Dougherty Valley HS AP Chemistry
Solutions – Raoult's Law Non-volatile solutes

WORKSHEET #3

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

Show all work and/or explain using chemistry principles

#1: What is the vapor pressure of an aqueous solution that has a solute mole fraction of 0.1000? The vapor pressure of water is 25.756 mmHg at 25 °C. [23.18 mmHg]

#2: The vapor pressure of an aqueous solution is found to be 24.90 mmHg at 25 °C. What is the mole fraction of solute in this solution? The vapor pressure of water is 25.756 mm Hg at 25 °C. [0.03324]

#3: How many grams of nonvolatile compound B (molar mass= 97.80 g/mol) would need to be added to 250.0 g of water to produce a solution with a vapor pressure of 23.756 torr? The vapor pressure of water at this temperature is 42.362 torr. [1063 g - Comment: this is a completely ridiculous amount to dissolve in 250.0 g of water, but that's not the point. The point is to solve the problem.]

#4: At 29.6 °C, pure water has a vapor pressure of 31.1 torr. A solution is prepared by adding 86.8 g of "Y", a nonvolatile non-electrolyte to 350. g of water. The vapor pressure of the resulting solution is 28.6 torr. Calculate the molar mass of Y. [51.1 g/mol]

#5: The vapor pressure of pure water is 23.8 mmHg at 25.0 °C. What is the vapor pressure of 2.50 molal $C_6H_{12}O_6$ [22.8 mmHg]

#6: How many grams of testosterone, $C_{19}H_{28}O_2$, a nonvolatile, nonelectrolyte (MW = 288.4 g/mol), must be added to 207.8 grams of benzene to reduce the vapor pressure to 71.41 mm Hg? (Benzene = C_6H_6 = 78.12 g/mol. The vapor pressure of benzene is 73.03 mm Hg at 25.0 °C.) **[**17.4 g]

#7: At 25.0 °C, the vapor pressure of benzene (C_6H_6) is 0.1252 atm. When 10.00 g of an unknown non-volatile substance is dissolved in 100.0 g of benzene, the vapor pressure of the solution at 25.0 °C is 0.1199 atm. Calculate the mole fraction of solute in the solution, assuming no dissociation by the solute. [0.04233]

#8: What is the vapor pressure at 25.0 °C of a solution composed of 42.71 g of naphthalene (a non-volatile compound, MW = 128 g/mol) and 40.65 g of ethanol (MW = 46.02 g/mol). (The vapor pressure of pure ethanol at 25.0 °C is 96 torr.) [70. Torr]

#9: A nonvolatile organic compound Z was used to make up a solution. Solution A contains 5.00 g of Z dissolved in 100. g of water and has a vapor pressure of 754.5 mmHg at the normal boiling point of water. Calculate the molar mass of Z. [124 g/mol]

#10: What is the molality of an aqueous solution of urea, $CO(NH_2)_2$, if the vapor pressure above the solution is 22.83 mmHg at 25 °C? Assume that urea is non-volatile. The vapor pressure of pure water is 23.77 mmHg at 25 °C [2.31 m]

#11: 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.

#12: 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]

#13: 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]

#14: 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]

#15: 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]

#16: 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. [0.0180 kg]