

Homework - Worksheet



$$\Delta H_r = ?$$

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

$$\Delta H_r = \left[(4 \text{ mol}) \left(90.2 \frac{\text{kJ}}{\text{mol}} \right) + (6 \text{ mol}) \left(-241.8 \frac{\text{kJ}}{\text{mol}} \right) \right] - \left[(4 \text{ mol}) \left(-45.9 \frac{\text{kJ}}{\text{mol}} \right) + (5 \text{ mol}) \left(0 \frac{\text{kJ}}{\text{mol}} \right) \right]$$

$$\underline{\Delta H_r = -906.4 \text{ kJ}}$$

$$\Delta H_r = nH_r$$

$$H_r = \frac{\Delta H_r}{n} = \frac{-906.4 \text{ kJ}}{4 \text{ mol}} = \boxed{-226.6 \frac{\text{kJ}}{\text{mol}}}$$

Multi-Step Energy Calculations

Step 1: *Find H° general*

- use Hess's law
- from equation
- use calorimetry

Step 2: *Find n (specific)*

- mass (molar mass)
- concentration
- $n = \Delta H / H^\circ$
- calorimetry

Step 3: *Find ΔH (specific) / mass / ΔT ...*

Sample Problem



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

100 000 g

Step 1: H_r (general)

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

$$\Delta H_r = n H_r$$

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

Step 2: n (specific)

$$\left(\frac{100\,000\text{g}}{84.01\text{g/mol}} \right)$$

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

Step 3: ΔH_r (specific)

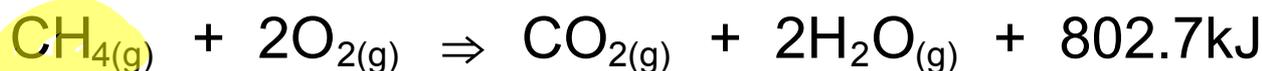
$$\Delta H_r = n H_r$$

$$\Delta H_r = (1190.33\text{mol})(64.6\text{kJ/mol})$$

$$\Delta H_r = 76\,900\text{kJ}$$

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

ΔH_r



Step 1: H_r (general)

$$\Delta H_r = n H_r$$

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

Step 2: n (specific)

$$\Delta H_r = n H_r$$

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

Step 3: mass

$$4.609\text{ mol CH}_4 \times \frac{16.05\text{g CH}_4}{1\text{mol}} = \boxed{73.98\text{g CH}_4}$$

Worksheet #1-5