Worksheet 6.1

Constructing enthalpy cycles (Hess cycles)

1 Given the enthalpy changes ΔH_1 and ΔH_2 below, construct an enthalpy cycle that will enable you to find the enthalpy change for the following reaction:

$CaCO_3(s) \rightarrow CaO(s) + CO_2(g)$ ΔH_r

$CaCO_3(s) + 2HCl(aq) \rightarrow CaCl_2(aq) + CO_2(g) + H_2O(l)$ ΔH_1
$CaO(s) + 2HCl(aq) \rightarrow H_2O(l) + CaCl_2(aq)$ ΔH_2 [4]

2 Given the enthalpy changes ΔH_3 and ΔH_4 below, construct an enthalpy cycle that will enable you to find the enthalpy change for the following reaction:

$CuBr_2(s) + 4H_2O(l) \rightarrow CuBr_2.4H_2O(s)$ ΔH_r

$CuBr_2(s) + aq \rightarrow CuBr_2(aq)$ ΔH_3
$CuBr_2.4H_2O(s) + aq \rightarrow CuBr_2(aq)$ ΔH_4 [4]

3 Given the enthalpy changes ΔH_5 and ΔH_6 below, construct an enthalpy cycle that will enable you to find the enthalpy change for the following reaction:

$2NaHCO_3(s) \rightarrow Na_2CO_3(s) + CO_2(g) + H_2O(l)$ ΔH_r

$HCl(aq) + NaHCO_3(s) \rightarrow NaCl(aq) + CO_2(g) + H_2O(l)$ ΔH_5
$2HCl(aq) + Na_2CO_3(s) \rightarrow 2NaCl(aq) + CO_2(g) + H_2O(l)$ ΔH_6 [4]

4 Suggest a reaction for which the enthalpy change of reaction would be difficult to determine directly. Write the equations for the reactions that could be used to determine the enthalpy change indirectly, using an enthalpy cycle. [10]