$$C_m = \frac{1.68\ ^\circ\cancel{C}}{20.0\ \frac{^\circ\cancel{C}}{m}} = 0.0840\ m$$

$$0.0840\ \frac{mol}{\cancel{kg}}\left(0.01541\cancel{kg}\right)$$

$$= 1.294 \times 10^{-3}\ mol$$

$$MWT = \frac{\text{mass in grams}}{\#\ mol} = \frac{0.514\ g}{1.294 \times 10^{-3}\ mol}$$

$$= 397\ \frac{g}{mol}$$

$$PV = nRT$$

↓ solve for P

$$P = \frac{nRT}{V} = \left(\frac{n}{V}\right)RT$$

$$P = M \cdot RT \quad \text{gas}$$

$$\Pi = MRT \quad \text{osmotic pressure}$$

↑ Mouse equation

A 2.31 g sample of a protein having a molecular weight of 32800 $\frac{g}{mol}$ was dissolved in enough water to produce 35.7 mL of solution. What is the osmotic pressure (in torr) of this solution at 25 °C?

$$\Pi = M \cdot R \cdot T = 0.04827 \text{ atm}$$

$$\left(1.973\times10^{-3}\ \frac{\text{mol}}{\text{L}}\right)\left(0.08206\ \frac{\text{L atm}}{\text{K mol}}\right)(298.15\ \text{K})$$

$$M = \frac{\#\ \text{mol}}{\#\ \text{L}} = \frac{7.043\times10^{-5}\ \text{mol}}{0.0357\ \text{L}} = 1.973\times10^{-3}\ \text{mol/L}$$

$$2.31\ \text{g}\left(\frac{1\ \text{mol}}{32800\ \text{g}}\right) = 7.043\times10^{-5}\ \text{mol}$$

$$0.04827\ \text{atm}\left(\frac{760\ \text{torr}}{1\ \text{atm}}\right) = 36.7\ \text{torr}$$

A 3.22 g sample of a protein was dissolved in enough water to produce 42.8 mL of solution. The solution was found to have an osmotic pressure of 21.6 torr at 25°C. What is the molecular weight of the protein?

$$MWT = \frac{\#\,g}{\#\,mol} = \frac{3.22\,g}{\qquad}$$

$$M = \frac{\#\,mol}{\#\,L} \rightarrow \#_{mol} = M(\#L)$$

$$= M\left(0.0428\,L\right)$$

$$\Pi = M \cdot R \cdot T$$

$$\downarrow = 1.162 \times 10^{-3}\ \frac{mol}{L}$$

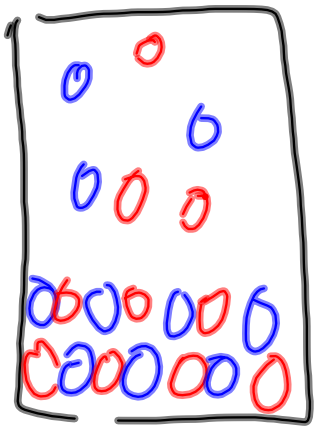
$$M = \frac{\Pi}{RT} = \frac{0.02842\,atm}{\left(0.08206\ \frac{L\,atm}{K\,mol}\right)(298.15K)}$$

$$21.6\ \cancel{torr}\left(\frac{1\,atm}{760\ \cancel{torr}}\right) = 0.02842\,atm$$

$$1.162 \times 10^{-3} \frac{mol}{L} \left(0.0428 \, L\right)$$

$$= 4.972 \times 10^{-5} \, mol$$

$$MW = \frac{3.22 g}{4.972 \times 10^{-5} mol} = 6.48 \times 10^{4} \frac{g}{mol}$$



Raoult's Law

A

B

$$P_A = X_A \cdot P_A^\circ$$

$$P_B = X_B \cdot P_B^\circ$$

$$P_T = P_A + P_B$$