ENZYMES

A **CATALYST** is a substance that speeds up a chemical reaction by reducing the amount of **ACTIVATION ENERGY** needed to start that reaction. **ENZYMES** are the biological molecules (proteins or RNA) that act as catalysts in a living organism.

The seemingly simple act of breaking down food molecules to release energy is actually a series of dozens of chemical reactions. Without enzymes to speed up these reactions, energy would not be released fast enough to support all but the smallest organisms. Enzymes are not changed during the chemical reactions that they expedite – so they can be reused over and over again.

"LOCK AND KEY" MODEL OF ENZYME ACTION

When you go home at night and the door is locked, can it open itself? Nope. You need a key that is just the right shape to fit in that lock. Otherwise you're stuck in the cold. Enzymes work in a similar way. Enzymes complete very specific jobs and do nothing else. They are very specific locks and the compounds they work with are the special keys.

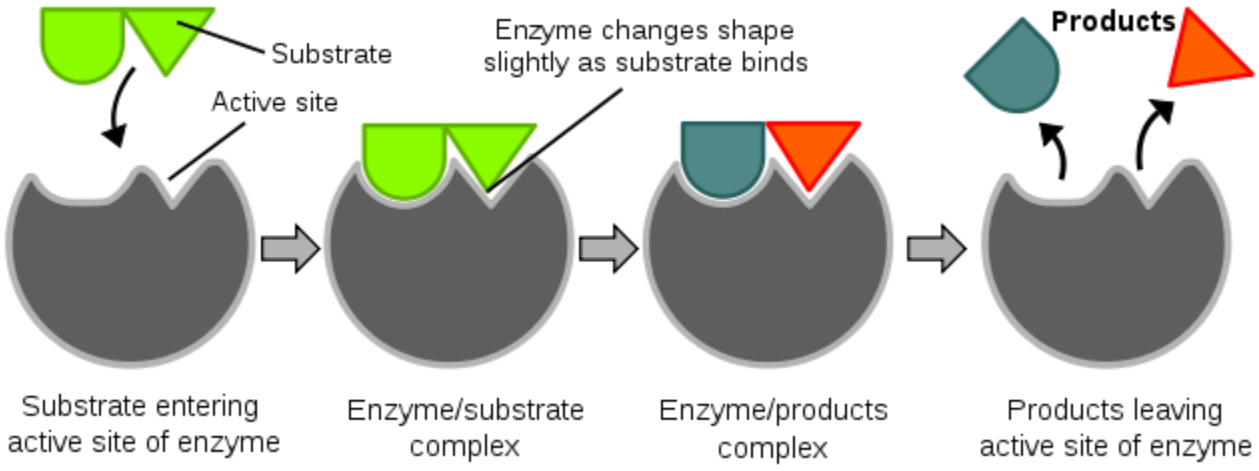
There are four steps in the process of an enzyme working.

(1) An enzyme and a **SUBSTRATE** are in the same area. The substrate is the biological molecule that the enzyme will work on.

(2) The enzyme grabs onto the substrate with a special area called the **ACTIVE SITE**. The active site is a specially shaped area of the enzyme that fits around the substrate. The active site is the keyhole of the lock.

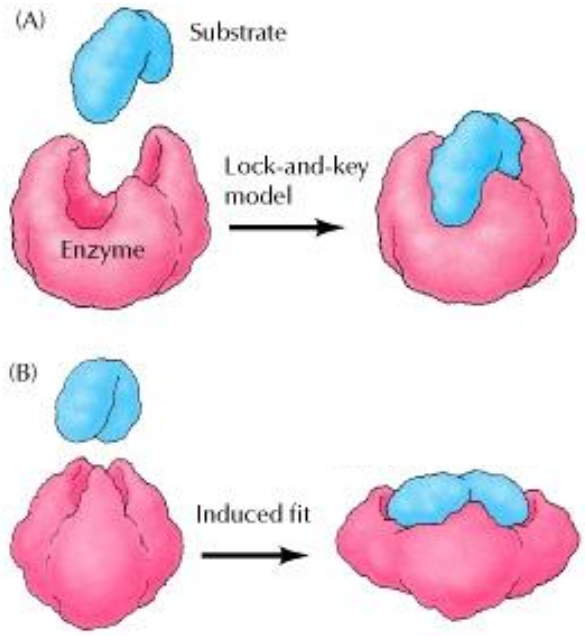
(3) A process called **CATALYSIS** happens. Catalysis is when the substrate is changed. It could be broken down or combined with another molecule to make something new.

(4) The enzyme lets go. Big idea - When the enzyme lets go, it returns to normal, ready to do another reaction. The substrate is no longer the same. The substrate is now called the **PRODUCT**.



INDUCED FIT MODEL OF ENZYME ACTION

The induced fit model of enzyme action expands on the lock and key model by showing that the shape of the enzyme changes when the substrate attaches to the active site. The change in the shape of the enzyme causes some of the bonds in the substrate to weaken – lessening the activation energy needed to break the bonds and start the reaction. As with the lock and key method, the enzyme returns to its original shape after releasing the products and can be used again.



ENZYMES AND THEIR ENVIRONMENT

An enzyme may not work if it's environment is changed. Both models of enzyme action depend on an exact fit between the active site of an enzyme and the substrate to which it binds. If anything were to block the active site or change the shape of the protein (enzyme), it could prevent the enzyme from working properly

(1) TEMPERATURE:
Proteins (including enzymes) change shape as temperatures change. Just think of what happens to an egg (mostly protein) as you cook it or your hair (protein) when you use a curling iron. Because so much of an enzyme's activity is based on its shape, temperature changes can mess up the process and the enzyme won't work.

(2) pH LEVELS:
In the same way that temperature can change the shape of proteins, the acidity of the environment does the same thing. Remember that the pH is a measure of how acidic or basic something is.

(3) INHIBITORS:
Inhibitor are molecules that either slow down or stop the activity of an enzyme. They often bond to the enzyme – causing the shape to change. Remember - When the shape changes, the enzyme will not work the same way. Examples of inhibitors include snake venom and nerve gas from World War I.

1. What do catalysts do?
    a. They speed up chemical reactions by destroying atoms.
    b. They slow down chemical reactions by creating atoms.
    c. They speed up chemical reactions by reducing the amount of activation energy needed to start the reaction.
    d. They heat up the products of a reaction making them move faster.

2. What is an enzyme?
    a. A biological molecule that acts as a catalyst in a living organism.
    b. An organelle in animal cells only.
    c. The energy required to start a chemical reaction.
    d. A sugar molecule that is broken down by a chemical reaction.

3. Why do enzymes generally bind to only one type of substrate?
    a. They only like to eat one type of substrate.
    b. The shape of the enzyme only allows certain types of substrates to bind.
    c. Enzymes can only operate at night when certain types of substrates are around.
    d. Enzymes take a long time to work, so they specialize in working with only one type of substrate.

4. How are the “lock and key” and “induced fit” models of enzyme/substrate complexes similar?
    a. Both models show an enzyme that returns to its original shape after releasing products and it can be used again.
    b. Both models show an enzyme that can change shape after a chemical reaction.
    c. Both models show an enzyme that destroys compounds during a chemical reaction.
    d. Both models show a substrate that turns into water after a chemical reaction.

5. How are the “lock and key” and “induced fit” models of enzyme/substrate complexes different?
    a. A “lock and key” model shows an enzyme that changes shape to better fit the substrate.
    b. An “induced fit” model shows an enzyme that changes shape when a substrate binds to its active site.
    c. A “lock and key” model shows a substrate that changes shape after it leaves the enzyme.
    d. An “induced fit” model shows a substrate that becomes positive after the chemical reaction.

6. How does temperature inhibit enzyme activity?
    a. An increase in temperature will result in the enzyme growing to twice its normal size.
    b. A decrease in temperature will result in the enzyme closing up and becoming cold.
    c. Temperature changes can result in the active site becoming positively charged and repelling the substrates away.
    d. Temperature changes can alter the shape of an enzyme and without the proper shape, the enzyme won’t work.