Chemistry I (H)
Thermodynamics Practice Quiz

1. Specific heat capacity problem (8 pts.)
   - The specific heat capacity of aluminum is 0.89 J/g·°C. If 2.50kJ of heat are supplied to a 3.00 g piece of aluminum foil at 23°C, what will the final temperature (in °C) of the foil be?

2. Graph reading to determine phases, energy absorption and release, and temperatures of phase changes. (6 pts.)

3. Draw an energy diagram for either an exothermic reaction with the following items illustrated and labeled: (8 pts.)
   - Axes
   - Reactants and products
   - Activation energy
   - Change in enthalpy
   - Effect of a catalyst

4. Energy and stoichiometry problem (7pts.)
   - Obviously your body temperature increases when you have a fever. Let's assume that your body temperature goes from 37.0°C to 40.0°C during one particularly grueling illness and that your body released 787 kJ of heat in the process. If you presume that only glucose was combusted in this process, how many grams of glucose are combusted when that temperature change occurs inside of you?
     $C_6H_{12}O_6(s) + 6O_2(g) \rightarrow 6H_2O(l) + 6CO_2(g)$ $\Delta H° = -2802$ kJ

5. Hess's Law Problem (11 pts.)
   - Given the following elementary steps:
     a. $S(s) + 1½O_2(g) \rightarrow SO_3(g)$ $\Delta H = -395.2$ kJ
     b. $SO_2(g) + ½O_2(g) \rightarrow SO_3(g)$ $\Delta H° = -99.1$ kJ

     Calculate the ΔH for the following overall reaction by rewriting each step as it should occur with its appropriate change in enthalpy:
     $S(s) + O_2(g) \rightarrow SO_2(g)$

6. Enthalpy, entropy, and free energy problem (30 pts.)
   - Write the balanced reaction for the combustion of ethene, C_2H_4, that gas used to ripen fruits. Using the information in the chart below, determine the
     a. change in enthalpy (ΔH) and state whether the reaction is exothermic or endothermic
     b. change in entropy (ΔS) and state whether the reaction's entropy increases or decreases
     c. change in free energy (ΔG) and state whether the reaction is spontaneous or nonspontaneous at 15.0°C.

	$\Delta H_f°$(kJ/mol)	S°(J/K·mol)
$C_2H_4(g)$	+227.0	+201
$O_2(g)$	0	+205
$CO_2(g)$	−393.5	+214
$H_2O(g)$	−242.0	+189

Chemistry I (H)
Thermodynamics Practice Quiz #2

1. Specific heat capacity problem (8 pts.)
   - The specific heat capacity of titanium is 0.52 J/g·°C. If 468 J of heat are supplied to the Ti stem in my femur (my fake hip) and its temperature rises from 37°C to 39°C, what is the mass of my Ti stem?

2. Graph reading to determine phases, energy absorption and release, and temperatures of phase changes. (6 pts.)

3. Draw an energy diagram for either an endothermic reaction with the following items illustrated and labeled: (8 pts.)
   - Axes
   - Reactants and products
   - Activation energy
   - Change in enthalpy
   - Effect of a catalyst

4. Energy and stoichiometry problem (7pts.)
   - The thermite reaction will be demonstrated for you and is written below. It is often put to use in the welding of rails upon train tracks. If in the reaction that you witness, 0.020 g of aluminum is reacted with excess iron (III) oxide, how many kilojoules are produced?

     $2Al(s) + Fe_2O_3(s) \rightarrow Al_2O_3(s) + 2Fe(s)$ $\Delta H° = -850$ kJ

5. Hess's Law Problem (11 pts.)

   Given the following elementary steps:

   a. $3CO_2(g) + 4\ H_2O(l) \rightarrow C_3H_8(g) + 5O_2(g)$ $\Delta H° = 4440$ kJ

   b. $C(graphite) + O_2(g) \rightarrow CO_2(g)$ $\Delta H° = -788$ kJ

   c. $C_3H_8(g) \rightarrow 3\ C(graphite) + 4H_2(g)$ $\Delta H° = 208$ kJ

   Calculate the ΔH for the following overall reaction by rewriting each step as it should occur with its appropriate change in enthalpy:

   $H_2O(l) \rightarrow H_2(g) + \frac{1}{2}O_2(g)$

6. Enthalpy, entropy, and free energy problem (30 pts.)
   - Write the balanced reaction for the combustion of hexane, C_6H_{14}, the primary combustion reaction taking place in the internal combustion engine of most automobiles. Using the information in the chart below, determine the
     a. change in enthalpy (ΔH) and state whether the reaction is exothermic or endothermic
     b. change in entropy (ΔS) and state whether the reaction's entropy increases or decreases
     c. change in free energy (ΔG) and state whether the reaction is spontaneous or nonspontaneous at the typical internal combustion temperature of 820°C.

	$\Delta H_f°$(kJ/mol)	S°(J/K·mol)
$C_6H_{14}\ (l)$	– 198.7	+295
$O_2(g)$	0	+205
$CO_2(g)$	–393.5	+214
$H_2O(g)$	–242.0	+189