Question2: The boiling point of water at 750 mm Hg is 99.63°C. How much sucrose is to be added to 500 g of water such that it boils at 100°C. Molal elevation constant for water is 0.52 K kg mol -1.

Answer :

Here, elevation of boiling point ΔT_b= (100 + 273) - (99.63 + 273)

= 0.37 K

Mass of water, w_1= 500 g

Molar mass of sucrose ($C_{12}H_{22}O_{11}$), M_2= 11 × 12 + 22 × 1 + 11 × 16

= 342 g mol^{-1}

Molal elevation constant, K_b= 0.52 K kg mol^{-1}

We know that:

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

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

$$= \frac{0.37 \times 342 \times 500}{0.52 \times 1000}$$

= 121.67 g (approximately)

Hence, 121.67 g of sucrose is to be added.