Chemistry 121 Name:

Sample Exam 2 (Chapters 5, 6 and 7)

Open book, homework, labs, notes, calculators allowed; 50 minutes, no collaboration. Partial credit for problems can be awarded only with a clear setup of the problem.

1. (4 points) How many **moles** are there in 1060. g of Na_2CO_3?

2. (3 points each) Balance the following chemical equations:

$HCl +$ $Na_2CO_3 \rightarrow$ $CO_2 +$ $H_2O +$ $NaCl$

$CH_4 +$ $F_2 \rightarrow$ $CF_4 +$ HF

3. (4 points) Fill in the other **reactant** and predict the **products** for the combustion of propanediol ($C_3H_8O_2$ or $CH_2OHCH_2CH_2OH$ — they're equivalent). Finally, please **balance** the equation.

$C_3H_8O_2 +$ $\rightarrow$ $+$

4. (6 points) Acetylene, C_2H_2, can be produced from methane by the reaction:

$$6\ CH_4\ (g) + O_2\ (g) \rightarrow 2\ C_2H_2\ (g) + CO\ (g) + 10\ H_2\ (g)$$

How many **grams** of carbon monoxide gas can be produced from 64 grams of methane? Use molar mass of CH_4 = 16 g/mol; molar mass of O_2 = 32 g/mol; molar mass of C_2H_2 = 26 g/mol; molar mass of CO = 28 g/mol and molar mass of H_2 = 2 g/mol.

5. (4 points) According to the equation, from **what volume** of hydrogen fluoride would 11.2 L of H_2 gas be obtained, assuming constant temperature and pressure?

$$4\ HF + Si \rightarrow SiF_4 + 2\ H_2$$

6. (2 points) On Venus, the atmosphere is 92.0% carbon dioxide and 8.00% hydrogen sulfide by volume. What is the **partial pressure** of carbon dioxide (in torr) when the atmospheric pressure is 6.84×10^4 torr?

7. (4 points) In the molar mass of carbon dioxide lab (Lab 3), suppose you put 4.4 g of dry ice (CO_2) into the flask and immediately put a rubber stopper on the flask, before any of the dry ice could sublimate. The dry ice has a temperature of –78°C. You let the carbon dioxide warm to room temperature (25°C). If the rubber stopper did not pop off, what is the **pressure inside the flask** when all the gases are at room temperature? Report your answer in atmospheres, assume that there was 1.0 atm of air pressure inside the flask already and the molar mass of carbon dioxide is 44 g/mol. R = 0.0821 L•atm/mol•K.

8. (2 points) It takes 30.6 kJ of heat to vaporize 1.0 mol of benzene liquid (C_6H_6). **How much heat** (in kJ) will be released when 1.0 mol of benzene vapor condenses to benzene liquid?

9. (4 points) When food is burned in a calorimeter, is that an **exothermic** or **endothermic** reaction? Even though you can't *see* the reaction occur, how can you justify your answer?

10. (4 points) Water has a specific heat of 1.00 cal/g°C; ammonia has a specific heat of 0.488 cal/g°C. Suppose a powerful villain has replaced all of the Earth's water oceans with oceans of ammonia. Everything else being the same, would the world's oceans be **hotter, cooler** or **the same temperature**? Justify your answer, and use the equation $\Delta H = m\ c\ \Delta T$ in a semi-quantitative way.