

## Homework - Worksheet

## Multi-Step Energy Calculations

Step 1: *Find H general*

- use Hess' law
- from equation
- use calorimetry

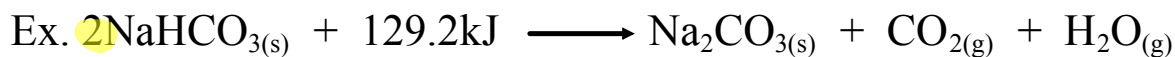
Step 2: *Find n (specific)*

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

- use calorimetry  
 $\Delta H_r = -q$

Step 3: *Find  $\Delta H$  (specific), mass,  $\Delta T$ , etc.*

## Sample Problem



What quantity of energy  $\Delta H_r$  is required to decompose 100. kg of  $\text{NaHCO}_3(\text{s})$ ?

Step 1:  $H_r$  (general)

$$\Delta H_r = nH_r \quad \leftarrow \quad \Sigma nH_{\text{fp}} - \Sigma nH_{\text{fr}}$$

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

Step 2:  $n$  (specific)

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

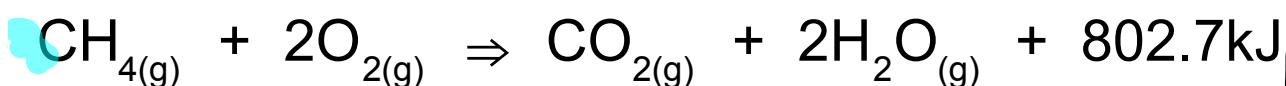
Step 3:  $\Delta H_r$  (specific)

$$\Delta H_r = nH_r$$

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

$$\Delta H_r = 76900 \text{ kJ}$$

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



Step 1:  $H_r$  (general)

$$\Delta H_r = n H_r$$

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

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)

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

GENERAL (eq n)

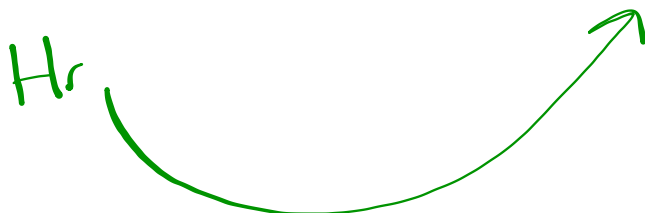
$$\Delta H_r = -802.7 \text{ kJ}$$

$$n = 1 \text{ mol}$$

SPECIFIC

$$\Delta H_r = -3700 \text{ kJ}$$

$$n = ?$$



Worksheet #1-2