

# Enthalpy Stoichiometry

## Chem Worksheet 16-3

Name \_\_\_\_\_

The **molar enthalpy of reaction** ( $\Delta H_{rxn}$ ) 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  $\Delta H_{rxn}$ . A reaction that absorbs heat is **endothermic** and has a positive  $\Delta H_{rxn}$ .

### Example

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



- 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.

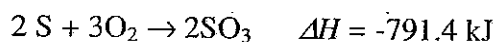
- write the 'given' and 'unknown' units:  $\frac{85 \text{ g S}}{1} \times \text{_____} \times \text{_____} = \text{kJ}$

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

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



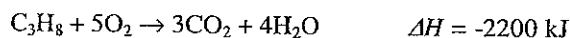
3. How much heat will be absorbed when 38.2 g of bromine reacts with excess  $H_2$  according to the following equation?



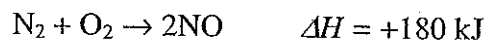
4. How much heat will be released when 1.48 g of chlorine reacts with excess phosphorus according to the following equation.



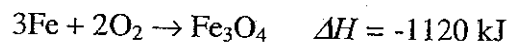
5. What mass of propane,  $C_3H_8$  must be burned in order to produce 76,000 kJ of energy?



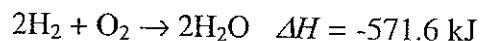
6. How much heat will be absorbed when 13.7 g of nitrogen reacts with excess  $O_2$  according to the following equation?



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

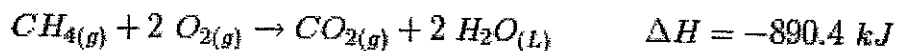


8. How much heat will be released when 12.0 g of  $H_2$  reacts with 76.0 g of  $O_2$  according to the following equation? (when one reactant runs out the reaction stops)



## Enthalpy Worksheet

1. The combustion of methane,  $CH_4$ , releases  $890.4 \text{ kJ/mol}$  of heat. That is, when one mole of methane is burned,  $890.4 \text{ kJ}$  are given off to the surroundings. This means that the products have  $890.4 \text{ kJ}$  less energy stored in the bonds than the reactants. Thus,  $\Delta H$  for the reaction =  $-890.4 \text{ kJ}$ . A negative symbol for  $\Delta H$  indicates an exothermic reaction.



A. How much energy is given off when  $2.00 \text{ mol}$  of  $CH_4$  are burned?

B. How much energy is released when  $22.4 \text{ g}$  of  $CH_4$  are burned?

C. If you were to attempt to make  $45.0 \text{ g}$  of methane from  $CO_2$  and  $H_2O$  (with  $O_2$  also being produced), how much heat would be absorbed during the reaction?