Dougherty Valley HS AP Chemistry
Solutions – Extra Raoult's Law

WORKSHEET #7*

Name: **Date:** **Period:** **Seat #:**

Show all work and/or explain using chemistry principles. Box your final numerical answer(s).

Directions: Any worksheet that is labeled with an * means it is suggested extra practice. We do not always have time to assign every possible worksheet that would be good practice for you to do. You can do this worksheet when you have extra time, when you finish something early, or to help you study for a quiz or a test. If and when you choose to do this Extra Practice worksheet, please do the work on binder paper. You will include this paper stapled into your Rainbow Packet when you turn it in, even if you didn't do any of this. We want to make sure we keep it where it belongs so you can do it later if you want to (or need to). If you did the work on binder paper you can include that in your Rainbow Packet after this worksheet. If we end up with extra class time then portions of this may turn into required work. If that happens you will be told which problems are turned into required. Remember there is tons of other extra practice on the class website…and the entire internet! See me if you need help finding practice on a topic you are struggling with.

#1: Calculate the mass of propylene glycol ($C_3H_8O_2$) that must be added to 500. grams of water to reduce the vapor pressure by 4.75 mmHg at 40.0 °C.

#2: What is the vapor pressure of water above a solution in which 32.5 g of glycerin ($C_3H_8O_3$) are dissolved in 125. g of water at 343 K? The vapor pressure of pure water at 343 K is 233.7 torr **[222.4 torr**]

#3: A solution is prepared by dissolving 396 g of sucrose in 624 g of water at 30.0 °C. What is the vapor pressure of this solution? (The vapor pressure of water is 31.82 mmHg at 30.0 °C.) **[30.8 mmHg**]

#4: Calculate the vapor pressure of a solution made by dissolving 21.80 g of glucose (molar mass = 180.155 g/mol) in 460.0 g of H_2O at 30.0 °C. (The vapor pressure of the pure solvent is 31.82 mmHg at 30.0 °C.) [**31.67 mmHg**]

#5: The vapor pressure of carbon tetrachloride (CCl_4) at 50.0 °C is 0.437 atm. When 7.42 g of a pure nonvolatile substance is dissolved in 100.0 g of carbon tetrachloride, the vapor pressure of the solution is 0.411 atm. Calculate the molar mass of the solute. [**180. g/mol**]

#6: At 27.0 °C, the vapor pressure of pure water is 23.76 mmHg and that of an aqueous solution of urea is 22.97 mmHg. Calculate the molality of urea in this solution. [**1.87 m**]

#7: Calculate the mass of propylene glycol ($C_3H_8O_2$) that must be added to 500. grams of water to reduce the vapor pressure by 4.75 mmHg at 40.0 °C. [**199 g**]

#8: Bromobenzene (MW: 157) steam distills at 95 °C. Its vapor pressure at 95 °C is 120 mmHg. (Steam distillation is when two immiscible liquids are heated and agitated in order to expose both liquids to the surface well enough that the total vapor pressure is the sum of both liquids vapor pressures)
a. What is the vapor pressure of water at 95 °C?
b. How many grams of bromobenzene would steam distill with 20 grams of water? [**33.00 g of bromobenzene**]

#9: Given that the vapor above an aqueous solution contains 18.3 mg water per liter at 25.0 °C, what is the concentration of the solute within the solution in mole percent? Please assume ideal behavior. [**0.106**]

#10: An 18.2% by mass aqueous solution of an electrolyte is prepared (molar mass = 162.2 g/mol). If the vapor pressure of the solution is 23.51 torr, into how many ions does the electrolyte dissociate? The vapor pressure of water at this temperature is 26.02 torr. [**Solution Overview:** (1) we will calculate the mole fraction of the solute in the 18.2% solution (2) we will calculate the mole fraction of the solute in the solution via Raoult's Law (3) will divide #2 by #1 – **4**]

#11: The vapor pressure of pure benzene (C_6H_6, symbolized by B) and toluene (C_7H_8, symbolized by T) at 25.0° C are 95.1 and 28.4 torr, respectively. A solution is prepared with a mole fraction of toluene of 0.75. Determine the mole fraction of toluene in the gas phase. Assume the solution to be ideal. [**0.472**]

#12: 1-propanol ($P_1°$ = 20.9 torr at 25.0 °C) and 2-propanol ($P_2°$ = 45.2 torr at 25.0 °C) form ideal solutions in all proportions. Let χ_1 and χ_2 represent the mole fractions of 1-propanol and 2-propanol in a liquid mixture, respectively. For a solution of these liquids with χ_1 = 0.520, calculate the mole fraction composition of the vapor phase at 25.0 °C. [**0.334, 0.666**]