

Transition State Theory

During a chemical reaction, atoms are rearranged to form new substances by breaking old bonds and forming new bonds. Bond breaking takes energy, while bond making releases energy. Even exothermic reactions, such as burning wood, need energy to get started. One explanation for this is that old bonds must be broken before new bonds form. The energy needed to get the reaction started is called the **activation energy**. It comes from the collisions between the reacting particles. Measurements show, however, that the energy needed to break the bonds during a chemical reaction is greater than the activation energy. An alternate explanation is that instead of the energy from the collisions being used to break the bonds, it is used to form an unstable, high energy **activated complex**. The high energy activated complex is so unstable, it quickly falls apart to form the products. Because the activated complex lasts only a short time, it is also called a **transition state complex**. According to transition state theory, during a chemical reaction, intermediate products, known as the transition state complex, form that exist for only brief periods of time while the atoms rearrange themselves.



A typical reaction on the molecular playground.

Answer the questions below based on the reading above and on your knowledge of chemistry.

- Why is it necessary to supply energy in the form of a spark to ignite the gasoline in an automobile engine if gasoline releases energy when it burns? _____

- According to collision theory, where does the activation energy during a reaction come from? _____

- According to transition state theory, what is activation energy used for? _____

- What is an activated complex? _____
 - Why does it last only a short time? _____
 - Why is it unstable? _____
 - What forms from the activated complex? _____
 - How does the potential energy of the activated complex compare to that of the reactant or the product? _____

 - What evidence is there that an activated complex forms during a reaction? _____

