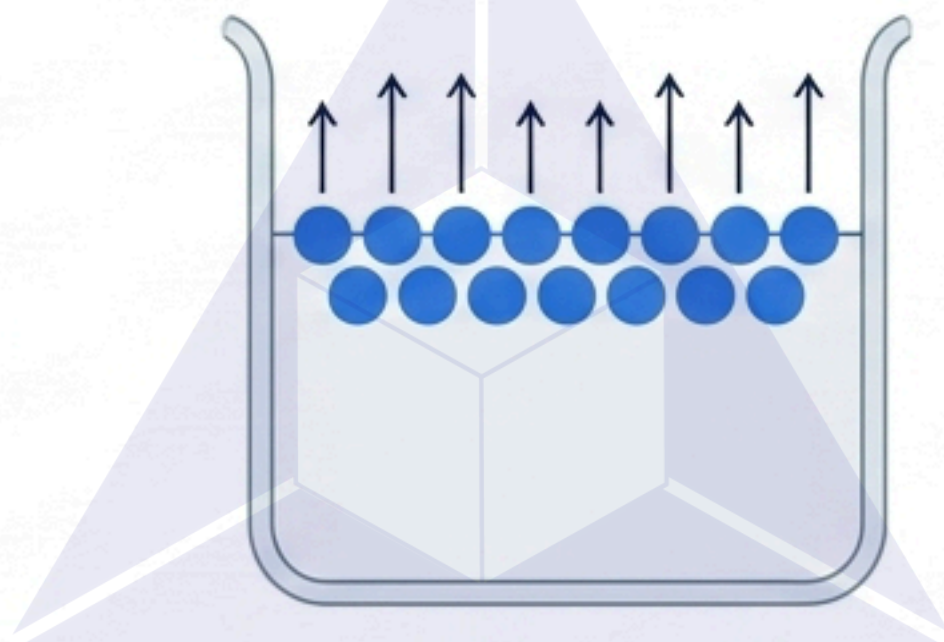
Elevation of Boiling Point

Understanding why adding a non-volatile solute increases the boiling temperature of a solvent.



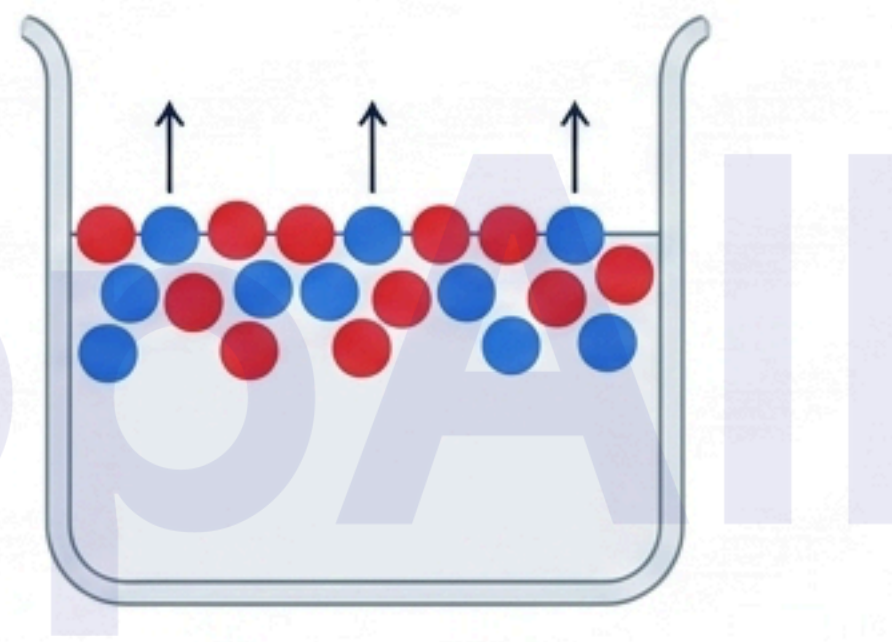
The Cause: Blocked Surface Area

Pure Solvent



High vapour pressure

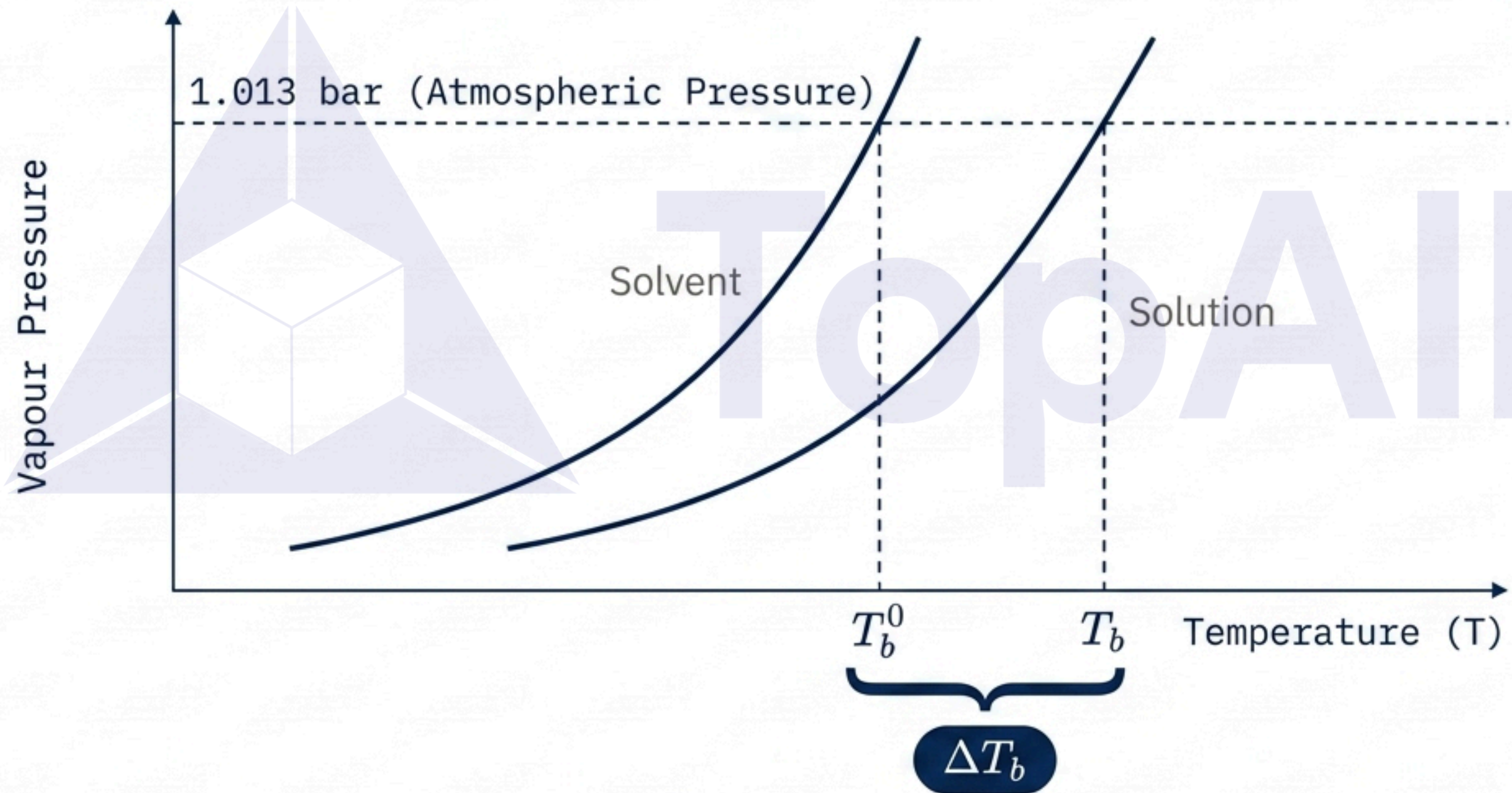
Solution



Lower vapour pressure

A liquid boils when its vapour pressure equals atmospheric pressure. If vapour pressure is lowered by a solute, more heat is required to reach the boiling point.

The Vapour Pressure Curve Shift





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$$E=mc^2$$



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Defining Boiling Point Elevation

$$\Delta T_b = T_b - T_b^0$$

$T_b \rightarrow$ Boiling point of the solution (Higher)

$T_b^0 \rightarrow$ Boiling point of the pure solvent
(Lower)

$\Delta T_b \rightarrow$ The Elevation of Boiling Point

Colligative Property

Like lowering of vapour pressure, ΔT_b depends strictly on the number of solute molecules present relative to the total particles, completely independent of their chemical identity.

The Core Equation

Valid for dilute, ideal solutions

Relating Elevation to Concentration

$$\Delta T_b = K_b \cdot m$$

ΔT_b

Elevation of boiling point.

K_b

Ebullioscopic Constant
(Boiling Point Elevation
Constant).

Units: K kg mol^{-1} . Value
depends on the nature of the
solvent.

m

Molality.

Number of moles of solute
dissolved in 1 kg of solvent.

Practical Application

Determining Molar Mass (M_2)



Step 1 (Recall Molality)

$$m = \frac{w_2 \times 1000}{M_2 \times w_1}$$



Step 2 (Substitute into Core Equation)

$$\Delta T_b = K_b \times \left[\frac{w_2 \times 1000}{M_2 \times w_1} \right]$$



Step 3 (Rearrange for Molar Mass)

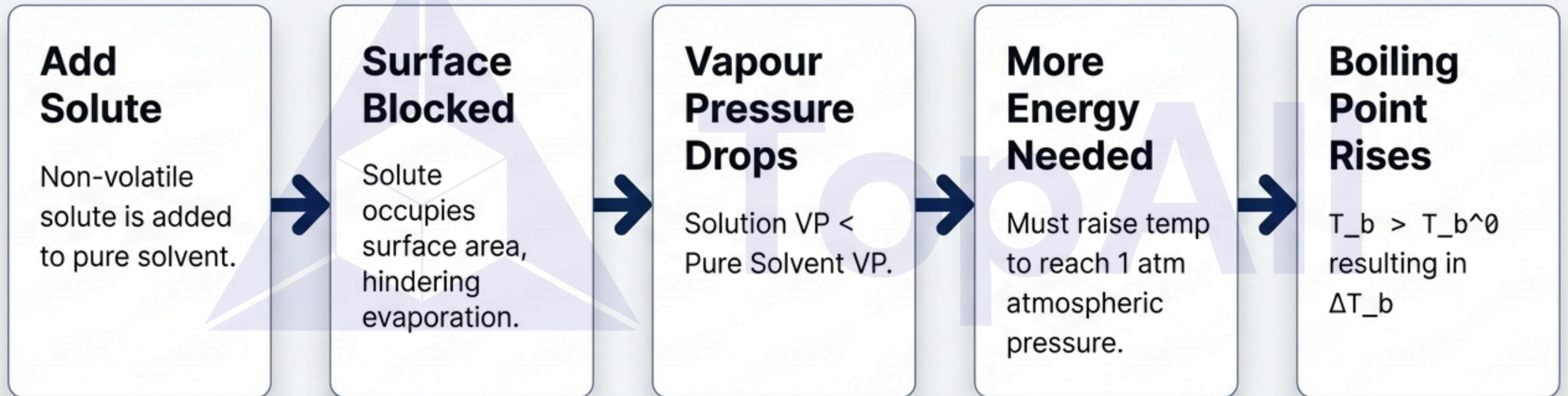
$$M_2 = \frac{1000 \times w_2 \times K_b}{\Delta T_b \times w_1}$$

⌘ w_1 = mass of solvent

⌘ w_2 = mass of solute

M_2 = molar mass of solute

The Chain of Events





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