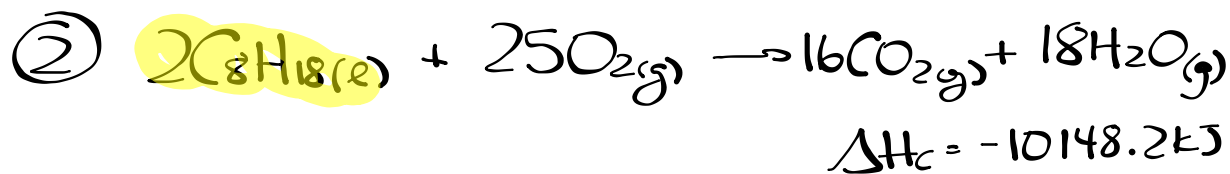


Homework - Worksheet



Step 1: H_r (general)

$$\Delta H_r = n H_r \quad \dots \quad \Sigma n H_{\text{fp}} - \Sigma n H_{\text{r}}$$

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

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: ΔH_r (specific)

$$\Delta H_r = n H_r$$

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

$$\Delta H_r = -44\,408 \text{ kJ}$$

$$= \boxed{-44.4 \text{ MJ}}$$

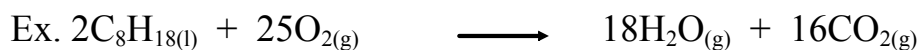
Multi-Step Energy Calculations can be used when energy produced in one chemical reaction is used to heat another substance. These calculations are very similar to calorimetry calculations.

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)

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

$$\Delta H_r = \left[(18 \text{ mol}) \left(-241.8 \frac{\text{kJ}}{\text{mol}} \right) + (16 \text{ mol}) \left(-393.5 \frac{\text{kJ}}{\text{mol}} \right) \right] - \left[(2 \text{ mol}) \left(-250.1 \frac{\text{kJ}}{\text{mol}} \right) + (25 \text{ mol}) \left(0 \frac{\text{kJ}}{\text{mol}} \right) \right]$$

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

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

Step 2: n (specific)

$$\Delta H_r = -q$$

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

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

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

Step 3: m (specific)

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

Worksheet #3-5