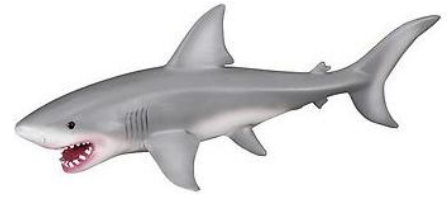


Problem 13-26 Osmoregulation

The sharks balances the osmotic pressure of the ambient sea water by retention of urea in their bodies. What should be the concentration of urea (grams per 1 dm³) in body liquids of a shark to survive at 25 °C in the sea water the osmotic pressure of approximately 2.8·10⁶ Pa? Assume that van't Hoff equation can be applied to the shark. Molar mass $M = 60 \text{ g mol}^{-1}$.



[67.77 g dm⁻³]

Solution:

$$T = 298.15 \text{ K}$$

$$m_{\text{urea}} = ?$$

$$V = 1 \text{ m}^3$$

$$\pi = 2.8 \text{ MPa}$$

$$\pi = \frac{RT}{M_{\text{urea}}} \cdot \frac{m_{\text{urea}}}{V}$$

$$\frac{m_{\text{urea}}}{V} = \frac{M_{\text{urea}}}{RT} \cdot \pi = \frac{60}{8.314 \cdot 298.15} \cdot 2.8 \cdot 10^6 = 67.77 \cdot 10^3 \text{ g/m}^3 = 67.77 \text{ g dm}^{-3}$$

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