Name: _____   Section: _____

CHM 151 Exam 4: Chapters 9 and 8
You must show all work to receive credit. Clearly mark your final answer!

1. Matching: Indicate how the following changes made to a system (shown on the left) will affect the pressure of the system (letter options on the right). The system is initially filled with oxygen molecules (32g/mol).   For each change, assume variables not mentioned are held constant. Note: Answer choices may be used more than once!

<u>**Changes to system:**</u>
____ Volume is doubled
____ Temperature changes from 200°C to 400°C
____ Temperature is halved and volume is halved
____ O_2 molecules are replaced with SO_2 (64g/mol)
____ Half of the molecules effuse from the container

<u>**Pressure changes:**</u>
a. Pressure is doubled
b. Pressure is quadrupled
c. No change in pressure
d. Pressure lowers
e. None of the above

2. What must happen if you cool a gas?   Explain, as described in lecture, what other things might happen and describe the conditions under which they will happen.

3. A sample of gas (28g/mol) initially at 1.50 L was cooled from 400°C at constant pressure until the volume of the gas was 0.75 L. After the cooling, the gas temperature is _____ °C. Which law is illustrated by this example? Show your work.

4. A sample of metal that weighs 2.56g is heated to 65°C and placed in a 12.5g sample of water at 21.65°C. If the final temperature of the water is 22.1°C, what is the specific heat capacity of the metal?

5. A closed 2.50 L container holds CH_4 and H_2 gases. The partial pressure of hydrogen is measured to be 675 torr at 22.5°C.

a) How many moles of hydrogen are present?

b) If the mole fraction of hydrogen is 0.842, what is the total pressure of the gas sample?

6. In a balloon with a small pinhole leak, which gas will have the highest concentration outside the balloon after one hour if all gases were at equal concentrations initially? Show your work.

      a. neon

      b. sulfur dioxide

      c. fluorine

      d. butane (C_4H_{10})

7. Write the chemical equation that corresponds to the heat of formation for each substance. Indicate whether the value of the heat of formation is a positive number, negative number or zero.

a) $I_2(s)$

b) $CO_2(g)$
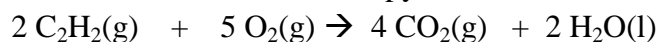
c) $CaCO_3(s)$

d) $Br_2(g)$

8a. Write the balanced equation (smallest whole number coefficients) for the combustion of magnesium.

b. If the heat of formation of magnesium oxide is -601.7 kJ, what is the enthalpy change for the reaction represented by the equation in part a?

c. How much energy will be released if 2.5 mol of Mg is burned in the presence of excess oxygen gas?

9. A gas has been discovered by a chemist who believes its formula is C_3O_2. In order to confirm this, he determines its density. What should be the density of this gas at a pressure of 0.863 atm and a temperature of 296.7 K?

10. Given the following information, calculate the enthalpy of combustion of acetylene, C_2H_2.
$$2\ C_2H_2(g)\ +\ 5\ O_2(g) \rightarrow 4\ CO_2(g)\ +\ 2\ H_2O(l)$$

ΔHf^o of $CO_2(g)$ = -393.5 kJ/mol
ΔHf^o of $H_2O(l)$ = -285.8 kJ/mol
ΔHf^o of $C_2H_2(g)$ = 227.4 kJ/mol