Name_____ H. Chem, Period _____

Collision Theory and Reaction Profiles

1. What is collision theory?

Collision theory simply states that for a chemical reaction to occur, reactant particles must collide with sufficient energy (activation energy) and the correct orientation. Collision theory explains why different reactions occur at different rates and suggests ways to change the rate of a reaction.

2. Define the following:
   a. activation energy – The minimum amount of energy required for a reaction to occur.

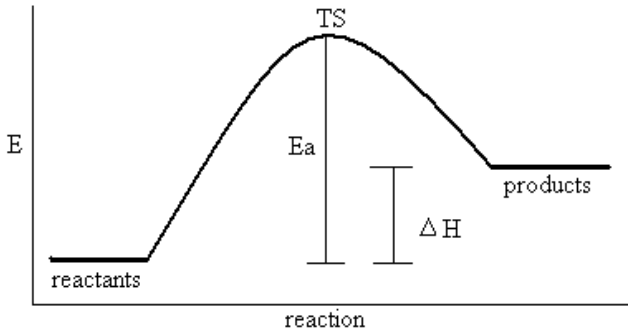
   b. transition state – The in between configuration where reactant bonds are ½ broken and product bonds ½ formed. This is a very high energy and unstable species that exists less than a millisecond and thus, cannot be isolated.

   c. Change in heat energy – change in heat energy = product's heat – reactant's heat

   d. Endothermic – a process or reaction that absorbs heat or energy from its surroundings increasing the energy of the system

   e. Exothermic – a process or reaction that releases heat or energy from the system to the surroundings decreasing the energy of the system

3. Draw an endothermic reaction profile. Label axes, reactants, products, energy of activation, transition state, ΔH, and state why it is endothermic.



4. State at least 3 factors affecting rate of reaction.
   a. Increase the concentration of the reactants.

   b. Increase the temperature.

   c. Add a catalyst.

5. Explain why the rate of reaction increases when the concentration of reactants in a solution increases.

   As the concentration of reactants increases, more collisions will occur increasing the probability of successful collisions with enough energy of activation for a reaction to begin.

6. Explain why the rate of reaction increases when the size of solid reactants is in powder form instead of in large lumps.

   The more surface area that is available for collisions to occur in the right orientation, the probability of successful collisions with enough energy of activation for a reaction to begin.

7. Explain how temperature affects the rate of reaction.

   As the molecules move faster, the number of collisions increase. The collisions also occur with more energy. This increases the probability of successful collisions with enough energy of activation for a reaction to begin.

8. Explain how a catalyst works. Use a potential energy diagram.
   A catalyst provides an alternate reaction pathway with lower E_a. The alternate pathway is formed by stabilizing the transition state by physically holding it together. This only affect the amount of energy needed to get the reaction to begin. The catalyst itself is unchanged in the reaction and can be used again.