

## Section 18B

### Vapor Pressure Lowering (assume all situations are at 50°C)

- 1) What is the vapor pressure if 15.0 g NaCl is dissolved in 200 g H<sub>2</sub>O?  $P_0 = 92.6$  torr
- 2) What is the new vapor pressure if 125 g of benzene has 3.5 g of caffeine dissolved in it?
- 3) What is the new vapor pressure if 50.0 g CaCl<sub>2</sub> dissolves in 500 mL ethanol?  
 $P_{\text{eth}} = 220.9$  torr
- 4) What is the vapor pressure if 100 mL of water and 100 mL of ethanol are mixed together?  $P_{\text{H}_2\text{O}} = 92.6$  torr  $P_{\text{eth}} = 220.9$  torr

### Boiling Point Elevation (assume situations are at sea level)

- 1) What is the new boiling point when 1.25 moles of NaCl is dissolved in 250 mL of water?
- 2) What is the new boiling point when 1.25 moles of CaCl<sub>2</sub> is dissolved in 250 mL of water?
- 3) What is the new boiling point when 35.0 g of LiF are dissolved in 300 mL of ethanol? density of ethanol is 0.789 g/mL
- 4) What is the boiling point of a solution of when 1.00 kg of ethylene glycol is added to a radiator that contains 4.5 L of water?

### Freezing Point Depression (assume solutions are at sea level)

- 1) What is the new freezing point when 1.25 moles of NaCl is dissolved in 250 mL of water?
- 2) What is the new freezing point when 1.25 moles of CaCl<sub>2</sub> is dissolved in 250 mL of water?
- 3) What is the new freezing point when 35.0 g of LiF are dissolved in 300 mL of ethanol? density of ethanol is 0.789 g/mL
- 4) What is the freezing point of a solution of when 1.00 kg of ethylene glycol is added to a radiator that contains 4.5 L of water?

1) Determine the vapor pressure of each of the following solutions:

a) What is the vapor pressure of a solution of 34.5 g glucose (C<sub>6</sub>H<sub>12</sub>O<sub>6</sub>) dissolved in 145 g of water at 35°C?

b) What is the vapor pressure of a solution of 75.0 g of CaCl<sub>2</sub> dissolved in 75.0 mL of water at 20°C?

2) What is the overall vapor pressure of a mixture of 38.2 mL propanol and 61.8 mL of ethanol at 20°C. The densities are .803 g/mL and .789 g/mL respectively. The vapor pressures for each are 18.0 mm Hg and 67.5 mm Hg respectively.

3) 18.9 g of sodium chloride is dissolved in 100 g of ethanol, what is the new boiling point and freezing point of the mixture.

$$K_b = 1.22 \text{ }^\circ\text{C}/m \quad \text{BP} = 78.4 \text{ }^\circ\text{C} \quad K_f = 1.99 \text{ }^\circ\text{C}/m \quad \text{FP} = -117.3 \text{ }^\circ\text{C}$$

4) 56.2 g of sucrose is dissolved in 250-g of benzene, determine the new boiling point and freezing point of the solution.

$$K_b = 2.53 \text{ }^\circ\text{C}/m \quad \text{BP} = 80.1 \quad K_f = 5.12 \text{ }^\circ\text{C}/m \quad \text{FP} = 5.5 \text{ }^\circ\text{C}$$

5) Calculate the mass of  $\text{MgCl}_2$  needed to melt the ice on a 1.5 km street by lowering the freezing point from  $0^\circ\text{C}$  to  $-5^\circ\text{C}$ . The street is 10.0m wide and the ice has a thickness of 2.0 cm. The density of ice is  $0.9340 \text{ g/cm}^3$ .

### Lab – Molar Mass By Freezing Point Depression