Friday worksheet 9 Hess'Law and enthalpy
Name ……

1. Given the following thermochemical equations
   $4NH_3(g) + 3O_2(g) \rightarrow 2N_2(g) + 6H_2O(l)$, $\Delta H = -1530 kJmol^{-1}$
   $H_2(g) + 1/2O_2(g) \rightarrow H_2O(l)$, $\Delta H = -288\ kJmol^{-1}$
   Calculate the enthalpy of formation of ammonia.

2. $CH_4(g) + 2O_2(g) \rightarrow CO_2(g) + 2H_2O(l)$ $\Delta H = -890\ kJmol^{-1}$
   $CO(g) + 1/2O_2(g) \rightarrow CO_2(g)$ $\Delta H = -284\ kJmol^{-1}$
   $C(s) + O_2(g) \rightarrow CO_2(g)$ $\Delta H = -393\ kJmol^{-1}$
   $H_2(g) + 1/2O_2(g) \rightarrow H_2O(l)$ $\Delta H = -286\ kJmol^{-1}$

a) Given the thermochemical equations above write balanced thermochemical equations for the :
   i. formation of methane (formation of methane from its elements)

   ii. formation of carbon monoxide (formation of CO from its elements)

   iii. combustion of methane in limited oxygen to form carbon monoxide and liquid water.

b) Calculate the enthalpy of formation of glucose according to the equation below
   $6C(s) + 6H_2(g) + 3O_2(g) \rightarrow C_6H_{12}O_6(s) \Delta H = ?$
   Given
   $C_6H_{12}O_6(s) + 6O_2(g) \rightarrow 6CO_2(g) + 6H_2O(l)$ $\Delta H = -1273.3 kJ/mol$
   and the equations

3. 1------ $CH_4(g) + 2O_2(g) \rightarrow CO_2(g) + 2H_2O(l)$ $\Delta H = -890\ kJmol^{-1}$
   2------ $CO(g) + 1/2O_2(g) \rightarrow CO_2(g)$ $\Delta H = -284\ kJmol^{-1}$
   3------ $C(s) + O_2(g) \rightarrow CO_2(g)$ $\Delta H = -393\ kJmol^{-1}$
   4-------$H_2(g) + 1/2O_2(g) \rightarrow H_2O(l)$ $\Delta H = -286\ kJmol^{-1}$

4. When ethanol burns in oxygen under standard conditions CO_2 and liquid water are produced.
   a. Write a balanced thermochemical equation for the complete combustion of ethanol using information from the Data Booklet .

   b. Calculate the enthalpy of formation of ethanol given the equations below.
      $2H_2(g) + O_2(g) \rightarrow 2H_2O(l)$ $\Delta H = -394 kJ/mol$
      $C(s) + O_2(g) \rightarrow CO_2(g)$ $\Delta H = -286 kJ/mol$

5. *A 5.30 gram sample of pure solid ammonium nitrate is dissolved in 50.0 mL of pure water at 25.0 °C. If the temperature of the water was finally measured at 15.5°C calculate the* ΔH of the equation $NH_4NO_3(s) \rightarrow NH_4^+(aq) + NO_3^-(aq)$.