

## Energy Changes in Chemical Reactions

Name - \_\_\_\_\_

1.) You can think of this reaction,  $\text{CH}_4 + 2 \text{O}_2 \rightarrow \text{CO}_2 + 2 \text{H}_2\text{O}$ , as occurring in two steps (it doesn't go this way, but it is convenient to think of it this way).

Step 1 -  $\text{CH}_4 + 2 \text{O}_2 \rightarrow \text{C} + 4 \text{H} + 4 \text{O}$  (the reactants are broken down to individual atoms)

Step 2 -  $\text{C} + 4 \text{H} + 4 \text{O} \rightarrow \text{CO}_2 + 2 \text{H}_2\text{O}$  (the individual atoms are assembled into products)

a.) Does step 1 absorb or give off energy?

b.) Does step 2 absorb or give off energy?

c.) Since the overall reaction is exothermic, which step involves more energy, step 1 or 2?

2.) The energy needed to break an H-Cl bond is 432 kJ.  $2 \text{HCl} + 432 \text{ kJ} \rightarrow \text{H}_2 + \text{Cl}_2$

How many kilojoules of energy are given off in the following reaction? Why?



3.) Is the burning of wood exothermic or endothermic?

4.) Is the melting of sugar exothermic or endothermic?

5.) A beaker becomes warm when a reaction occurs in it. Are the chemicals in the beaker gaining or losing energy? Is the reaction endothermic or exothermic?

6.) Which contains more energy in an endothermic reaction, the reactants or products?

7.) In an exothermic reaction, do you have to add or remove energy in order to allow particles to form?

8a.) Is  $\Delta H > 0$  or  $\Delta H < 0$  for an endothermic reaction?

b.) Is  $\Delta H > 0$  or  $\Delta H < 0$  for an exothermic reaction?

9.) Draw an energy diagram having  $\Delta H = +25 \text{ kJ}$ .



10.) Draw an energy diagram having  $\Delta H = -50 \text{ kJ}$ .



11.)  $\Delta H = -50 \text{ kJ}$  for the reaction  $F \rightarrow G$ . Re-write this equation to show the  $50 \text{ kJ}$  properly on the reactant or product side.

12.) If a reaction absorbs  $30 \text{ kJ}$  of heat, what is the  $\Delta H$  for the reaction?

13.) If  $P \rightarrow Q + 25 \text{ kJ}$ , what is the  $\Delta H$  for the reaction? Which have more energy, the reactants or products?