

## CHEM 1114 Exam 1. February 25, 2009

Name \_\_\_\_\_

Useful information:  $\ln \frac{[A]_t}{[A]_0} = -kt$ ,  $\frac{1}{[A]_t} = kt + \frac{1}{[A]_0}$ ,  $k = Ae^{-\frac{E_a}{RT}}$ ,  $P_{\text{solution}} = P_A^0 \chi_A + P_B^0 \chi_B$ ,  
 $\Pi = MRT$ ,  $R = 8.314 \frac{J}{mol \cdot K}$ ,  $0.0821 \frac{l \cdot atm}{mol \cdot K}$ ,  $\Delta T_b = K_b c_m$ ,  $\Delta T_f = -K_f c_m$ , solubility =  $k \cdot P$ ,  
 $\ln P_{\text{vap}} = \frac{-\Delta H_{\text{vap}}}{RT} + C$ ,  $\ln \frac{P_2}{P_1} = \frac{\Delta H_{\text{vap}}}{R} \left( \frac{1}{T_1} - \frac{1}{T_2} \right)$  m=moles/kg

**You must show work for credit.**

(1) (4 points) What types of solvents (if any) should dissolve the following compounds?

(a)  $\text{Na}_2\text{SO}_4$

(b)  $\text{CH}_3\text{OH}$

(c)  $\text{PCl}_3$

(d) W

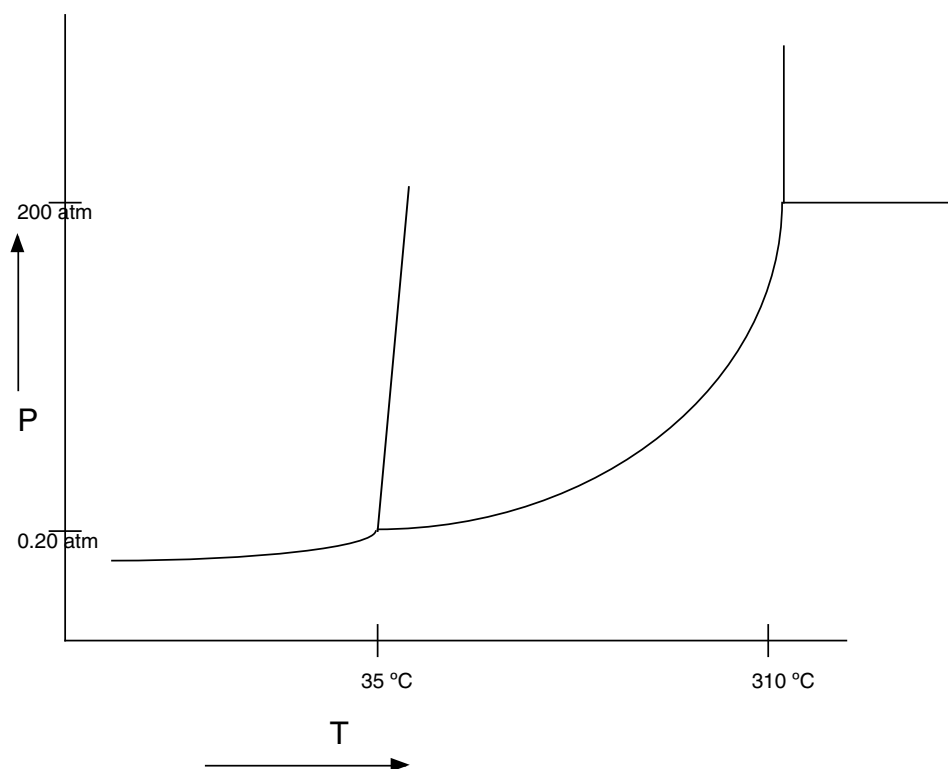
(2)(4 points) What types of compounds exhibit ionic bonding?

(3)(2 points) Sketch a face centered cubic unit cell. How many atoms are contained inside the unit cell?

(4)(4 pts) If a compound has a normal boiling point of 85 °C, and  $\Delta H_{\text{vap}}$  of 35.2 kJ/mol, what is its vapor pressure at 25 °C?

(5)(4 pts) A solid as a simple cubic crystal structure with an edge length of 314 pm. If the density of the solid is 3.16 g/cm<sup>3</sup>, what is the element?

(6) (6 pts) Using the phase diagram shown, answer the following questions



(a) What is the triple point?

(b) Is the solid or the liquid more dense?

(c) If the temperature is raised from 15 °C to 350 °C at a pressure of 30 atm, what phase changes, if any, would occur?

(7)(4 points) At a certain town in Colorado, the atmospheric pressure is only 0.88 atm. How much NaCl (in g) needs to be added to 1.00 L of water to make it boil at 100 °C?

(8)(4 pts) If it requires 0.442 atm of pressure to purify water from a freshwater stream at 27 °C, what is the concentration of dissolved particles in the stream?

(9)(2 points) What intermolecular forces are present in the following molecules?

(a) CH<sub>3</sub>OH

(b) PCl<sub>3</sub>

(11)(4 points) Write out the condensed, ionic, and net ionic equations for the following reactions.



(12)(4 points) Label the following as electrolytes or nonelectrolytes.

(a) Al

(b)  $\text{Na}_3\text{PO}_4$

(c)  $\text{NH}_3$

(d)  $\text{PCl}_5$