Heat Summation

(1)

2. Using heats of formation from pg 799 in your text and that $\Delta H^\circ_{Al2O3(s)} = -1866.44$ kJ and $\Delta H^\circ_{Al4C3(s)} = -30.9$ kcal determine the heat of reaction for:

$$Al_2O_3(s) + CH_4(g) \Rightarrow Al_4C_3(s) + H_2O(g)$$

(1)

3. The heat of combustion of octane ($C_8H_{18}(l)$) is -5470.1 kJ. Use $\Delta H^\circ_{CO2(s)} = -393.5$ kJ, $\Delta H^\circ_{H2O(l)} = -285.8$ kJ and the heat summation rule to determine the heat of formation of octane. Once again DO NOT USE THE TABLES IN THE BOOK FOR THIS QUESTION (accept to perhaps check your answer)!!!

(3)

2. Calculate the change in enthalpy for the combustion reaction of oleic acid ($C_{18}H_{34}O_2$). Use tables and the fact that:

$$\Delta H_{C_{18}H_{34}O_2} = -818.81 \text{ kJ/mol}$$

(4)

3. Using the summation of heats of formation technique, calculate the heat of reaction in kJ, if $FeSO_4$ (s) is decomposed to form Fe (s) plus sulphur dioxide gas plus oxygen gas. Use the values in the text for help. Now determine the mass of natural gas (CH_4 (g)) in kg that must be combusted to provide enough heat to decompose 750 kg of ferrous sulphate. Use -922.6 for the heat of formation of FeSO4

(9)

3. Calculate the heat of reaction for:

$$Al(NO_3)_3(aq) + (NH_4)_2SO_4(aq) \Rightarrow Al_2(SO_4)_3(s) + NH_4NO_3(s)$$

Using the following heats of formation and heats of formation listed in your text.

$\Delta H^\circ_{Al(NO3)3(aq)} = -273.65$ kcal
$\Delta H^\circ_{(NH4)2SO4(aq)} = -281.86$ kcal
$\Delta H^\circ_{Al2(SO4)3(s)} = -820.98$ kcal

(11)

2. Determine the heat of combustion of zinc sulphide (ZnS) given that the oxide products are zinc oxide and sulphur dioxide. Use the heat summation method for this determination (i.e. don't use Hess' Law). When you have determined the heat of combustion, write a thermochemical equation that represents this process. You must write a balanced chemical equation before you begin.

(12)

2. Using the table found in your text book, determine the heat of reaction for the decomposition of potassium chlorate.

$$KClO_3(s) \Rightarrow KCl(s) + O_2(g) \quad \Delta H = ?$$

(2)

2. Using the table of values in the back of the text book, determine the heat of combustion of ethyl alcohol. The formula of ethyl alcohol is $C_2H_5OH(l)$. This is not a Hess' law.

2. Use heats of formation directly (i.e. not Hess Law) to calculate the heat of reaction for:

$$3CuO(s) + 2NH_3(g) \Longrightarrow 3Cu(s) + 3H_2O(l) + N_2(g)$$

(5)

Use your answer to determine:

a) the heat released in kJ if 500 g of Cu(s) is recovered

b) the heat released in kcal if 1.5 L of nitrogen gas is recovered at S.T.P. (22.414 L of gas = 1 mol of gas)