

Enthalpy Stoichiometry

Chem Worksheet 16-3

Name _____

KEY

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?



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

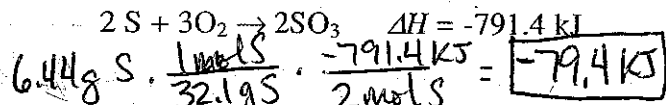
- write the 'given' and 'unknown' units: $\frac{85 \text{ g S}}{1} \times \frac{1 \text{ mol S}}{32.06 \text{ g S}} \times \frac{-792 \text{ kJ}}{2 \text{ mol S}} = \text{kJ}$

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

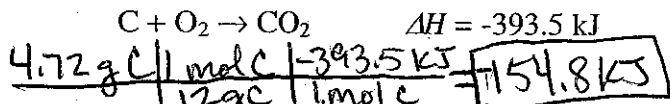
- solve: $\frac{85 \text{ g S}}{1} \times \frac{1 \text{ mol S}}{32.06 \text{ g S}} \times \frac{-792 \text{ kJ}}{2 \text{ mol S}} = -1050 \text{ kJ}$

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

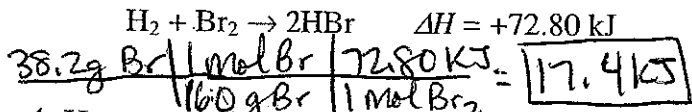
1. How much heat will be released when 6.44 g of sulfur reacts with excess O_2 according to the following equation?



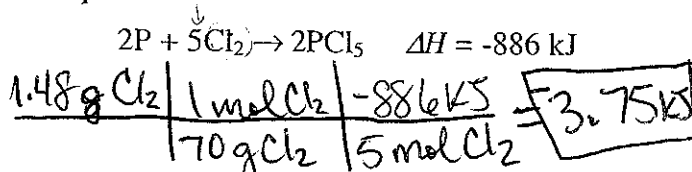
2. How much heat will be released when 4.72 g of carbon reacts with excess O_2 according to the following equation?



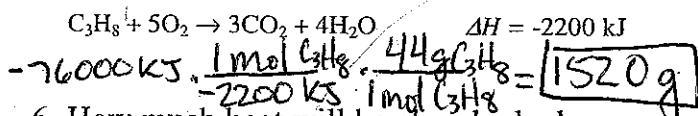
3. How much heat will be absorbed when 38.2 g of bromine reacts with excess H_2 according to the following equation?



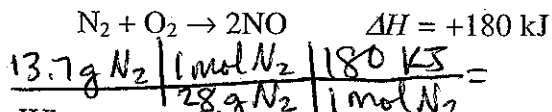
4. How much heat will be released when 1.48 g of chlorine reacts with excess phosphorus according to the following equation.



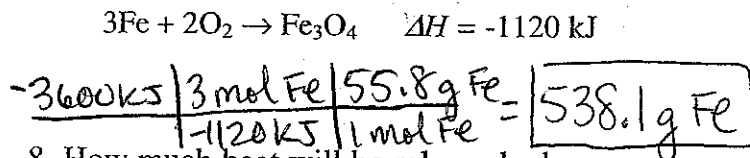
5. What mass of propane, C_3H_8 must be burned in order to produce 76,000 kJ of energy?



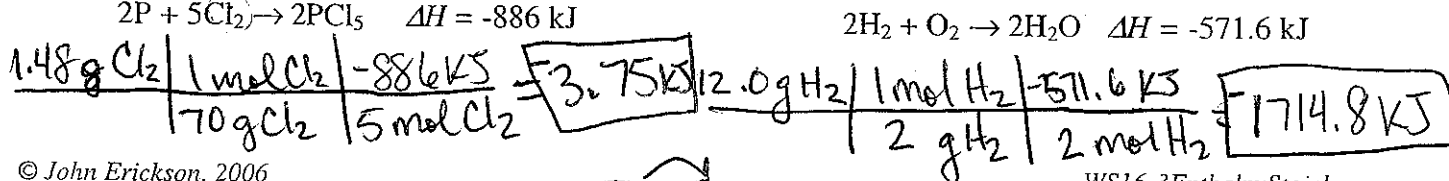
6. How much heat will be absorbed when 13.7 g of nitrogen reacts with excess O_2 according to the following equation?



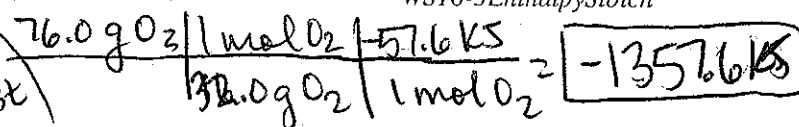
7. What mass of iron must react to produce 3600 kJ of energy?



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)

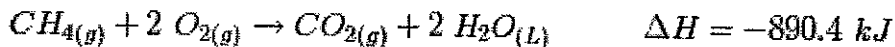


O_2 will run out 1st



Enthalpy Worksheet

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



A. How much energy is given off when 2.00 mol of CH_4 are burned?

$$\frac{2.00 \text{ mol CH}_4}{1 \text{ mol CH}_4} \times \frac{-890.4 \text{ kJ}}{1 \text{ mol CH}_4} = \boxed{-1780.8 \text{ kJ}}$$

B. How much energy is released when 22.4 g of CH_4 are burned?

$$\frac{22.4 \text{ g CH}_4}{16 \text{ g CH}_4} \times \frac{1 \text{ mol CH}_4}{1 \text{ mol CH}_4} \times \frac{-890.4 \text{ kJ}}{1 \text{ mol CH}_4} = \boxed{-1246.6 \text{ kJ}}$$

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

$$\frac{45 \text{ g CH}_4}{16 \text{ g CH}_4} \times \frac{1 \text{ mol CH}_4}{1 \text{ mol CH}_4} \times \frac{890.4 \text{ kJ}}{1 \text{ mol CH}_4} = \boxed{2504.2 \text{ kJ}}$$