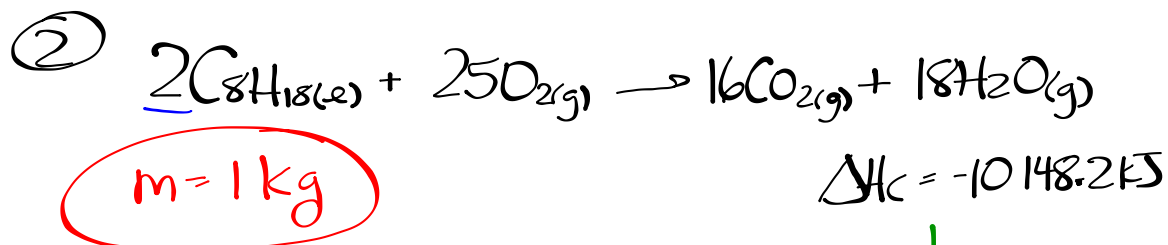


## Homework - Worksheet



$$m = 1 \text{ kg}$$

$$\Delta H_c = -10148.2 \text{ kJ}$$

↓

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

Step 1:  $H_r$  (general)

$$\Delta H_r = n H_r$$

$$H_r = \frac{\Delta H_r}{n} = \frac{-10148.2 \text{ kJ}}{2 \text{ mol}} = -5074.1 \text{ kJ/mol}$$

Step 2:  $n$  (specific)

$$1000 \text{ g C}_8\text{H}_{18} \times \frac{1 \text{ mol C}_8\text{H}_{18}}{114.26 \text{ g C}_8\text{H}_{18}} = 8.752 \text{ mol C}_8\text{H}_{18}$$

Step 3:  $\Delta H_r$  (specific)

$$\Delta H_r = n H_r$$

$$\Delta H_r = (8.752 \text{ mol}) \left( -5074.1 \frac{\text{kJ}}{\text{mol}} \right)$$

$$\Delta H_r = -44408 \text{ kJ}$$

$$\Delta H_r = -44.4 \text{ MJ}$$

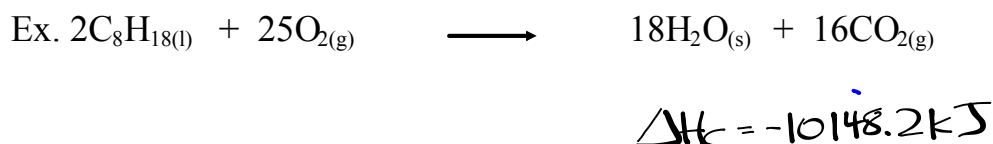
Multi-Step Energy Calculations can be used when energy produced in one chemical reaction is used to heat another substance. These calculations are very similar to calorimetry calculations.

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  $-10^{\circ}\text{C}$  to  $70^{\circ}\text{C}$ ? The volumetric heat capacity of aqueous ethylene glycol is  $3.7 \text{ kJ/L}^{\circ}\text{C}$ .



Step 1:  $H_r$  (general)

$$\Delta H_r = n H_r$$

$$H_r = \frac{\Delta H_r}{n} = \frac{-10148.2 \text{ kJ}}{2 \text{ mol}} = -5074.1 \text{ kJ/mol}$$

Step 2:  $n$  (specific)

$$\overset{\text{octane}}{\Delta H_r} = -q \quad \leftarrow \text{coolant}$$

$$n H_r = -v C \Delta T$$

$$n \left( -5074.1 \frac{\text{kJ}}{\text{mol}} \right) = - (20. \text{L}) (3.7 \frac{\text{kJ}}{\text{L}^{\circ}\text{C}}) (80.^{\circ}\text{C})$$

$$n = 1.1667 \text{ mol}$$

Step 3: mass

$$1.1667 \text{ mol C}_8\text{H}_{18} \times \frac{114.26 \text{ g C}_8\text{H}_{18}}{1 \text{ mol C}_8\text{H}_{18}} = \boxed{130 \text{ g C}_8\text{H}_{18}}$$



Worksheet #1-5