Practice Exam for Exam 4

1. (15 points) Calculate the ***boiling point*** of water at 2.500 bar.

2. (15 points) I have created a new element in my garage that I am calling Milliganium (Ml). The density of this element is 25.96 g/mL. Chemical tests indicate that the atomic mass of this element is 312.3 amu. X-ray diffraction data indicate that the edge length of the unit cell is 341.9 pm. What is the ***type of unit cell*** does this element use? What is the ***radius*** of the atom in pm?

3. (16 points) Four ice cubes at exactly 0°C with a total mass of 53.5 g are combined with 115 g of water at 75°C in an insulated container. If no heat is lost to the surroundings, what is the *final temperature* of the mixture?

4. (19 points) A solution is made by combining 22.5 mL of benzene (density = 0.8765 g/mL, molar mass = 78.11 g/mol) and 83.5 mL of propyl chloride (density = 0.8909 g/mL, molar mass = 78.54 g/mol). Assume the volumes are additive. The vapor pressures of these two liquids are 94.61 mmHg and 337.9 mmHg, respectively. Calculate the *mole fraction of each component* of the solution. Calculate the *mole fraction of the solute* in the vapor above the solution.

5. (15 points) 425 g of a protein are dissolved into enough water to make 100.0 mL of solution. If the osmotic pressure of this solution is 0.726 bar at 35.2°C, what is the *molar mass* of the protein? (Proteins are molecular substances)

6. (20 points) You are given a 0.4563-m solution of glucose ($C_6H_{12}O_6$) which has a density of 1.315 g/mL? Determine the *molar concentration* of the solution. (Hint: it is NOT 0.4563 M!) Calculate the *melting point, boiling point* and *osmotic pressure* in bar of this solution at 31.4 °C. Use 2 decimal places for the unchanged melting and boiling points.