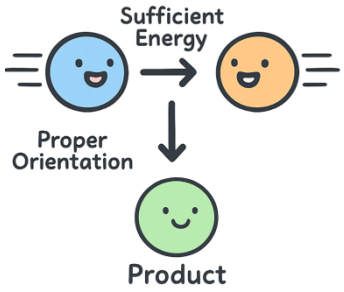
Kinetics and Equilibrium **Name**_____

Reaction Rates and the Collision Model

Read from **Lesson 1: Kinetics of Reactions** in the **Chemistry Tutorial Section, Chapter 14** of **The Physics Classroom**:
Part a: Reaction Rates Part b: Factors Affecting Reaction Rates
Part c: The Collision Model of Reactions

In chemistry, the rate of a reaction tells us how quickly reactants are converted into products. Knowing what affects reaction rates helps chemists control important reactions in industry and medicine. Some key factors that can speed up or slow down a reaction include temperature, concentration, surface area, and catalysts.
All of these factors connect back to the collision model. This model states that particles must collide with sufficient energy and proper orientation for a reaction to occur. The minimum amount of energy required for a successful collision is called the activation energy.



Questions

1. Is the rate at which reactants disappear always equal to the rate at which products appear?

2. As a reaction progresses, how does its instantaneous rate typically change – does it tend to increase or decrease? Explain your answer.

3. Ellie Ment adds an antacid tablet to a glass of water and notices that bubbles form more quickly when she uses warm water instead of cold water. Using the collision model, explain why using warmer water increases the rate of reaction.

4. Charlie Chandler observes a candle burning steadily in a room. When Charlie places a glass jar over the candle, the flame goes out after a few seconds. Using the collision model, explain what happens to the reaction rate as the jar is placed over the flame, and why the reaction eventually stops completely.

Kinetics and Equilibrium

5. In her lab's fume hood, Cathy Carbon conducts a reaction between sucrose and sulfuric acid. She notices that powdered sugar reacts with sulfuric acid much faster than a sugar cube does. Why does breaking a solid into smaller pieces increase its reaction rate, even though the total amount of sugar remains the same? (Consider the collision model.)

6. Analyze the energy diagrams and answer the following questions. Write **1**, **2**, **both**, or **none** in the space provided before each statement.

Diagram 1

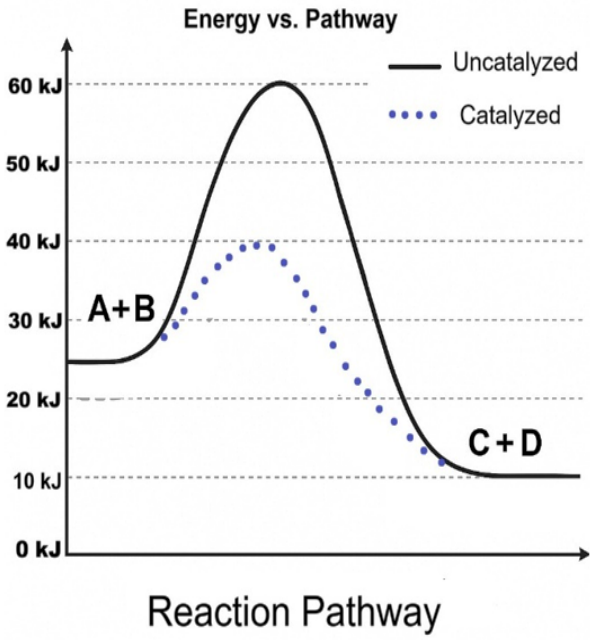
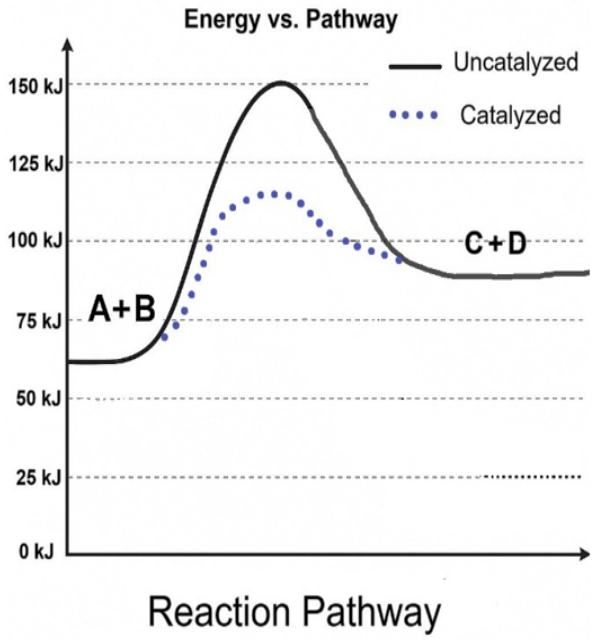


Diagram 2



_____ **a.** Which diagram represents an *endothermic reaction*?

_____ **b.** Which diagram represents an *exothermic reaction*?

_____ **c.** Which diagram shows a Δ*Energy* of 15 kJ?

_____ **d.** Which diagram displays an *activation energy* of 35 kJ?

_____ **e.** Which diagram shows the *greatest lowering of activation energy* due to a *catalyst*?

_____ **f.** Which diagram illustrates a reaction where the Δ*Energy* is changed by increasing the *surface area of the reactants*?

_____ **g.** Which diagram depicts a reaction in which the *catalyzed pathway has a higher activation energy* than the *uncatalyzed pathway*?

_____ **h.** Which diagram represents a reaction where the *activation energy is altered* by increasing the *concentration of the reactants*?