CHEM 1P92 Assignment 12A (Solutions). Version # 34

1. Fill in the blanks in the table for aqueous solutions of the compounds shown. The density of the solution is in g/mL. Abbreviations: m is molality, Mass % is the mass percentage of the solute, Mole Frac. is the mole fraction of the solute, and M is molarity of the solute.

Compound	f.w.	d. soln.	m	Mass %	Mole Frac.	M
CH_3CO_2H	60.05	1.0052		5.000		
HCl	36.47	1.1791	15.42			
KI	166.03	1.1284				1.087

CHEM 1P92 Assignment 12B (Liquids, Solids, and Intermolecular Forces). Version # 34

1. Draw Lewis structures for the following compounds. Remember to enclose ions in square brackets. On your answer sheet, state the number of valence electrons in each compound.
(a) CH_3I (b) $CaCl_2$ (c) $Mg(NO_3)_2$

2. List the most important (strongest) intermolecular force(s) that must be overcome to
(a) vaporize liquid CH_3OH
(b) remove water of hydration from $NiSO_4 \cdot 7H_2O$
(c) melt solid KBr

3. Consider what happens when solid CsI dissolves in liquid CH_3OH.
(a) What type of attractive forces must be overcome in the liquid CH_3OH?
(b) What type of forces must be overcome in the solid CsI?
(c) What type of attractive forces are important when CsI dissolves in liquid CH_3OH?

4. (a) Which of the ions Mg^{2+}, Ca^{2+}, K^+ will have the largest heat of hydration? Which the smallest?
(b) Of the two compounds $MgCl_2$ and NaCl, which has the stronger intermolecular forces?
(c) Of the two compounds H_2O and CCl_4, which has the stronger intermolecular forces?

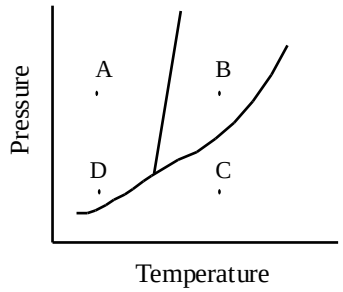
5. Calculate the heat (in kJ) required to transform 45.30 g of hydrogen peroxide from a solid at a temperature of -0.4 °C to a gas at 186 °C. Report your answer to one decimal place. Data:

Molar mass of hydrogen peroxide, H_2O_2 = 34.015 g/mol
Melting point = -0.4 °C Boiling point = 150°C.
Enthalpy of fusion = 12.5 kJ/mol
Enthalpy of vaporization = 51.6 kJ/mol.
Molar heat capacity of the liquid phase = 89.1 J/mol $\cdot$ K
Molar heat capacity of the gas phase= 43.1 J J/mol $\cdot$ K.

6. Make a plot of the heat transfer and temperature change for the system described in Question 5. Plot the temperature on the y axis and the heat added on the x-axis. Label the parts of the graph (solid melts, liquid is heated, etc.) Your graph will resemble Figure 11.39 in Tro, Fridgen and Shaw.

7. A metal crystallizes in th e face-centered cubic crystal structure with a unit cell edge of 4.95×10^{-8} cm. The density of the metal is 11.3 g/cc.
(a) What is the mass, in grams, of a single atom of this element?
(b) What is the atomic weight of the element (g/mol).
(c) What is the radius, in cm, of an atom of the element?

8. As a substance is subjected to pressure and/or temperature changes, it may undergo condensation, deposition, freezing, melting, sublimation, or vaporization. (a) Consider the phase diagram shown below and s tate the changes that take place upon going from points A to B to C to D.
(b) Is the transition from B to C exothermic or endothermic?



9. Molybdenum crystallizes in the body-centered cubic structure with an edge length of 314.7 pm.
(a) Calculate the radius (in pm) of an atom of Mo to 4 significant figures.
(b) Calculate the density of the metal to 4 significant figures.