Heats of Formation, ΔH^o_f

You can find the standard enthalpies of formation in the appendix of your textbook or at the following link:

[Standard Enthalpies of Formation]

1. Write a balanced formation equation for each the following:

   a) $K_2CrC_2O_4$

   $2\ K\ (s) + Cr\ (s) + 2\ C\ (graphite) + 2\ O_2\ (g) \rightarrow K_2CrC_2O_4$

   b) CH_3Cl

   $C\ (graphite) + 3/2\ H_2\ (g) + ½\ Cl_2\ (g) \rightarrow CH_3Cl\ (g)$

   c) H_2SO_4

   $H_2\ (g) + S\ (s) + 2\ O_2\ (g) \rightarrow H_2SO_4\ (l)$

2. Write a balanced formation equation for ethanol, CH_3CH_2OH (l), and include the value of ΔH^o_f. (look in the appendix of your book for ΔH^o_f values or use the link at the top of the page).

   $C\ (graphite) + H_2\ (g) + O_2\ (g) \rightarrow CH_3CH_2OH \quad \Delta H^o_f = -277.7$ kJ/mol

3. Use the ΔH^o_f values in the appendix of your text to determine the enthalpy change for the following reactions: (balance the equations)

   a) $2\ Fe_2O_3\ (s) + 3\ C\ (graphite) \rightarrow 4\ Fe\ (s) + 3\ CO_2\ (g)$

   $2\ Fe_2O_3\ (s) + 3\ C\ (graphite) \rightarrow 4\ Fe\ (s) + 3\ CO_2\ (g)$

   [3 mol CO_2 x -393.5 kJ/mol + 4 mol Fe x 0 kJ/mol] –
   [2 mol Fe_2O_3 x -824.2 kJ/mol + 3 mol C x 0 kJ/mol] = **467.9 kJ**

   b) $CaCO_3\ (s) \rightarrow CaO\ (s) + CO_2\ (g)$ equation is balanced

   [1 mol CO2 x -393.5 kJ/mol + 1 mol CaO x -634.9 kJ/mol] –
   [1 mol CaCO3 x -1207.6 kJ/mol] = +179.2 kJ

4. Use **[bond dissociation energies]** to calculate ΔH^o_{rxn} for the following reaction.

   $H_2O\ (l) + SO_3\ (g) \rightarrow H_2SO_4\ (l)$

   Reactants; 2 H—O and 3 S=O Product: 2 S—O, 2 S=O, 2 H—O

   [2 mols H—O x 463 kJ/mol + 3 mol S=O x 523 kJ/mol] –
   2 mol S—O x 364 kJ/mol + 2 mol S=O x 523 kJ/mol + 2 mol H—O x 463 kJ/mol = **-205 kJ**