

CHM225 Problem Set #5– December 3, 2008

1. Benzene and toluene form nearly ideal solutions. At 300°K, $P_{\text{toluene}}^* = 4274.2$ Pa and $P_{\text{benzene}}^* = 6067.7$ Pa. Consider a liquid mixture of benzene and toluene composed of one mole of benzene and one mole of toluene at 300°K.
 - (i) If the pressure over the mixture is reduced, at what pressure does the vapor first form?
 - (ii) What is the composition of the first trace of vapor that is formed?
 - (iii) If the pressure is reduced further, at what pressure does the last trace of liquid disappear?
 - (iv) What is the composition of the last trace of liquid?
 - (v) What will be the pressure, composition of the liquid and the composition of the vapor when one mole of the mixture has been vaporized?

2. Consider a vertical tube with a cross sectional area of 1 cm². The bottom of the tube is closed with a semi-permeable membrane and 1 g of glucose, $C_6H_{12}O_6$, is placed in the tube. The end of the tube closed with the membrane is immersed in pure water. The temperature is 25°C. The density of the solution may be taken to be 1 g/cm³. Assume negligible depth of immersion of the tube in water.
 - (i) What will the height of the liquid in the tube be at equilibrium?
 - (ii) What is the osmotic pressure at equilibrium?