Marks 4

- A saline solution used for intravenous injections contains 900 mg of sodium chloride in 100 mL. What is the concentration of this sodium chloride solution?

The molar mass of NaCl is (22.99 (Na) + Cl (35.45)) g mol^{-1} = 58.44 g mol^{-1}. The number of moles in 900 mg is therefore:

$$\text{number of moles} = \frac{\text{mass}}{\text{molar mass}} = \frac{900 \times 10^{-3}\ \text{g}}{58.44\ \text{g mol}^{-1}} = 0.0154\ \text{mol}$$

The concentration is therefore:

$$\text{concentration} = \frac{\text{number of moles}}{\text{volume}} = \frac{0.0154\ \text{mol}}{0.100\ \text{L}} = 0.154\ \text{mol L}^{-1}$$

Answer: **0.154 M**

What is the osmotic pressure of this solution at 37 °C?

The osmotic pressure for strong electrolyte solutions is given by:

$$\Pi = i \times (cRT)$$

where i is the amount (mol) of particles in solution divided by the amount (mol) of dissolved solute.

For 0.154 M NaCl, c = 0.154 and i = 2 (as NaCl → $Na^+ + Cl^-$, each mole of NaCl produces two moles of particles). Hence:

$$\Pi = (2 \times 0.154\ \text{mol L}^{-1}) \times RT$$
$$= (2 \times 0.154\ \text{mol L}^{-1}) \times (0.08206\ \text{atm L K}^{-1}\ \text{mol}^{-1}) \times ((37 + 273)\ \text{K})$$
$$= 7.84\ \text{atm}$$

Answer: **7.84 atm**

Why is it better to use a saline solution rather than pure water when administering drugs intravenously?

Saline solution is isotonic with blood plasma. Injection water would have a hypotonic effect and cause lysis of cells.