CHM 1046 - JOENS WORKSHEET #4 Due date: Monday, September 17th

WORKSHEETS ARE DUE AT THE BEGINNING OF CLASS ON THE DATE GIVEN ON THE WORKSHEET. LATE WORKSHEETS WILL NOT BE ACCEPTED.

NOTE: EXAM 1 IS IN CLASS ON FRIDAY, SEPTEMBER 21ST. THE EXAM WILL COVER CHAPTERS 13 AND 14 OF THE TEXTBOOK.

NAME _____ Panther ID _____

For problems involving calculations you must show your work for credit.

1) For each of the following pairs of substances circle the substance expected to have the larger value for S° (at T = 25.0 °C).

a) $CH_3CH_2OH(\ell)$ $CH_3CH_2CH_2CH_2OH(\ell)$

b) $C_{10}H_8(g)$ $C_{10}H_8(s)$

c) $CH_3COOH(\ell)$ $CH_3COOH(aq)$

2) Hydrazine (N_2H_4) is a reactive compound often used as a fuel in rockets. Thermochemical data for hydrazine as a liquid and as a gas are given below (at T = 298.0 K). Based on these data, estimate the value for $T°_b$, the normal boiling point for hydrazine. Give your final answer in °C.

substance	$\Delta H°_f$ (kJ/mol)	$\Delta G°_f$ (kJ/mol)	S° (J/mol·K)
$N_2H_4(\ell)$	50.6	149.2	121.2
$N_2H_4(g)$	95.4	159.3	238.4

3) When a metal reacts with oxygen a metal oxide forms. For many metals there are several different oxides that can be produced, each with its own formula. Adding oxygen to one metal oxide will often produce a different metal oxide.

Consider the follow reaction

$2\ PbO(s) + O_2(g) \rightarrow 2\ PbO_2(s)$

substance	$\Delta H°_f$ (kJ/mol)	$\Delta G°_f$ (kJ/mol)	$S°$ (J/mol•K)
$O_2(g)$	0.0	0.0	205.0
$PbO(s)$	- 217.3	- 187.9	68.7
$PbO_2(s)$	- 277.4	- 217.4	68.6

Thermochemical data for the reactants and products are given above at T = 298.0 K

a) Using the data in the table, find the values for $\Delta H°_{rxn}$, $\Delta G°_{rxn}$, and $\Delta S°rxn$ for the above reaction at T = 298.0 K.

b) As discussed in class, a second way for finding $\Delta G°rxn$ for a chemical reaction is to use the relationship

$$\Delta G°_{rxn} = \Delta H°_{rxn} - T\Delta S°_{rxn}$$

Use this equation to find $\Delta G°_{rxn}$ from the values for $\Delta H°_{rxn}$ and $\Delta S°_{rxn}$ calculated in part a, and check to see if you get the same value for $\Delta G°_{rxn}$ found directly in part a of the problem.

c) Is the above reaction spontaneous for standard conditions (yes/no/cannot tell)? Briefly justify your answer.