Homework - Worksheet

(2) $2C_8H_{18(l)} + 25O_{2(g)} \rightarrow 16CO_{2(g)} + 18H_2O_{(g)}$

m = 1 kg

$\Delta H_c = -10148.2 kJ$

↓

$\Delta H_r = \Sigma nH_{fp} - \Sigma nH_{fr}$

Step 1: Hr (general)

$\Delta H_r = nH_r$

$H_r = \frac{\Delta H_r}{n} = \frac{-10148.2 kJ}{2 mol} = -5074.1 kJ/mol$

Step 2: n (specific)

$1000 g\ C_8H_{18} \times \frac{1 mol\ C_8H_{18}}{114.26 g\ C_8H_{18}} = 8.752 mol\ C_8H_{18}$

Step 3: ΔH_r (specific)

$\Delta H_r = nH_r$

$\Delta H_r = (8.752 mol)(-5074.1 \frac{kJ}{mol})$

$\Delta H_r = -44408 kJ$

$\Delta H_r = -44.4 MJ$

Multi-Step Energy Calculations can be used when energy produced in one chemical reaction is used to heat another substance. These calculations are very similar to calorimetry calculations.

total enthalpy change = quantity of heat

$$\Delta H_r = -q$$

Sample Problem

What mass of octane is completely burned during the heating of 20.L of aqueous ethylene glycol automobile coolant from -10.°C to 70.°C? The volumetric heat capacity of aqueous ethylene glycol is 3.7 kJ/L°C.

Ex. $2C_8H_{18(l)} + 25O_{2(g)} \longrightarrow 18H_2O_{(s)} + 16CO_{2(g)}$

$\Delta H_r = -10148.2\text{ kJ}$

Step 1: Hr (general)

$\Delta H_r = nH_r$

$H_r = \frac{\Delta H_r}{n} = \frac{-10148.2\text{ kJ}}{2\text{ mol}} = -5074.1\text{ kJ/mol}$

Step 2: n (specific)

octane → $\Delta H_r = -q$ ← coolant

$nH_r = -vC\Delta T$

$n\left(-5074.1\frac{\text{kJ}}{\text{mol}}\right) = -(20.\text{L})\left(3.7\frac{\text{kJ}}{\text{L}\cdot{}^\circ\text{C}}\right)(80.^\circ\text{C})$

$n = 1.1667\text{ mol}$

Step 3: mass

$1.1667\text{ mol } C_8H_{18} \times \frac{114.26\text{ g } C_8H_{18}}{1\text{ mol } C_8H_{18}} = \boxed{130\text{ g } C_8H_{18}}$

Worksheet #1-5