Quiz Six CHM 203 (Dr. Mattson) 2 December 2003	Quiz: _____ / 50 A ≥ 46.5; B+ ≥ 43.5; B ≥ 41.0; C+ ≥ 37.5; C ≥ 34.00; D ≥ 30.00	Name:

Instructions: Show all work whenever a calculation is required! You will receive credit for how you worked each problem as well as for the correct answer. This exam is worth 50 points, but the questions total 55 points. You may skip 5 points or attempt all questions. Your score will be determined by subtracting the number missed from 55. Scores greater than 50 will be recorded as 50. BOX YOUR ANSWERS!

1. (4 pts) An open-end manometer containing a sample of gas in the bulb and open to an external pressure of 790 mmHg. It the level of mercury in the arm connected to the bulb is 14.5 cm higher than the level of mercury in the arm open to the atmosphere, what is the pressure inside the bulb?

Show work

2. (4 pts) At what temperature would 4.00 g nitrogen gas occupy 5.00 L at 795.0 mmHg?

Show work

3. (5 pts) What is the MM of a gas with a density of 2.99 g/L at 25 ^{o}C and 744 mmHg? Derive the needed formula starting with PV = nRT and show your work.

Show work

4. (5 pts) Suppose a sample of argon occupies 550 mL at 300 K and 2.5 atm pressure. What is the volume of the gas at STP?

Show work

5. (5 pts) What is the density of carbon dioxide at STP? Derive the needed formula starting with PV = nRT and show your work.

Show work

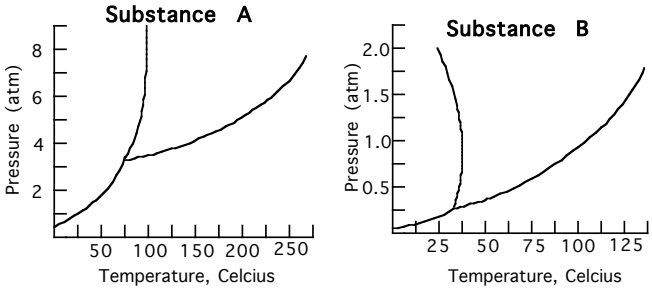
6. (4 pts) Calculate the relative rates of effusion for $CH_4(g)$ and $SF_6(g)$, u_{CH_4}/u_{SF_6}

Show work

8. (4 pts) Calculate the amount of heat required to convert a 450-g ice cube at -22°C to water at 35°C. [Possibly useful information: Specific heats: $H_2O(s)$: 2.10 J/g deg; $H_2O(l)$: 4.18 J/g deg; $H_2O(g)$: 1.80 J/g deg; ΔH_{vap} = +40.7 kJ/mol; ΔH_{fus} = +6.0 kJ/mol]

Show work

9. (6 pts) Phase diagrams for two substances are given below. Answer the following questions about Substances A and B.



(a) What is the phase of Substance B at 50 °C and 1.5 atm?

(b) What phase change is Substance A undergoing at 25 °C and 1 atm?

(c) In order to convert Substance A (at STP) into liquid form, what is necessary?

(d) What is the phase of Substance B in a hot car on a summer day (50 °C and 1 atm)?

(e) What is the normal boiling point of Substance B?

(f) Water has the unusual characteristic of going from solid to liquid under increased pressure at constant temperature. Which substance also shares this characteristic?

10. (5 pts) In each pair of compounds listed below, circle the one with the higher melting and boiling points. List a brief reason (H-bonding, ionic, metallic, stronger London forces, stronger Coulombic forces, etc.) behind each.

		Reason:
a.	Na	N_2
b.	C(s)	CH_4
c.	PCl_5	$CaCl_2$
d.	H_2S	H_2O
e.	PH_3	SiH_4

11. (4 pts) Consider the differences between the four important forms of bonding to answer these questions:

(a) What crystalline solid is characterized as being held together by dispersion forces or dipole-dipole interactions? Circle one:
ionic molecular network-covalent metallic

(b) What crystalline solid is characterized as hard, high melting, like quartz or diamond? Circle one:
ionic molecular network-covalent metallic

(c) What type of crystalline solid forms a 3-dimensional lattice of oppositely charged species? Circle one:
ionic molecular network-covalent metallic

(d) What type of force exists in magnesium? Circle:
ionic molecular network-covalent metallic

12. (4 pts) Polonium metal crystallizes in a simple cubic arrangement and has a density of 9.31 g/cm^3. Calculate the radius of polonium.

Show work

13. (5 pts) True/False

T F Only non-polar substances have London-dispersion forces.

T F Dipole forces are stronger than covalent bonds.

T F Hydrogen chloride, HCl, has hydrogen-bonding intermolecular forces.

T F When the temperature is sufficient to break all intermolecular forces, the substance will melt.

T F London dispersion forces can be more important than hydrogen-bonding or dipole forces for molecules with large molar mass.

Answers:

1. 645 mmHg

2. 446 K

3. 75 g/mol

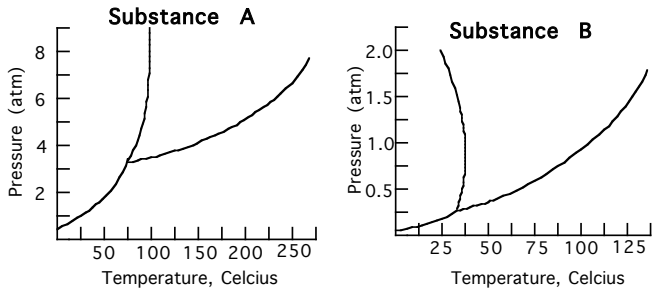
4. 1250 mL

5. 1.96 g/mL

6. u_{CH_4}/u_{SF_6} = 3.0/1.0

8. 237 kJ

9. (6 pts) Phase diagrams for two substances are given below. Answer the following questions about Substances A and B.



(a) liquid

(b) sublimation

(c) increase temperature and pressure

(d) liquid

(e) 75 degrees

(f) Substance B

10.

		Reason:
a.	Na	metallic forces
b.	C(s)	network covalent
c.	$CaCl_2$	ionic
d.	H_2O	H-bonding
e.	PH_3	dipole

11.
(a) molecular
(b) network-covalent
(c) ionic
(d) metallic

12. 3.35×10^{-8} cm = 0.335 nm = 335 pm.

13. F F F F T