Enthalpy Stoichiometry
Chem Worksheet 16-3

Name ________________

The **molar enthalpy of reaction** (ΔH_{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 ΔH_{rxn}. A reaction that absorbs heat is **endothermic** and has a positive ΔH_{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 ΔH 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: $\frac{85\text{ g S}}{1} \times \frac{\quad}{\quad} \times \frac{\quad}{\quad} = \quad \text{kJ}$

- fill in factors: $\frac{85\text{ g S}}{1} \times \frac{1\text{ mol S}}{32.06\text{ g S}} \times \frac{-792\text{ kJ}}{2\text{ mol S}} = \quad \text{kJ}$

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

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?

   $2S + 3O_2 \rightarrow 2SO_3 \quad \Delta H = -791.4\text{ kJ}$

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

   $C + O_2 \rightarrow CO_2 \quad \Delta H = -393.5\text{ kJ}$

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

   $H_2 + Br_2 \rightarrow 2HBr \quad \Delta H = +72.80\text{ kJ}$

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

   $2P + 5Cl_2 \rightarrow 2PCl_5 \quad \Delta H = -886\text{ kJ}$

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

   $C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O \quad \Delta H = -2200\text{ kJ}$

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

   $N_2 + O_2 \rightarrow 2NO \quad \Delta H = +180\text{ kJ}$

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

   $3Fe + 2O_2 \rightarrow Fe_3O_4 \quad \Delta H = -1120\text{ kJ}$

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?
   (when one reactant runs out the reaction stops)

   $2H_2 + O_2 \rightarrow 2H_2O \quad \Delta H = -571.6\text{ kJ}$