Homework - Worksheet

Multi-Step Energy Calculations

Step 1: *Find H^o general*
-use Hess's law
-from equation
-use calorimetry

Step 2: *Find n (specific)*
-use mass (molar mass)
-use concentration
-use $n = \Delta H/H^o$

Step 3: *Find ΔH (specific)/mass/volume/temp change*
-use $\Delta H = nH^o$

-use $\Delta H = -q$

-use molar mass

Sample Problem

Ex. $2NaHCO_{3(s)} + 129.2kJ \longrightarrow Na_2CO_{3(s)} + CO_{2(g)} + H_2O_{(g)}$

What quantity of energy ΔH_r, is required to decompose 100. kg of $NaHCO_{3(s)}$?

Step 1: Hr (general)

$\Delta Hr = nHr$

$Hr = \frac{\Delta Hr}{n} = \frac{129.2\ kJ}{2\ mol} = 64.6\ kJ/mol$

Step 2: n (specific)

$100\,000g \times \frac{1\ mol}{84.01\ g} = 1190.33\ mol$

Step 3: ΔHr (specific)

$\Delta Hr = nHr$

$\Delta Hr = (1190.33\ mol)(64.6\ \frac{kJ}{mol})$

$\Delta Hr = 76\,900\ kJ$

Calculate the mass of methane combusted when 3700. kJ of energy is released according to the following reaction.

$$CH_{4(g)} + 2O_{2(g)} \Rightarrow CO_{2(g)} + 2H_2O_{(g)} + 802.7kJ$$

Step 1: Hr (general)

$\Delta Hr = nHr$

$$Hr = \frac{\Delta Hr}{n} = \frac{-802.7 kJ}{1 mol} = -802.7 kJ/mol$$

Step 2: n (specific)

$\Delta Hr = nHr$

$$n = \frac{\Delta Hr}{Hr} = \frac{-3700. kJ}{-802.7 kJ/mol} = 4.609 mol$$

Step 3: m (specific)

$$4.609 mol \times \frac{16.05 g}{1 mol} = \boxed{73.97 g}$$