Thermochemistry #4

1. For the following reactions tell whether the sign of ΔS^o_{rxn} is + or – by analyzing the states on the reactant and product sides:

   a. C_2H_5OH (aq) + O_2 (g) → CH_3COOH (aq) + H_2O (l)

   b. O_3 (g) → O_2 (g) + O (g)

   c. 2Na (s) + Cl_2 (g) → 2NaCl (s)

   d. CCl_4 (l) + 5 O_2 (g) → CO_2 (g) + 4 ClO_2 (g)

   e. NH_4NO_3 (s) + H_2O (l) → 2 NH_3 (g) + 2O_2 (g)

2. Using Appendix C calculate the ΔS^o_{rxn} ΔH^o_{rxn} and ΔG^o_{rxn} for the following at 25 °C:

   a. C_2H_2(g) + 5/2 O_2 (g) → 2CO_2 (g) + H_2O (g)

   b. 2H_2S (g) + 3 O_2 (g) → 2 H_2O (g) + 2 SO_2 (g)

3. After balancing each of the following redox reactions use Appendix C to calculate the ΔS^o_{rxn} :

   a. NO (g) + MnO_4^- + H^+ → NO_3^- + Mn^{+2} + H_2O (l)

   b. Fe^{+2} + CrO_4^{-2} + H^+ → Fe^{+3} + Cr (s) + H_2O (l)

4. Write the thermochemical eq'n for the rxn from 2a above and then do the following problems with it:

   a. How many kJ of heat are released if 2.50 g of C_2H_2 are combusted in excess oxygen?

   b. If 500. kJ of heat are released what volume of CO_2 gas was made at STP conditions?

5. Fructose is a sugar commonly found in fruit. A sample of fructose, $C_6H_{12}O_6$, having a mass of 4.50 g is burned in a bomb calorimeter. The bomb's heat capacity = 21.2 kJ/°C. If the temperature of the bomb rises from 23.49 °C to 27.71 °C what is the heat of the reaction? What is the heat for one mole of fructose burning?

6. 4CO (g) + 8 H_2 (g) → 3CH_4 (g) + CO_2 (g) + 2H_2O (l) ΔH^o_{rxn} = ?

   Using the following info find the ΔH^o_{rxn} for the above reaction:

   C(graphite) + O_2 (g) → CO_2 (g) ΔH^o_{rxn} = -110.5 kJ

   H_2 (g) + ½ O_2 (g) → H_2O (l) ΔH^orxn = -285.8 kJ

   CO (g) + ½ O_2 (g) → CO_2 (g) ΔH^o_{rxn} = -283.0 kJ

   C(graphite) + 2 H_2(g) → CH_4 (g) ΔH^o_{rxn} = -74.81 kJ