Chem 1515 Problem Set #2	Name
Fall 2001	TA Name

Lab Section #____

ALL work must be shown to receive full credit. Due at the beginning of lecture on Friday, September 7, 2001.

PS2.1. In the phase diagram for water shown below;



- a) determine the physical state of water at
 - i) 900 mmHg and 40 $^{\circ}$ C
 - ii) 500 mmHg and 30 $^{\circ}$ C
 - iii) 300 mmHg and $90 \degree C$
- b) At 400 mm Hg what is the approximate temperature needed to convert water from a solid to a liquid?
- c) What is the approximate pressure at which water changes from a liquid to a gas at 80 °C?

- PS2.2. Carbon disulfide, CS_2 , has a vapor pressure of 298 mm Hg at 20 °C. A sample of 6.00 g of CS_2 , is placed into a stoppered flask at 20 °C.
 - a) What is the maximum volume the flask can have if equilibrium is to be established between liquid and vapor?

b) If the flask has a volume of 3.0 L, what will be the pressure of CS_2 ?

c) If the flask has a volume of 6.0 L, what will be the pressure of CS_2 ?

- PS2.3. Indicate all the various types of intermolecular attractive forces that may operate in each of the following:
 - a) $C_2H_6(l);$
 - b) $H_2S(l);$
 - b) $CH_3NH_2(l)$;
 - d) MgCl₂(s)

- PS2.4. 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
- PS2.5. Arrange the following substances in order of increasing boiling point; I₂, F₂, Cl₂, Br₂ Explain why you arranged the substances in the order you determined.

PS2.6. For each of the following pairs of substances predict which will have the higher boiling point and <u>indicate</u> why:

a) CO ₂ or OCS	b) CH ₃ CH ₂ OH or HOCH ₂ CH ₂ OH
c) HCl or KCl	d) N ₂ or Ba

- PS2.7. In terms of intermolecular attractive forces explain each of the following;
 - a) even though NH₃ or CH₄ have similar molar masses, NH₃ has a much higher normal boiling point (-33 °C) than CH₄ (-164 °C).

b) at 25 Δ C and 1.0 atmosphere, ethane (C₂H₆) is a gas and hexane (C₆H₁₄) is a liquid.

c) Si melts at a much higher temperature (1410 °C) than Cl₂ (-101 °C).

PS2.8. Indicate the type of crystal (molecular, metallic, extended covalent, or ionic) each of the following would form upon solidification:

a) CO ₂ ;	g) KBr ;
b) SiO_2 ;	$h) H_2O;$
c) Si ;	i) NaOH ;
d) CH ₄ ;	j) U ;
e) Ru ;	k) PH3;
f) I ₂ ;	l) CaCO ₃ .

PS2.9. Europium metal crystallizes in a body-centered cubic unit cell. The density of europium is $5.26 \frac{g}{cm^3}$. Calculate the edge length of the unit cell and the atomic radius of europium.

PS2.10. Aluminum crystallizes in a face-centered cubic unit cell and has a density of $2.70 \frac{g}{cm^3}$. What are the unit cell dimensions (edge length)?