Enthalpy Practice

GHP

1. Identify if the following reactions are **endothermic** or **exothermic** based on the information provided:
    a. $A + B \rightarrow C + HEAT$
    b. $X + Y + HEAT \rightarrow Z$
    c. When Mg metal reacts with hydrochloric acid the solution gets hot to the touch.
    d. An instant ice pack
    e. A flameless ration heater used by military personnel to heat up food in the field
    f. $Xe(g) + F_2(g) \rightarrow XeF_4(s)$ $\Delta H = -251kJ$
    g. $C_6H_4(OH)_2 \rightarrow C_6H_4O_2(aq) + H_2(g)$ $\Delta H = +177kJ$

2. Draw enthalpy diagrams for the following chemical reactions. Make sure to make the spacing relative to the values of dH and the activation energy. Use the sample enthalpy diagram below to remind yourself of the key parts of the diagram.
    a. $A + B \rightarrow C + HEAT$ (large activation energy)
    b. $X + Y + HEAT \rightarrow Z$ (small activation energy)
    c. When Mg metal reacts with hydrochloric acid the solution gets hot to the touch. (small activation energy)
    d. An instant ice pack (large activation energy)
    e. A flameless ration heater used by military personnel to heat up food in the field (large activation energy)
    f. $Xe(g) + F_2(g) \rightarrow XeF_4(s)$ $\Delta H = -251kJ$
    $E_a = 127.4$ kj
    g. $C_6H_4(OH)_2 \rightarrow C_6H_4O_2(aq) + H_2(g)$ $\Delta H = +177kJ$
    $E_a = 181$ kJ

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

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?

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

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)

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