The molar enthalpy of reaction ($\Delta H_{\text{rxn}}$) is the amount of heat transferred during a reaction. It is reported in kilojoules per mole of reactant. A reaction that produces heat is **exothermic** and has a negative $\Delta H_{\text{rxn}}$. A reaction that absorbs heat is **endothermic** and has a positive $\Delta H_{\text{rxn}}$.

**Example**

How much heat is produced when 85 g of sulfur reacts according to the reaction below?  

$$2S + 3O_2 \rightarrow 2SO_3 \quad \Delta H = -792 \text{ kJ}$$

- the $\Delta H$ value given in the equation is the amount of heat transferred when **2 moles** of sulfur and **3 moles** of oxygen react.

- write the ‘given’ and ‘unknown’ units:  

$$\frac{85 \text{ g S}}{1} \times \frac{1 \text{ mol S}}{32.06 \text{ g S}} \times \frac{-792 \text{ kJ}}{2 \text{ mol S}} = \ ? \text{ kJ}$$

- solve:  

$$\frac{85 \text{ g S}}{1} \times \frac{1 \text{ mol S}}{32.06 \text{ g S}} \times \frac{-792 \text{ kJ}}{2 \text{ mol S}} = -1050 \text{ kJ}$$

**Answer the following questions. Show all work and report answers with units.**

1. How much heat will be released when 6.44 g of sulfur reacts with excess $O_2$ according to the following equation?  

$$2 \text{S} + 3\text{O}_2 \rightarrow 2\text{SO}_3 \quad \Delta H = -791.4 \text{ kJ}$$

5. What mass of propane, $C_3H_8$, must be burned in order to produce 76,000 kJ of energy?  

$$C_3H_8 + 5\text{O}_2 \rightarrow 3\text{CO}_2 + 4\text{H}_2\text{O} \quad \Delta H = -2200 \text{ kJ}$$

2. How much heat will be released when 4.72 g of carbon reacts with excess $O_2$ according to the following equation?  

$$\text{C} + \text{O}_2 \rightarrow \text{CO}_2 \quad \Delta H = -393.5 \text{ kJ}$$

6. How much heat will be absorbed when 13.7 g of nitrogen reacts with excess $O_2$ according to the following equation?  

$$\text{N}_2 + \text{O}_2 \rightarrow 2\text{NO} \quad \Delta H = +180 \text{ kJ}$$

3. How much heat will be absorbed when 38.2 g of bromine reacts with excess $H_2$ according to the following equation?  

$$\text{H}_2 + \text{Br}_2 \rightarrow 2\text{HBr} \quad \Delta H = +72.80 \text{ kJ}$$

7. What mass of iron must react to produce 3600 kJ of energy?  

$$3\text{Fe} + 2\text{O}_2 \rightarrow \text{Fe}_3\text{O}_4 \quad \Delta H = -1120 \text{ kJ}$$

4. How much heat will be released when 1.48 g of chlorine reacts with excess phosphorus according to the following equation.  

$$2\text{P} + 5\text{Cl}_2 \rightarrow 2\text{PCl}_5 \quad \Delta H = -886 \text{ kJ}$$

8. How much heat will be released when 12.0 g of $H_2$ reacts with 76.0 g of $O_2$ according to the following equation?  

$$2\text{H}_2 + \text{O}_2 \rightarrow 2\text{H}_2\text{O} \quad \Delta H = -571.6 \text{ kJ}$$