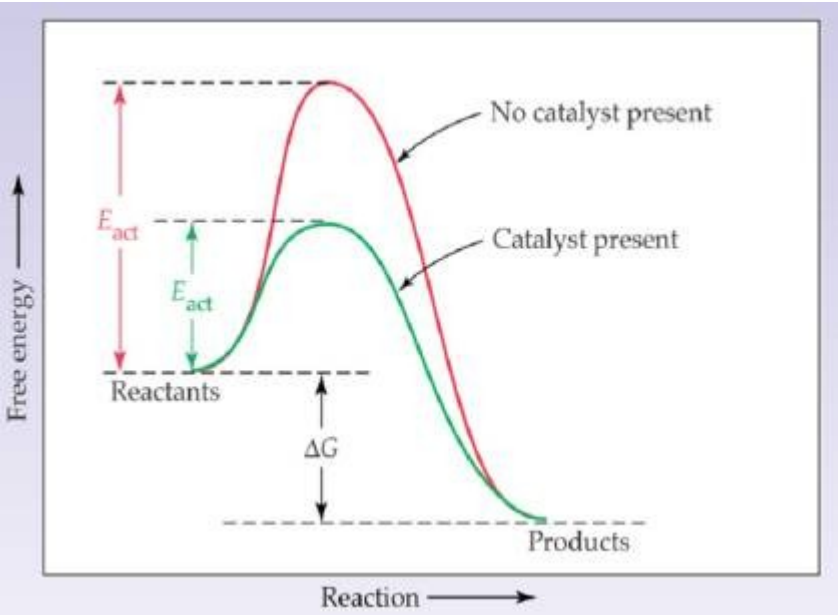

Chemistry
Notes: Chapter 19

Collision Theory: Atoms, ions, and molecules can react to form products when they collide provided that the particles have enough kinetic energy.

Activation energy is the minimum amount of energy that particles must have in order to react

Activation complex is the arrangement of atoms at the peak of the activation energy barrier.
It is sometimes called the **transition state** because it is as likely to re-form reactants as it is to form products.

Factors Affecting Reaction Rates:

Temperature: Usually, an increase in temperature causes an increase in the speed of a reaction, while a decrease in temperature corresponds to a decrease in the reaction speed. This occurs because the increased temperature causes more particles to collide, making it easier to achieve the activation energy required for a reaction.

Concentration: As concentration increases, so does the reaction rate. The reason for this is similar to the reason that temperature increases reaction rates. The increased number of particles means an increase in the number of particle collisions, so it is easier to cause particles to reach the activation energy required for a reaction.

Particle Size: As particle size decreases, the reaction rate increases. Because smaller particles have a larger surface area, it allows more particles to collide in the same space. Since the smaller particles collide more often than larger ones, the smaller particles will react faster.

Catalysts: A **catalyst** is a substance that increases the rate of a reaction without being used up itself during the reaction. Catalysts do not cause reactions to physically occur at a faster rate; instead, they lower the activation energy required for a reaction, so more reactants can form products in a given time period. An **inhibitor** is a substance that interferes with the action of a catalyst. Some inhibitors react with catalysts to reduce the number of active catalysts, which slows the reaction rate. (See illustration above for action of catalyst)

Reversible Reactions and Chemical Equilibrium:

Not all reactions completely form products as written. In a **reversible reaction**, the reactions occur simultaneously in both directions. The reaction that is read from left to right is called the forward reaction. The reaction that is read from right to left is called the reverse reaction. Eventually, the forward reaction will slow down and the reverse reaction will

speed up. Once the reactions occur at the same rate, the reaction has reached the state of **chemical equilibrium**.

However, the concentrations of the reactants are not necessarily the same; often, they are completely different. The **equilibrium position** is given by the relative concentration of the system's components at equilibrium.

Le Chatlier's Principle:

Equilibrium Constants:

In a reaction such as this, where *a* is the number of moles of reactant *A*, *b* is the number of moles of reactant *B*, and *c* and *d* are the numbers of moles of the products *C* and *D*:

$$aA + bB \leftrightarrows cC + dD$$

Equilibrium Constant (K_{eq}) is the ratio of product concentrations to reactant concentrations at equilibrium, with each concentration raised to a power equal to the number of moles of that substance in the balanced chemical equation. Equilibrium constants provide valuable chemical information. They can show whether products or reactants are favored at equilibrium.

$\mathbf{K_{eq} > 1}$, the products are favored at equilibrium.
$\mathbf{K_{eq} < 1}$, the reactants are favored.

Free Energy and Entropy:

Free energy: the energy in a system that is available to do work. That does not mean that free energy is available to perform work efficiently. A large percentage is lost as friction and heat.

Another complication is that energy can only be obtained from a reaction if it actually takes place. Although a balanced equation can be written for a reaction, it does not mean the reaction will occur.

spontaneous reaction: a reaction that occurs naturally and favor the formation of products at the specified conditions.

nonspontaneous reaction:. a reaction that does not occur naturally, do not favor the formation of products, and do not produce large numbers of products.

Entropy: the amount of disorder in a system.

Law of disorder: Processes move in the direction of maximum disorder or randomness.