Homework - Worksheet

③ $CH_3OH_{(l)} + \frac{3}{2}O_{2(g)} \rightarrow CO_{2(g)} + 2H_2O_{(g)}$

Step 1: Hr (general)

$\Delta H_r = \Sigma n H_{fp} - \Sigma n H_{fr}$

$\Delta H_r = \left[(1\,mol)(-393.5\,\frac{kJ}{mol}) + (2\,mol)(-241.8\,\frac{kJ}{mol})\right] - \left[(1\,mol)(-239.1\,\frac{kJ}{mol}) + (\frac{3}{2}\,mol)(0\,\frac{kJ}{mol})\right]$

$\Delta H_r = -638\,kJ$

$\Delta H_r = nH_r$

$H_r = \frac{\Delta H_r}{n} = \frac{-638\,kJ}{1\,mol} = -638\,kJ/mol$

Step 2: n (specific)

$\frac{1000\,g}{32.05\,g/mol} = 31.20\,mol$ $1000\,g \times \frac{1\,mol}{32.05\,g} = 31.20\,mol$

Step 3: ΔH_r (specific)

$\Delta H_r = nH_r$

$\Delta H_r = (31.20\,mol)(-638\,kJ/mol)$

$\Delta H_r = -19\,900\,kJ$

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

Step 1: H_r (general)

$\Delta H_r = \Sigma n H_{fp} - \Sigma n H_{fr}$

$\Delta H_r = -10\,148.2\ kJ$

$\Delta H_r = nH_r$

$H_r = \frac{\Delta H_r}{n} = \frac{-10\,148.2\ kJ}{2\ mol} = -5074.1\ kJ/mol$

Step 2: n (specific)

$\Delta H_r = -q$

$nH_r = -vC\Delta T$

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

$n = 1.1667\ mol$

Step 3: mass

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

Worksheet #1-5