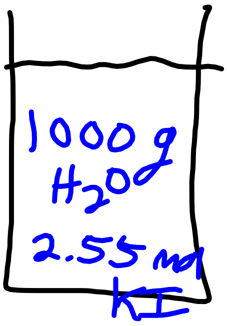


$$\text{molality} = \frac{\overset{2.55\ \text{mol}}{\#\ \text{mol KI}}}{\underset{1\ \text{kg}}{\#\ \text{kg } H_2O}}$$

$2.55\ \frac{\text{mol}}{\text{kg}}$

$$\text{Molarity} = \frac{\overset{2.55\ \text{mol}}{\#\ \text{mol KI}}}{\#\ \overset{1.1354}{\text{L solution}}}$$

2.55 m KI

$d = 1.254\ \frac{g}{mL}$

$= 1135\ mL$

$= 1.135\ L$

$$d = \frac{m}{V} = V = \frac{m}{d} = \frac{1423\ g}{1.254\ \frac{g}{mL}}$$

$$2.55\ \cancel{\text{mol}}\left(\frac{166\ g}{1\ \cancel{\text{mol}}}\right) = 423\ g$$

$$\begin{array}{l} 1000\ g\ H_2O \\ 423\ g\ KI \\ \hline 1423\ g\ \text{solution} \end{array}$$

NaCl

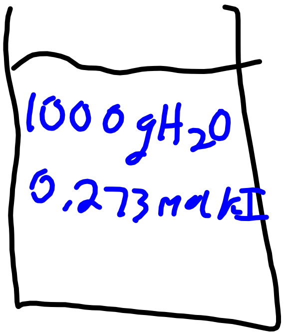
$$15.11\,\cancel{g}\left(\frac{1\text{ mol}}{58.44\,\cancel{g}}\right) = 0.25856\text{ mol}$$

H_2O

$$275.2\,\cancel{g}\left(\frac{1\text{ mol}}{18.016\,\cancel{g}}\right) = 15.27531\text{ mol}$$

$$0.25856\text{ mol} + 15.27531\text{ mol}$$
$$= 15.534\text{ mol}$$

$$X_{NaCl} = \frac{\#\text{ mol NaCl}}{\text{Total }\#\text{ mol}} = \frac{0.25856\,\cancel{\text{mol}}}{15.534\,\cancel{\text{mol}}}$$
$$= 0.0166$$
$$= 1.66 \times 10^{-2}$$



0.273 m KI

$X_{KI} = ?$

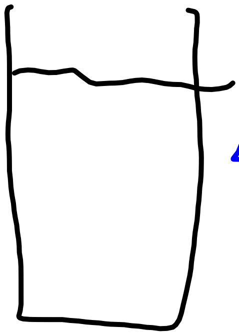
$$\text{molality} = \frac{\overset{0.273\ \text{mol}}{\#\ \text{mol KI}}}{\underset{1\ \text{kg}}{\#\ \text{kg}\ H_2O}}$$

$$0.273\ \frac{\text{mol}}{\text{kg}}$$

$$X_{KI} = \frac{\overset{0.273\ \text{mol}}{\#\ \text{mol KI}}}{\underset{0.273\ \text{mol}}{\#\ \text{mol KI}} + \underset{55.506\ \text{mol}}{\#\ \text{mol}\ H_2O}}$$

$$= 0.00489$$

$$1000\ \cancel{g}\left(\frac{1\ \text{mol}}{18.016\ \cancel{g}}\right) = 55.506\ \text{mol}$$



NaCl(aq)

$$X_{NaCl} = \frac{\overset{4.24\times10^{-2}\,mol}{\#\,mol\;NaCl}}{\underbrace{\#\,mol\;NaCl + \#\,mol\;H_2O}_{1\,mol}}$$

X_{NaCl}: 4.24×10^{-2}

$$\text{molality} = \frac{\overset{4.24\times10^{-2}\,mol}{\#\,mol\;NaCl}}{\#\,kg\;H_2O}$$

$X_{NaCl} = 4.24\times10^{-2}$

molality = ?

$$\begin{array}{rl} 1.0000\ mol & NaCl + H_2O \\ -\ 0.0424\ mol & NaCl \\ \hline 0.9576\ mol & H_2O \end{array}$$

It is left to the student to finish this problem.

Colligative Properties

Properties of a solution that depend on the concentration of solute particles, but not on their chemical identity.

$$C_{12}H_{22}O_{11}(s) \xrightarrow[i=1]{H_2O} C_{12}H_{22}O_{11}(aq)$$

$$NaCl(s) \xrightarrow[i=2]{H_2O} Na^{+}(aq) + Cl^{-}(aq)$$

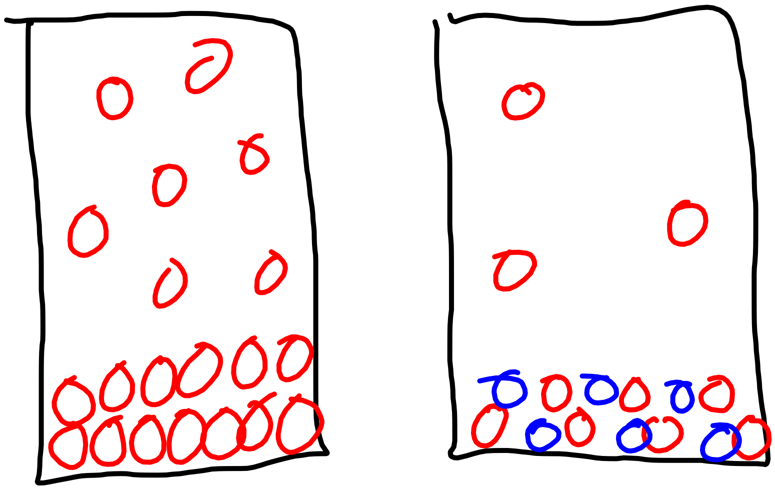
van't Hoff factor
(i)

$$CaCl_2(s) \xrightarrow[i=3]{H_2O} Ca^{2+}(aq) + 2Cl^{-}(aq)$$

$$AlCl_3(s) \xrightarrow[i=4]{H_2O} Al^{3+}(aq) + 3Cl^{-}(aq)$$

Colligative Properties

1. Vapor Pressure Lowering
2. Boiling point elevation
3. Freezing point depression
4. Osmotic pressure

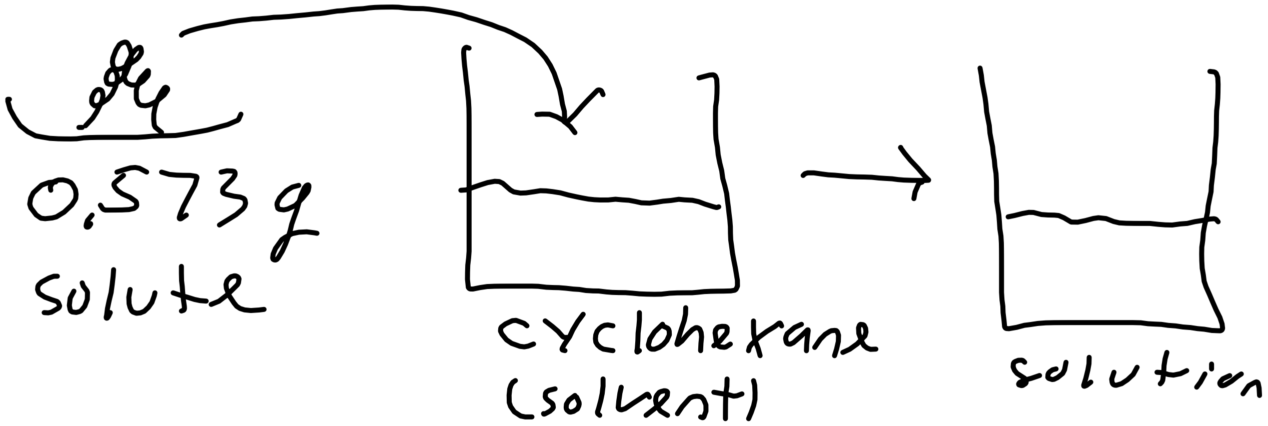


$$\Delta T_b = T_b - T_b^\circ$$

$$|\Delta T_f| = T_f^\circ - T_f$$

$$\Delta T_b = K_b \cdot c_m$$

$$|\Delta T_f| = K_f \cdot c_m$$



A 0.573 g sample of a non-volatile, non-ionizing solute was dissolved in 13.91 g of cyclohexane, producing a solution having a freezing point of 4.98 °C. The normal freezing point of pure cyclohexane is 6.55 °C. What is the molecular weight of the solute?

$K_f = 20.0 \frac{°C}{m}$ for cyclohexane

$$MWT = \frac{\text{mass in g}}{\#\text{ of mol}} = \frac{0.573\,g}{1.092\times10^{-3}\,mol}$$

$$= 525\ g/mol$$

$$|\Delta T_f| = 6.55^\circ C - 4.98^\circ C$$

$$= 1.57^\circ C$$

$$|\Delta T_f| = K_f \cdot c_m$$

$$\downarrow$$

$$c_m = \frac{|\Delta T_f|}{K_f} = \frac{1.57\,^\circ\cancel{C}}{20.0\,^\circ\cancel{C}/m}$$

$$= 0.0785\ m$$

$$0.0785\,\frac{mol}{\cancel{kg}}\left(0.01391\,\cancel{kg}\right)$$

$$= 1.092\times10^{-3}\ mol$$