Energy and Rates of Chemical Reactions

Objectives

- **Compare** exothermic and endothermic reactions.
- **Explain** activation energy.
- **Interpret** an energy diagram.
- **Describe** five factors that affect the rate of a reaction.

I. Reactions and Energy

A. Exothermic Reactions A chemical reaction in which energy is released is called an exothermic reaction.

B. **Endothermic Reactions** A chemical reaction in which energy is taken in is called an endothermic reaction.

C. **The Law of Conservation of Energy** The law of conservation of energy states that energy cannot be created or destroyed.

Sodium and Chlorine Reaction

II. Rates of Reactions

A. Activation Energy Activation energy is the smallest amount of energy that molecules need to react.

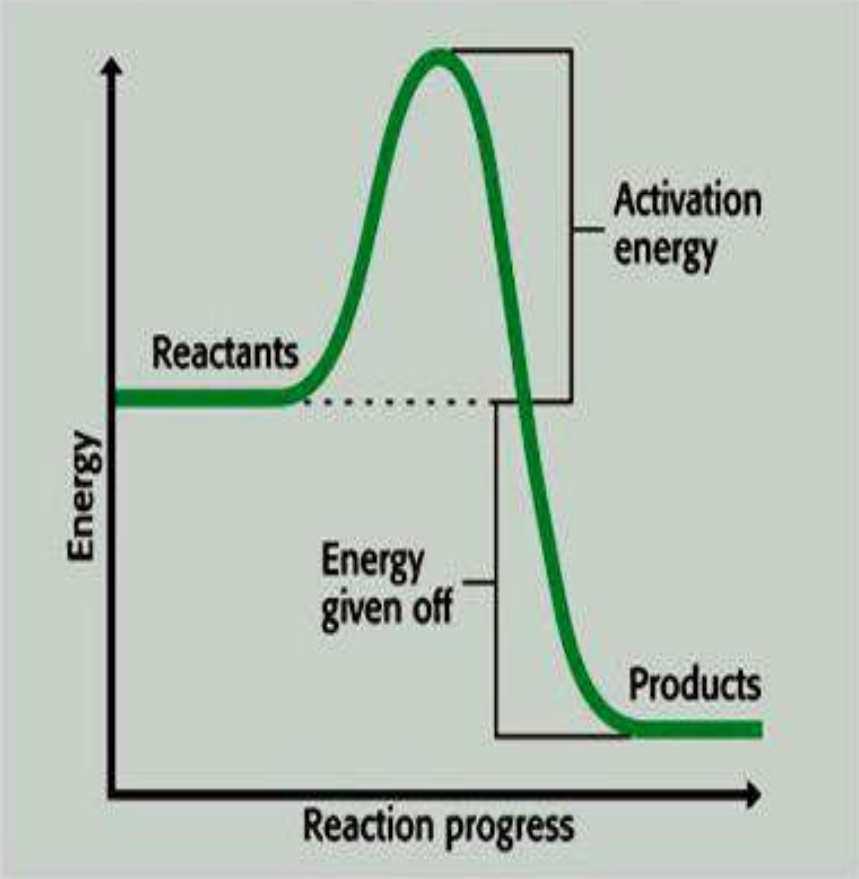
B. **Sources of Activation Energy** Friction is one source of activation energy. An electric spark in a car's engine is another source of activation energy. Light can also be a source of activation energy for a reaction.

Critical Thinking Time

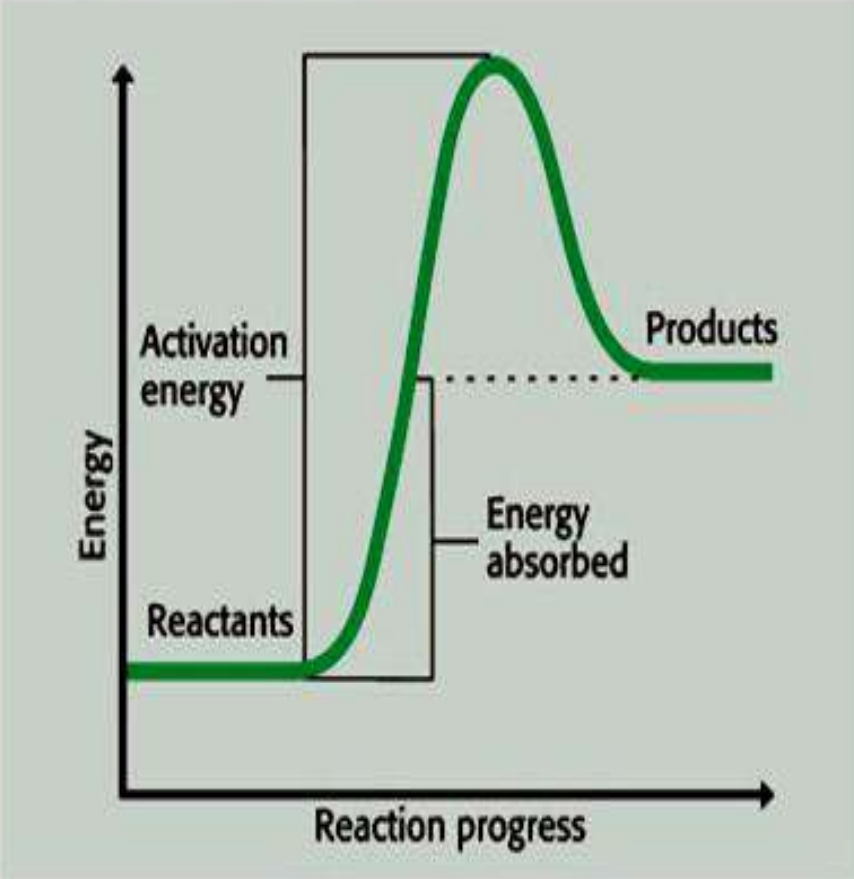
- Explain how a match lights up.
- Based on your knowledge of reactivity of elements, guess what element causes the match to light up.
- Matches that light from friction were invented in the 1820's by a British chemist named John Walker. Walker's matches were coated with phosphorus at one end. They caught fire when the phosphorus ignited because of thermal energy produced by the friction of rubbing a match on a rough surface. Many matches today are safety matches. They only light when rubbed against the striking surface of their package, because the phosphorus necessary for the reaction is on the surface, not in the match itself.

Energy Diagrams

Exothermic Reaction Once an exothermic reaction starts, it can continue. The energy given off as the product forms continues to supply the activation energy needed for the substances to react.



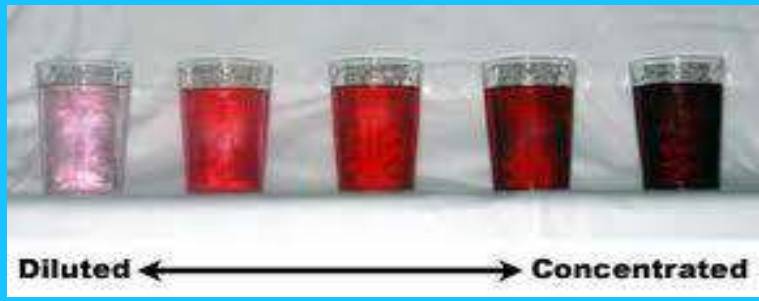
Endothermic Reaction An endothermic reaction continues to absorb energy. Energy must be used to provide the activation energy needed for the substances to react.



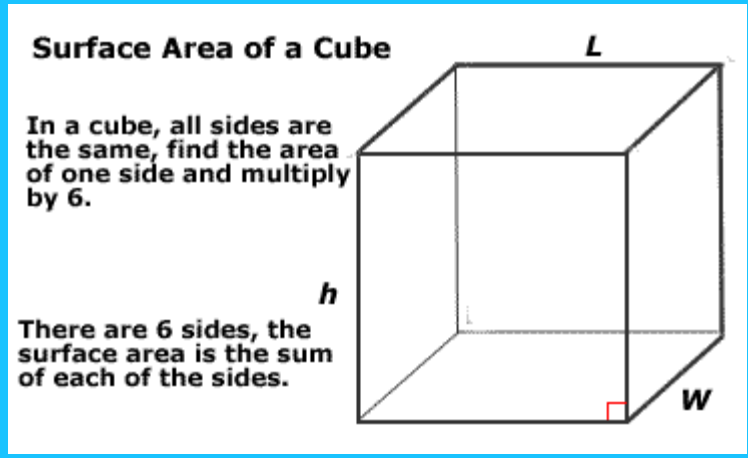
III. Factors Affecting Rates of Reaction

A. Temperature A higher temperature causes a faster rate of reaction.

B. Concentration In general, a high concentration of reactants causes a fast rate of a reaction. Concentration is a measure of the amount of one substance dissolved in another substance.

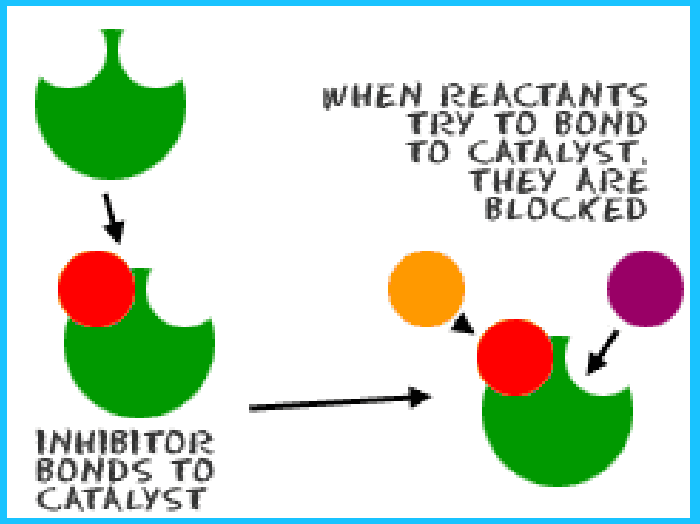


C. **Surface Area** Surface area is the amount of exposed surface of a substance. Increasing the surface area of solid reactants increases the rate of a reaction.

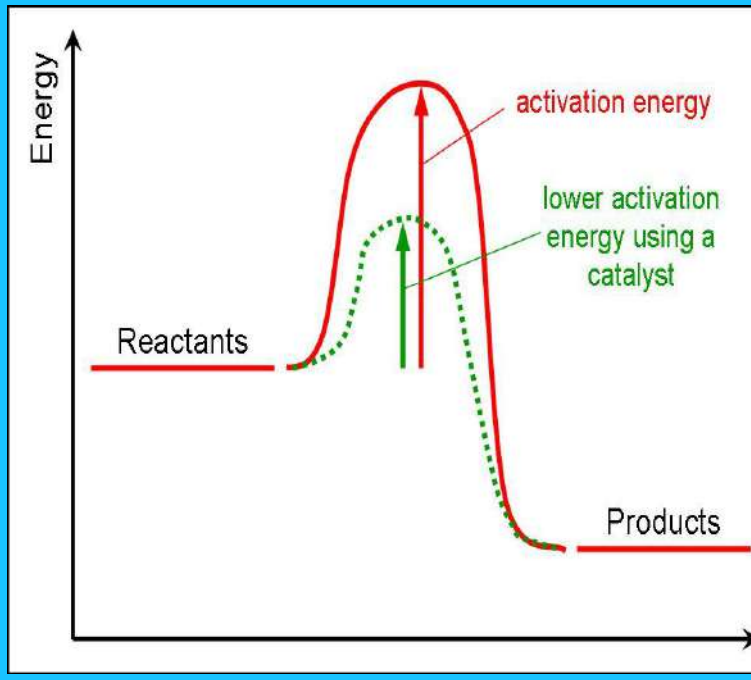


III. Factors Affecting Rates of Reaction

D. Inhibitors An inhibitor is a substance that slows down or stops a chemical reaction.



E. **Catalysts** Some chemical reactions would be too slow to be useful without a catalyst. A catalyst is a substance that speeds up a reaction without being permanently changed.



What did you learn today?

- Write a paragraph summarizing what we talked about today.
- You must write in complete sentences and use key terms from the section.
- You must also include drawings of the energy diagrams with an explanation for each one.