Exam Six **CHM 203 (Dr. Mattson)** **1 December 2006**	***Academic Integrity Pledge:*** *In keeping with Creighton University's ideals and with the Academic Integrity Code adopted by the College of Arts and Sciences, I pledge that this work is my own and that I have neither given nor received inappropriate assistance in preparing it.* **Signature:**

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 100 points. BOX YOUR ANSWERS!

1. (3 pts) Circle the larger pressure in each pair.

   A. 2.3 atm 720 mmHg

   B. 100 kPa 0.40 atm

   C. 500 mmHg 200 kPa

2(a) (3 pts) Sketch an open-ended U-tube manometer.

2(a)	2(b)

2(b) (4 pts) What is the pressure inside this manometer if the column of mercury attached to the closed vessel is 23.0 cm higher than the column in the open? The atmospheric pressure was determined to be 770 mmHg.

3. (6 pts) Circle all pairs of variables that would give a linear plot (y = mx + b) if graphed as indicated. The variables not mentioned can be assumed to be constant under the experimental conditions.

   A. P vs V B. P vs T C. V vs T

   D. V vs n E. n vs T F. P vs n

4. (4 pts) Calculate the volume of 1.70 g carbon dioxide at 25 ^{o}C and 730 mmHg.

5. (5 pts) In the US, the regulators used on pressurized gas cylinders read in units of pounds per square inch, or "psi." The relationship between psi and atm is 14.7 psi = 1 atm. How many moles of methane, CH_4, are present in a storage vessel with a capacity of 15.0 L at 25 ^{o}C and 2000 psi?

6. (4 pts) What is the pressure of the compressed methane described in the previous problem if the temperature in the tank rose to 85 ^{o}C?

7. (5 pts) What is the density of methane (CH_4) at STP? Start by deriving the equation used.

8. (5 pts) What is the MM of an unknown gas if it were determined that a 1.40 L of the gas at 20.0 ^{o}C and 730 mmHg had a mass of 1.90 g?

8(b) (2 pts) If the gas were known to be a fluoromethane, which one could it be?

CH_3F CH_2F_2 CHF_3 CF_4

9. (3 pts) Suppose methane and argon are mixed so that the resulting mixture contains 27% (by moles) argon. What is the mole fraction of methane?

9b (3 pts) If the mixture had a pressure of 40.4 atm, what is the partial pressure of argon?

10. (4 pts) Methane effuses from a pinhole 3.5 times faster than an unknown gas, X. What is the MM of Gas X?

11. (6 pts) Which of these molecules are polar? Circle all that are. Draw Lewis dot structures in support.

A. CH_4	B. NH_3
C. N_2	D. SH_2
E. CH_3OH	F. SO_2

11(b). (6 points) Underline all molecules with London dispersion forces and circle all molecules with hydrogen bonding.

A. CH_4 B. NH_3 C. N_2

D. SH_2 E. CH_3OH F. SO_2

12. (6 pts) For each pair of compounds, circle the one with the *higher* melting and boiling points.

A. NaCl, CCl_4 B. CCl_4, CH_4

C. CH_4, NH_3 D. C_3H_8, C_4H_{10}

E. C, Ar F. Zr, O_2

13. (6 pts) If you were to calculate how much heat was necessary to warm ice at –30 ^oC to hot water at 70 ^oC, which of the following values would you need? Circle all needed. [Note: SH is specific heat]

ΔH_{vap} ΔH_{fus} ΔH_{subl} SH_{ice} SH_{water} SH_{steam}

(b) (2 pts) In addition to the choices listed above, what one other piece of information would you need in order to calculate the amount of heat needed?

14. (8 pts) What are the four classes of substances in terms of bonding? Match term with the definitions.

Class of substance	Definition:
	Ions in a lattice. Very high melting and boiling points.
	Covalent bonds throughout the entire substance. Always very high mp and bp.
	Discrete molecules held together with covalent bonds and held to one another with intermolecular forces.
	Atoms exist as cations in a sea of electrons. High mp and bp.

15. (a) (4 pts) Sketch a phase diagram for a substance with the following properties: Normal melting point = 180 ^oC; normal boiling point = 320 ^oC; triple point = 200 ^oC and 0.080 atm; critical point = 440 ^oC and 21 atm.

(b) (8 pts) Using your phase diagram,

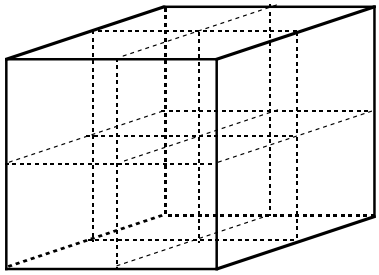
(i) What phase is present at 220 ^oC and 5 atm?

(ii) Above what temperature is this substance a "permanent gas" and cannot be condensed by increasing the pressure?

(iii) What phase transition occurs, if any, when the substance is warmed under constant pressure of 1.0 atm, from 150 ^oC to 250 ^oC?

(iv) below what pressure will the solid form of the substance sublime instead of melt?

16. (3 pts) On the following sketch of one unit cell, draw a small circle around all of the positions occupied in a face-centered cubic unit cell.



Print your name here:

Your exam score (100 possible): _____

Determine your grade:
A+ ≥ 95; A ≥ 90; B+ ≥ 85; B ≥ 80; C+ ≥ 75; C ≥ 70; D ≥ 60

Answers:

1. A. 2.3 atm; B. 100 kPa; C. 200 kPa

2(b) 540 mmHg

3. B, C, D, and F

4. 0.983 L

5. 83.4 mol

6. 163.5 atm

7. 0.716 g/L

8. 33.97 g/mol

8(b) CH_3F

9. 0.73

9b 10.9 atm

10. 196.6 g/mol

11. B, D, E, F

11(b). Underline all six molecules and circle B and E as well

12. A. NaCl; B. CCl_4; C. NH_3; D. C_4H_{10}; E. C; F. Zr,

13. ΔH_{fus} SH_{ice} SH_{water}

(b) mass of water

14. ionic; network covalent; molecular; metallic

15(b)
(i) liquid
(ii) 440 ^oC
(iii) solid to liquid
(iv) 200 ^oC

16. all eight corners and the center of all six faces