6.2. Elevation of Boiling point- ~~Ele~~

i) The vapour pressure of a liquid increases with increase of temperature. It boils at the temperature at which its vapour pressure is equal to the atmospheric pressure.

ii) Ex: the vapour pressure of an aqueous solution of sucrose is less than 1.013 bar at 373.15K. In order to boil, its vapour pressure must be increased to 1.013 bar by raising the temperature above the boiling temperature of pure solvent.

iii) Thus, the boiling point of a solution is always higher than that of the boiling point of the pure solvent in which the solution is prepared. (fig)

Let T_b° = boiling point of pure solvent

T_b = boiling point of solution

$\Delta T_b = T_b - T_b^\circ$

↓

Elevation of boiling point.

For dilute solutions,

$$\Delta T_b \propto m \text{ (viii) or } \Delta T_b = K_b m \text{ — (ix)}$$

Here,

m (molality) = no. of moles of solute dissolved in 1kg of solvent.

K_b = Constant of proportionality. is called Boiling point elevation constant or Molal elevation constant (Ebullioscopic constant)

unit = K kg mol^{-1}

$$m \text{ (molality)} = \frac{W_2 / M_2}{W_1 / 1000} = \frac{1000 \times W_2}{M_2 \times W_1} \quad \text{---} (x)$$

W_2 = solute of r, W_1 = solvent.

On substituting m in eq (ix)

$$\Delta T_b = \frac{K_b \times 1000 \times W_2}{M_2 \times W_1} \quad \text{---} (xi)$$

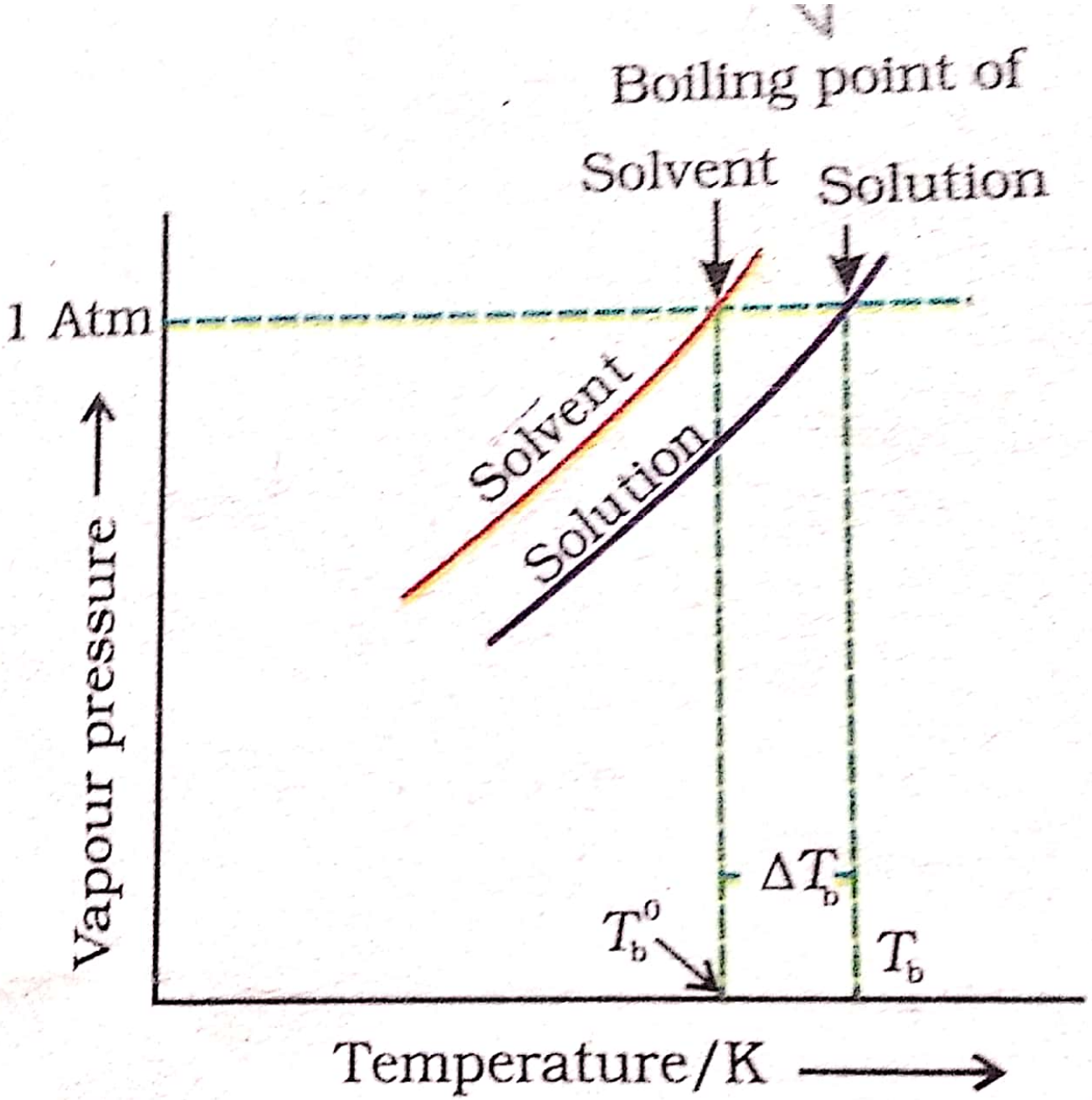

Fig. 2.7: *The vapour pressure curve for solution lies below the curve for pure water. The diagram shows that ΔT_b denotes the elevation of boiling point of a solvent in solution.*