

### Problem 13-28 Osmotic pressure of electrolyte solutions

Calculate the osmotic pressure of aqueous solution of a weak electrolyte  $\text{AB}_2$  of concentration of  $0.00053 \text{ mol dm}^{-3}$  at the temperature of  $16.2^\circ\text{C}$ . This electrolyte is at given conditions dissociated from 80 %. The solution density is  $1.024 \text{ g cm}^{-3}$ . At what high establishes the solution level in the osmometric capillary?

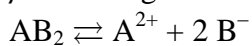
$$[\pi = 3.315 \text{ kPa}]$$

Solution:

$$c = 0.00053 \text{ mol dm}^{-3} = 0.53 \text{ mol m}^{-3}$$

$$T = 16.2 + 273.15 = 289.35 \text{ K}$$

$$\rho = 1.025 \text{ g cm}^{-3} = 1025 \text{ kg m}^{-3}$$



$$c_{\text{AB}_2} = c_0 \cdot (1 - \alpha)$$

$$c_{\text{A}^{2+}} = c_0 \alpha$$

$$c_{\text{B}^-} = 2 c_0 \alpha$$

$$\Sigma c = c_0 (1 - \alpha) + c_0 \alpha + 2 c_0 \alpha = c_0 (1 + 2 \alpha)$$

$$\pi = \Sigma c RT = c_0 \cdot (1 + 2 \alpha) \cdot RT =$$

$$= 0.53 \cdot (1 + 2 \cdot 0.8) \cdot 8.314 \cdot 289.35 = 3315 \text{ Pa} = 3.315 \text{ kPa}$$

$$\left[ (\text{mol m}^{-3}) \cdot (\text{J K}^{-1} \text{ mol}^{-1}) \cdot \text{K} = \text{J} \cdot \text{m}^{-3} = \text{Nm} \cdot (\text{m}^{-3}) = \text{Pa} \right]$$

$$\pi = h \rho g$$

$$h = \frac{\pi}{\rho \cdot g} = \frac{3315}{1024 \cdot 9.81} = 0.33 \text{ m} \left[ \frac{\text{Pa}}{(\text{kg m}^{-3}) \cdot (\text{ms}^{-2})} = \frac{\text{kg ms}^{-2} \text{m}^{-2}}{(\text{kg m}^{-3}) \cdot (\text{ms}^{-2})} = \text{m} \right]$$