- The osmotic pressure of a solution containing 5.5 g L^{-1} of a polypeptide is 0.103 atm at 5 °C. Calculate the molar mass of the polypeptide.

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The osmotic pressure, Π, is related to the concentration, c, and the temperature, T:

$$\Pi = cRT$$

where R is the gas constant. With Π = 0.103 atm and T = 5 °C = (273 + 5) K,

$$0.103 \text{ atm} = c \times (0.08206 \text{ L atm K}^{-1} \text{ mol}^{1}) \times (278 \text{ K})$$

$$c = 0.00452 \text{ mol L}^{-1}$$

where R = 0.08206 L atm K^{-1} mol^{1} has been used to remove the need to convert the pressure in Pascals.

As the solution contains 5.5 g L^{-1} of the polypeptide and this is equivalent to 0.00452 mol L^{-1}, 5.5 g must contain 0.00452 mol. Hence,

$$\text{molar mass} = \frac{5.5 \text{ g}}{0.00452 \text{ mol}} = 1200 \text{ g mol}^{-1} = 1.2 \times 10^{3} \text{ g mol}^{1}$$

Answer: **1200 g mol^{-1} = 1.2 × 10^{3} g mol^{1}**