

Solution Problems

Name \_\_\_\_\_

1. A solution of calcium nitrate,  $\text{Ca}(\text{NO}_3)_2$ , contains 2.05 g of solute in 252 g of water. What is the molality?  
 $2.05 \text{ g} / \left( \frac{164.1 \text{ g}}{\text{mol}} \right) = 0.125 \text{ mol} = \frac{0.125 \text{ mol}}{252 \text{ kg}} = 0.496 \text{ m}$

2. What is the mass of water in a 2.5 m solution of  $\text{Ca}(\text{NO}_3)_2$  if the mass of the solute is 8.2 g?  
 $2.5 \text{ m} = \frac{8.2 \text{ g}}{x} \Rightarrow x = \frac{8.2 \text{ g}}{2.5} = 3.28 \text{ g}$

3. What is the freezing point of a solution of a nonelectrolyte dissolved in water if the concentration of the solution is 0.24 m?  
 $(24 \text{ m}) (1.86^\circ \text{C}/\text{m}) (1) = 0.446$

4. What is the freezing point of a 0.850 m aqueous solution of sugar?  
 $(85 \text{ m}) (1.86^\circ \text{C}/\text{m}) (1) = -1.582^\circ \text{C}$

5. What is the freezing point of a solution that contains 68.4 g of sucrose,  $\text{C}_{12}\text{H}_{22}\text{O}_{11}$ , dissolved in 1.00 x 10<sup>2</sup> g of water?  
 $68.4 \text{ g} \left( \frac{342.3}{1} \right) = 0.1998 \text{ mol} = \frac{0.1998 \text{ mol}}{100 \text{ kg}} = 0.1998 \text{ m}$

A solution contains 4.50 g of a nonelectrolyte dissolved in 250 g of water and has a freezing point of -0.310°C. What is the gram molecular mass of the solute?  
 $0.310 = (x) / (1.86) (1) \Rightarrow x = 0.5766 \text{ m} = \frac{4.50 \text{ g}}{x} \Rightarrow x = 7.81 \text{ g/mol}$

A solution of a nonelectrolyte contains 18.0 g of solute in 2.00 x 10<sup>2</sup> g of water. Its freezing point is -2.79°C. What is the gram molecular mass of the nonelectrolyte?  
 $2.79 = x (1.86) (1) \Rightarrow x = 1.5 \text{ m} = \frac{18.0 \text{ g}}{x} \Rightarrow x = 12.0 \text{ g/mol}$

Great things are done by a series of small things brought together.



- Vincent van Gogh, Dutch painter (1853-1890)

MM = 9  
 $108 \text{ g/mol} = \frac{4.50 \text{ g}}{0.417 \text{ mol}}$