CH 222
Sample Quiz #5 Name: _____ Lab Section: _____

Be sure to show all work, use the correct number of significant figures, circle final answers and use correct units in all problems.

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1. A quantity (161 mmol, where 1 mmol = 10^{-3} mol) of a nonvolatile solute is dissolved in 0.101 kg of benzene (C_6H_6). The vapor pressure of pure benzene at 27 °C is 115.8 mm Hg. Find the mole fraction of the solute and the vapor pressure of the solution at 27 °C. (5 points)

2. Which will generate the higher osmotic pressure at 298 K: 1 L of a 0.250 M cesium sulfate solution or 1 L of a 0.220 M phosphoric acid? Explain your reasoning, calculate the osmotic pressure for both solutions and assume 100% dissociation into ions. (4 points)

3. Fill in the blanks. (6 points)

   For the following: **Cs_3PO_4(aq)** Solute: _____ Solvent: _____

   Volatile Solute? (yes/no) _____ approximate van't Hoff *i* factor: _____

   Solute miscible in benzene? (yes/no) _____ *Solvent* miscible in benzene? (yes/no) _____

4. Dissolving 5.52 g of a non-volatile compound in 36.0 g of benzene results in an observed freezing point of -1.87 °C. Calculate the molar mass of the unknown compound. (k_{fp} = 5.12, normal freezing point of benzene = 5.50 °C.) (5 points)

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Answers
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1. A quantity (161 mmol, where 1 mmol = 10^{-3} mol) of a nonvolatile solute is dissolved in 0.101 kg of benzene (C_6H_6). The vapor pressure of pure benzene at 27 °C is 115.8 mm Hg. Find the mole fraction of the solute and the vapor pressure of the solution at 27 °C. (5 points)

χ(solute) = 0.111
VP = 103 mm Hg

2. Which will generate the higher osmotic pressure at 298 K: 1 L of a 0.250 M cesium sulfate solution or 1 L of a 0.220 M phosphoric acid? Explain your reasoning, calculate the osmotic pressure for both solutions and assume 100% dissociation into ions. (4 points)

***for Cs_2SO_4:* π = 18.3 atm**
***for H_2PO_4:* π = 21.5 atm**
H_3PO_4 is higher!

3. Fill in the blanks. (6 points)

For the following: **Cs_3PO_4(aq)** Solute: _**Cs_3PO_4**_ Solvent: _**water**_

Volatile Solute? (yes/no) _**no**_ approximate van't Hoff *i* factor: _**4**_

Solute miscible in benzene? (yes/no) _**no**_ *Solvent* miscible in benzene? (yes/no) _**no**_

4. Dissolving 5.52 g of a non-volatile compound in 36.0 g of benzene results in an observed freezing point of -1.87 °C. Calculate the molar mass of the unknown compound. (k_{fp} = 5.12, normal freezing point of benzene = 5.50 °C.) (5 points)

107 g/mol