Thermochemistry-Thermochemical Equations-SS Name:

For complete credit show all the work for the calculations and give the answers in the correct significant figures.

1. Given the reaction of iron (III) oxide with carbon monoxide below, determine the ΔH for the two reactions below.

   $3Fe_2O_3(s) + CO(g) \longrightarrow 2Fe_3O_4(s) + CO(g)$ $\Delta H = -46$ KJ/mol

   a) $2Fe_2O_3(s) + 2/3CO(g) \longrightarrow 4/3\ Fe_3O_4(s) + 2/3CO(g)$ (Ans: -31KJ)

   b) $6Fe_3O_4(s) + 3CO(g) \longrightarrow 9Fe_2O_3(s) + 3\ CO(g)$ (Ans: +138KJ)

2. Given the reaction below of sodium peroxide with water, determine the ΔH for the equations below.

   $2Na_2O_2(s) + 2H_2O(l) \longrightarrow 4NaOH(s) + O_2(g)$ $\Delta H = -109$ KJ/mol

   a) $16Na_2O_2(s) + 16H_2O(l) \longrightarrow 32NaOH(s) + 8O_2(g)$ (Ans: -872KJ)

   b) $2NaOH(s) + ½\ O_2(g) \longrightarrow Na_2O_2(s) + H_2O(l)$ (Ans:+54.5KJ)

3. Calcium oxide reacts with carbon dioxide to form calcium carbonate (Chalk). How many KJ of heat are evolved in the reaction of 0.500 kg of CaO with excess of carbon dioxide? (Ans: -1591 KJ)

   $CaO(s) + CO_2(g) \longrightarrow CaCO_3(s)$ $\Delta H = -178.4$ KJ/mol

(***Strategy***: a) convert kg to g; b) convert g to mol; c) use the enthalpy to find amount of heat evolved from mols in b.)

4. Calcium carbide reacts with water to form acetylene, a gas used in welding. How many KJ of heat are evolved in the reaction of 3.50 kg of CaC_2 with 1.25 L of H_2O? (Ans:-4440KJ)

$CaC_2(s) + 2H_2O(l) \longrightarrow C_2H_2(g) + Ca(OH)_2(s) \quad \Delta H = -128.0$ KJ/mol

(***Strategy***: this is a limiting reagent problem. a) convert kg of CaC_2 to g and then to mols; b) find the amount of energy released using ΔH; c) convert L of H_2O to kg and then to g of H_2O and find mols; d) find the amount of energy released using ΔH; the lower amount of energy released is the correct answer).

5. How many liters of CO_2 gas, measured at 23°C and 779 Torr are produced when 4.45×10^7 KJ of heat is evolved in the burning of butane? (Ans: 1.46×10^6 L CO_2)

$2C_4H_{10}(l) + 12O_2 \longrightarrow 8CO_2(g) + 10H_2O(l) \quad \Delta H = -5.76 \times 10^3$ KJ/mol

(***Strategy***: This is part of gas laws. a) convert temp and pressure to SI units; b) find the **mols** needed to release the given energy using ΔH/mol of the equation; c) use gas law to find the volume of CO2.)