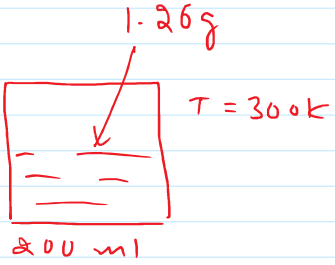
Question:

200 cm^3 of an aqueous solution of a protein contains 1.26 g of the protein. the osmotic pressure of such a solution at 300 k is found to be 2.57×10^{-3} bar.

Calculate the molar mass of the protein.



Answer

$\pi = CRT$

$2.57 \times 10^{-3} = \frac{W_{protein}}{M_{protein} V(in L)} RT$

$\frac{1.26}{M_{protein} \times 0.2} \times 0.083 \times 300$

$R = 0.083 \frac{bar\ L}{mol\ k}$

$M_{protein} = 61039\ g\ mol^{-1}$

Question

Calculate the osmotic pressure in pascals exerted by a solution prepared by dissolving 1.0 g of polymer of molar mass 185,000 in 450 mL of water at 37°C

Ans: $T = 37°C = 37 + 273 = 310\ k$

$C = \frac{n}{V(in L)} = \frac{w}{M V(in L)} = \frac{1}{185000 \times 0.45}$

$\pi = CRT = \frac{1}{185000 \times 0.45} \times 0.0821 \times 300$

$= 0.0003057\ atm$

$R = 0.0821 \frac{atm\ L}{mol\ k}$

$= 0.0003057 \times 101325\ Pa$

$= 30.97\ Pa$

$R = 8.314 \frac{J}{mol\ k}$

$R = 2 \frac{cal}{mol\ k}$

Question

At 300k, 36 g of glucose present in a litre of its

solution has an osmotic pressure of 4.98 bar. If the osmotic pressure of the solution is 1.52 bar at the same temperature, what would be its concentration?

Answer

Solution 1 (Glucose)

$\Pi_1 = 4.98$ bar

$C_1 = \frac{w}{M V(\text{in L})} = \frac{36}{180 \times 1}$

$\Pi_1 = C_1 R T$

$4.98 = \frac{36}{180} R T \quad - I$

Solution 2 (Glucose)

$\Pi_2 = 1.52$ bar

$C_2 = ?$

$\Pi_2 = C_2 R T$

$1.52 = C_2 R T \quad - II$

$\Pi \div I$

$\frac{C_2 \times 180}{36} = \frac{1.52}{4.98}$

$C_2 = 0.061 \frac{\text{mol}}{\text{L}}$