Homework - Worksheet

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

$\Delta H_r = -10148.2\,kJ$

Step 1: H_r (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)

octane $\Delta H_r = -q$ ← coolant

$nH_r = -vC\Delta T$

$n(-5074.1\ \frac{kJ}{mol}) = -(20.L)(3.7\ \frac{kJ}{L\cdot°C})(80.°C)$

$n = 1.1667\,mol$

Step 3: mass

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

Worksheet #1-5