CHEM-1105 TEST # 2 NAME:_____

Show all work. Work independently.

1. Calculate the standard enthalpy of formation, ΔH^o_f, of carbon disulfide, $CS_2(l)$ from the information given below. **[4]**

$C(s) + O_2(g) \rightarrow CO_2(g)$ $\Delta H^o = -393.5$ kJ

$S(s) + O_2(g) \rightarrow SO_2(g)$ $\Delta H^o = -296.1$ kJ

$CS_2(l) + 3\ O_2(g) \rightarrow CO_2(g) + 2\ SO_2(g)$ $\Delta H^o = -1072$ kJ

2. The standard enthalpy of formations (in kJ/mol) of $CO_2(g)$, $H_2O(l)$, and benzene, $C_6H_6(l)$, are –393.5, -285.8, and +49.04, respectively. Calculate the enthalpy of combustion reaction of benzene. **[4]**

$$C_6H_6(l) + 15/2\ O_2(g) \rightarrow 6\ CO_2(g) + 3\ H_2O(l)$$

3. A 50.0 mL solution of 0.100 M $AgNO_3$ was mixed with 52.0 mL solution of 0.100 M HCl. The two solutions were initially at 22.60°C. The final temperature of the reaction mixture was 23.40°C. assuming that the density of each solution is 1.00 g/mL and that the specific heat is 4.184 J/g °C. Calculate ΔH for the following reaction. **[4]**

$$AgNO_3(aq) + HCl(aq) \rightarrow AgCl(aq) + HNO_3(aq)$$

4. Write the complete thermochemical equation that corresponds to: **[2]**

   ΔH_f^o of $CaCO_3(s)$ = -1207 kJ/mol

5. Calculate the density of $COCl_2$, a poisonous gas at 27.0°C and 733 Torr. **[3]**

6. A 25.0 g impure sample of zinc is allowed to react with excess HCl:

$$Zn(s) + 2\ HCl(aq) \rightarrow ZnCl_2(aq) + H_2(g)$$

7.80 L of $H_2(g)$ is collected by displacement of water at 25.0°C and a pressure of 0.980 atm. Calculate the percent purity, by mass, of the zinc sample. Vapor pressure of water at 25.0°C is 23.8 Torr. **[5]**

7. Nitroglycerin, $C_3H_5(NO_3)_3$, an explosive compound decomposes according to the reaction:

$$4\ C_3H_5(NO_3)_3(l) \rightarrow 12\ CO_2(g) + 10\ H_2O(g) + 6\ N_2(g) + O_2(g)$$

a) What is the maximum pressure that a 10.0 L container will be able to withstand if 5.00 g of nitroglycerin was decomposed and the temperature reached 1250°C. **[4]**

b) What are the partial pressures of the gases under these conditions? **[4]**

8. At 520°C, K_c is 67 for the equilibrium , $H_2(g) + I_2(g) \Leftrightarrow 2\ HI(g)$

Calculate K_c at the same temperature for **[2]**

a) $2\ HI(g) \Leftrightarrow H_2(g) + I_2(g)$ K_c = _____

b) $HI(g) \Leftrightarrow ½\ H_2(g) + ½\ I_2(g)$ K_c = _____

9. For the equilibrium, $2\ HI(g) \Leftrightarrow H_2(g) + I_2(g)$ $K_c = 0.0025$ at 800°C. 0.80 mole of HI, 0.26 mole of H_2, and 0.26 mole of I_2 were placed in a 20.0 L container at 800°C. Calculate the concentrations of all the species at equilibrium. **[5]**

10. Consider the following equilibrium system:

$4\ NH_3(g) + 3\ O_2(g) \Leftrightarrow 2\ N_2(g) + 6\ H_2O(l)$ $\Delta H = -1530.4$ kJ

by using Le Chatelier's principle. indicate the following: (**I** = increase, **D** = decrease, **NC** = no change) **[3]**

	$[N_2]$	**K_c**
a) O_2 is removed	_____	_____
b) NH_3 is added	_____	_____
c) volume of container is increased	_____	_____
d) temperature is increased	_____	_____
e) water is added (no volume change)	_____	_____