City College, Chemistry Department
Chemistry 10301, sections L and L2, Prof. T. Lazaridis
Second Midterm exam, Oct. 26, 2000
Name (last name first): _____
I.D. Number: _____
Workshop leader: _____

Note: There are 9 questions in this exam (check both sides of the sheet). Fill in your answer in the blank space provided immediately following each question. One point will be subtracted every time you report a numerical result with an incorrect number of significant figures. The last sheet of this exam contains information that may or may not be needed to answer these questions.

1. a. (3) Will a nail made of iron dissolve in a calcium chloride solution? (Hint: use information provide on your data sheet)

b. (4) How many grams of glucose do you need to dissolve in 100 mL of water to make a solution of molarity 3.00 M? The molar mass of glucose is 180.2 g/mol.

c. (4) Write a balanced chemical equation for the neutralization of $Ba(OH)_2$ by hydrochloric acid. (You don't need to indicate the states of the reactants and products)

d. (4) What volume of a 14.8 M ammonia solution do we need in order to prepare 2.0 L of a 2.0 M ammonia solution?

2. (10) How many liters of oxygen at 25 ^oC and 750 torr and needed for the combustion of 2.0 g of propane (C_3H_8)? (R=0.0821 atm L/mol K)

3. (10) What is the standard enthalpy of the following reaction at 25 ^oC:

$$2C_2H_6(g) + 7O_2(g) \text{----------}> 4CO_2(g) + 6H_2O(g)$$

(Hint: use information on your data sheet)

4. (10) A 20.0 g bar of an unknown metal at 90.0 ^oC is dropped into 100 mL of water at 25.0 ^oC. The final temperature of the system is 26.1 ^oC. Estimate the specific heat of the unknown metal. The density of water is 1.00 g/cm^3. (Hint: use information on your data sheet)

5. (15) 5.0 g of a sample containing $CaCl_2$ along with other substances is dissolved in water together with potassium sulfite (K_2SO_3) and gives insoluble calcium sulfite, which, after drying, is found to weigh 2.1 g. The molar mass of calcium sulfite is 120.14 g/mol and of $CaCl_2$ is 110.99 g/mol.

(a) (4) Write a balanced chemical equation for the reaction (no need to indicate the state of the substances)

(b) (4) Write the net ionic equation for the reaction

(c) (7) Find the percentage by mass of $CaCl_2$ in the original sample.

6. A gas held at constant pressure of 1 atm is heated with an electrical wire of power 10 Watts for 10 minutes and its volume increases by 0.50 L. (1 Watt= 1J/s) (R= 8.3145 J/mol K = 0.0821 atm L/ mol K)

(a) (5) In the first law of thermodynamics, what is q, w, and ΔE in Joule?

(b) (5) What is the change in enthalpy of the gas

7. (10) Calculate the standard enthalpy of the reaction

$H_2(g) + Br_2(g) \text{ ----------> } 2HBr\ (g)$

using the following data:

$H_2(g) \text{ -----> } 2H(g)$	$\Delta H^o = +\ 436.0$ kJ
$Br_2(g) \text{ ------> } 2Br\ (g)$	$\Delta H^o = +193.9$ kJ
$HBr(g) \text{ ------> } H(g) + Br(g)$	$\Delta H^o = +365.7$ kJ

8. (10) Mercury(II) oxide is heated and decomposed into oxygen and mercury. The oxygen is collected over water to give a total pressure of 730.0 torr at 50 ^{o}C in 500 mL volume. How many moles of mercury oxide have decomposed in this reaction? (R=0.0821 atm L/mol K) (Hint: use information on your data sheet)

9. (10) A 100 mL solution of 1.50 M KOH was added to a 100 mL solution of 1.50 M HNO_3 in a polystyrene cup:

$$HNO_3 + KOH \text{ ----------> } KNO_3 + H_2O$$

The enthalpy of reaction is -57.10 kJ/mol. If the resulting temperature change was +9.50 ^{o}C, what is the heat capacity of the calorimeter (cup plus water) in J/^{o}C ?