

Homework - Worksheet

Multi-Step Energy Calculations

Step 1: *Find H° general*

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

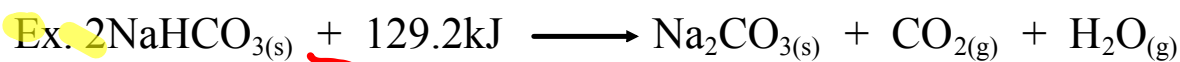
Step 2: *Find n (specific)*

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

Step 3: *Find ΔH (specific)/mass/volume/temp change*

- use $\Delta H = nH^\circ$
- use $\Delta H = -q$
- use molar mass

Sample Problem



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

Step 1: H_r (general)

$$\Delta H_r = n H_r$$

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

Step 2: n (specific)

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

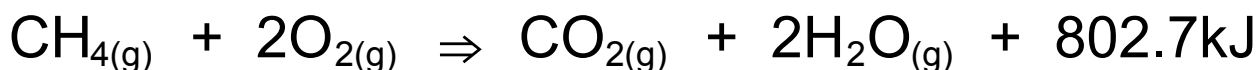
Step 3: ΔH_r (specific)

$$\Delta H_r = n H_r$$

$$\Delta H_r = (1190.33 \text{ mol}) \left(64.6 \frac{\text{kJ}}{\text{mol}} \right)$$

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

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



Step 1: Hr (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: m (specific)

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