

Homework - Worksheet

Multi-Step Energy Calculations

Step 1: *Find H general*

- use Hess' law
- from equation
- use calorimetry

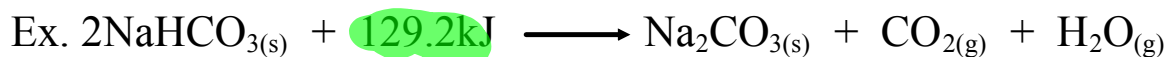
Step 2: *Find n (specific)*

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

- Calorimetry

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

Sample Problem



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

Step 1: H_r (general)

$$\Delta H_r = n H_r$$

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

$$\Delta H_r = \sum n H_{r,p} - \sum n H_{r,r}$$

Step 2: n (specific)

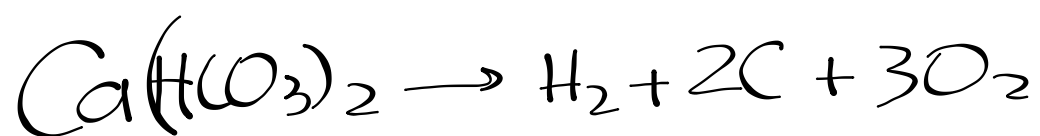
$$100000 \text{ g NaHCO}_3 \times \frac{1 \text{ mol NaHCO}_3}{84.01 \text{ g NaHCO}_3} = 1190.33 \text{ mol}$$

Step 3: ΔH_r (specific)

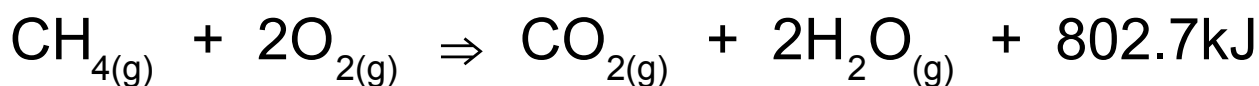
$$\Delta H_r = n H_r$$

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

$$\Delta H_r = 76900 \text{ kJ} \quad \cdot \quad 76.9 \text{ MJ}$$

$\Delta H_r = ?$ 

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: mass

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



Worksheet #1-2