Chem 1515 Section 2
Problem Set #1
Spring 1998

Name_____
TA Name _____
Lab Section #_____

ALL work must be shown to receive full credit. **Due in lecture at 1:30 p.m. Wednesday, January 21st**

PS1.1. Indicate all the various types of intermolecular attractive forces that may operate in each of the following:

a) $C_2H_{6(l)}$;

b) $H_2S_{(l)}$;

c) $CH_3NH_{2(l)}$;

d) $MgCl_{2(s)}$

PS1.2. What are the required structural features for a substantial hydrogen-bonding contribution to the intermolecular attractive forces between two identical or different substances?

PS1.3. What is the strongest intermolecular attraction, or bond, that must be broken when each of the following substances is melted?

a) nitrogen monoxide

b) boron trifluoride

c) ammonium chloride

d) bromine

e) propane

PS1.4 For each of the following pairs of substances predict which will have the higher boiling point and indicate why:

a) CO_2 or OCS	b) CH_3CH_2OH or $HOCH_2CH_2OH$
c) HCl or KCl	d) N_2 or Ba

PS1.5. Indicate the type of crystal (molecular, metallic, extended covalent, or ionic) each of the following would form upon solidification:

a) CO_2 ;

b) SiO_2 ;

c) Si ;

d) CH_4 ;

e) Ru ;

f) I_2 ;

g) KBr ;

h) H_2O ;

i) NaOH ;

j) U ;

k) PH_3 ;

l) $CaCO_3$.

PS1.6. Define the term equilibrium vapor pressure.

b) Use a vapor-pressure table (in your text or some other reference book) to look up the equilibrium vapor pressure of a sample of water at 95 ˚C and at 83 ˚C.

c) Consider two closed containers each partially filled with liquid water one at 95 ˚C and the other at 83 ˚C. Can the pressure of water vapor in the gas phase in either container ever exceed the equilibrium vapor pressure at the particular temperature? Explain why or why not.

PS1.7. A sample of water vapor in a flask of constant volume exerts a pressure of 635 mm Hg at 100 ˚C. The flask is slowly cooled.

a) Assuming no condensation, use the Ideal Gas Law to calculate the pressure of the vapor at 95 ˚C; at 83 ˚C.

b) Will condensation occur at 95 ˚C; 83 ˚C?

c) On the basis of your answers in a) and b), predict the pressure exerted by the water vapor at 95 ˚C; at 83 ˚C.

PS1.8. Consider the following data for the vapor pressure:

Lithium T (K)	P_v (mm Hg)	Magnesium T (K)
750	1	620
890	10	740
1080	100	900
1240	400	1040
1310	760	1110

a) Use Cricket Graph (or any other graphing software) to plot ln (P_v) vs. $\frac{1}{T}$ for each metal and use your graph to determine the slope of the best line through the data. The heat of vaporization of a liquid can be obtained from such a plot. The relationship is given as,

$$\text{slope} = -\frac{\Delta H^\circ_{vap}}{8.314 \frac{J}{mol \cdot K}}$$

Calculate the heat of vaporization for lithium and magnesium. (Note: Be sure to clearly label the graph.)

b) In which metal is the bonding stronger?

c) Determine the temperature of a sample of lithium and of magnesium when the vapor pressure is 350 mmHg.

d) Determine the vapor pressure of a sample of lithium and of magnesium at 800. ˚C.

PS1.9. The normal boiling point of acetone, $(CH_3)_2CO$ is 56.2 ˚C and its ΔH°_{vap} = 32.0 $\frac{kJ}{mol}$. Draw a Lewis structure for acetone and calculate the temperature at which acetone has a vapor pressure of 570. mmHg.

PS1.10. When a volatile liquid vaporizes into the atmosphere from an uninsulated container, the temperature of the liquid remains equal to the temperature of the surrounding. If the same liquid is placed into an insulated container the temperature of the liquid falls below the temperature of the surrounding. Explain these observations.