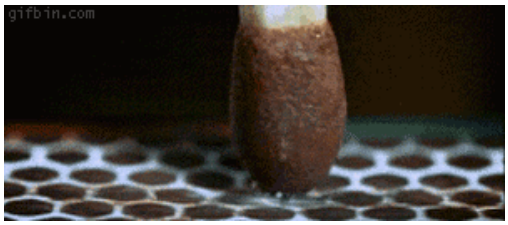
Rates of Reaction

Collision Theory

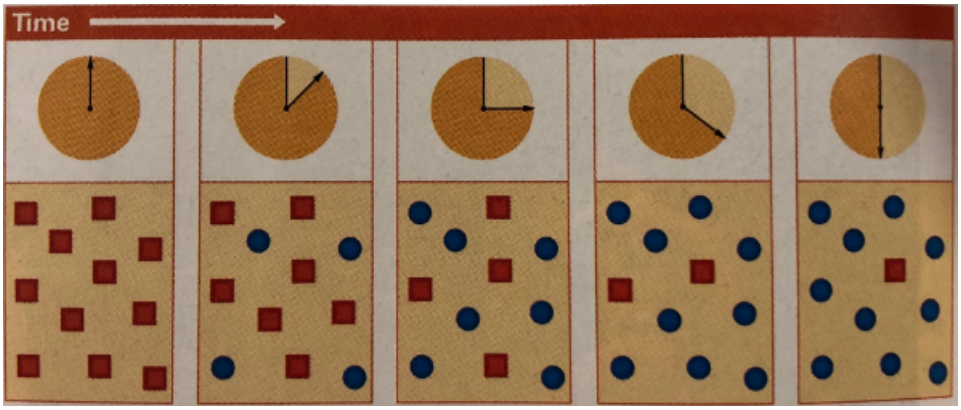
When a match is struck, it ignites instantly and burns quickly.



Other reactions, such as the decomposition of food, occur more slowly.

We can measure the *rate* at which reactions occur.

In chemistry, the rate of chemical change or the reaction rate is usually expressed as the amount of reactant changing per unit time.



According to collision theory, atoms, ions, and molecules can react to form products when they collide with one another; provided the colliding particles have enough kinetic energy.

Similarly, if enough energy is given to molecules, the bonds holding the molecule together can break apart.

The minimum energy that colliding particles must have in order to react is called the **activation energy**.

See the graph on page 543 and answer the three 'interpreting graphs' questions.

The **activated complex (transition state)** is an unstable arrangement of atoms that forms momentarily at the peak of the energy barrier. This only lasts for about 10^{-13} sec.

It ends either with the reformation of the reactants or the formation of products.

Factors Affecting Reaction Rates

Every chemical reaction proceeds at its own rate.

The rate of a chemical reaction depends upon temperature, concentration, particle size, and the use of a catalyst.

Temperature - Usually, increasing the temperature speeds up the reaction. It causes products to form faster by allowing more particles to cross the activation-energy barrier.

Concentration - The number of particles in a given space affects the rate at which the reaction occurs. It increases the likelihood of collisions leading to a higher reaction rate.

Particle Size - The total surface area affects the reaction rate. Smaller particles will have greater total surface area available for collisions.

Another way to increase the surface area of a solid is to dissolve them.

Catalysts - A substance that increases the rate of the reaction without being part of the overall process.

They allow reactions to proceed along a lower energy path.

See graph on page 547. Answer the 'interpreting graphs' section

Answer questions 1-5 on page 547