

## 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.

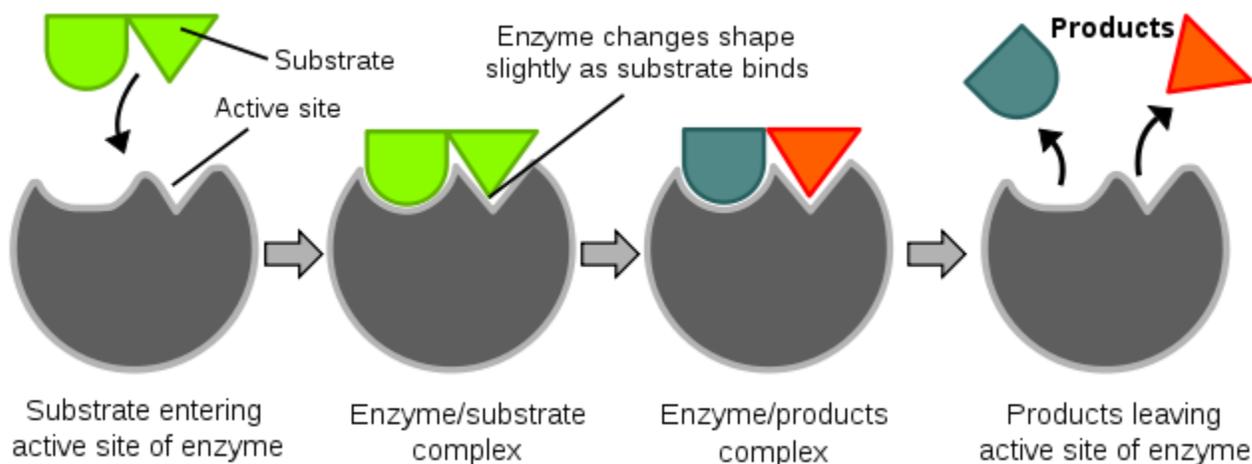
The seemingly simple act of breaking down food molecules to release energy is actually a series of dozens of chemical reactions. Without enzymes to speed up these reactions, energy would not be released fast enough to support all but the smallest organisms. Enzymes are not changed during the chemical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

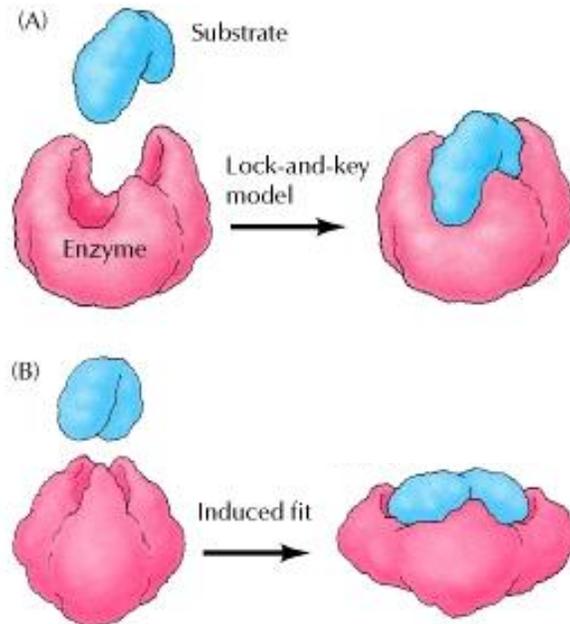
There are four steps in the process of an enzyme working.

- (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 its 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:

Inhibitors 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.

## Enzyme Worksheet

After reading the information on enzymes answer the following questions:

1. What does a catalyst do? \_\_\_\_\_

\_\_\_\_\_

2. What is an enzyme? \_\_\_\_\_

\_\_\_\_\_

3. Why do enzymes generally bind to only one type of substrate? \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

4. How are the "lock and key" and "induced fit" models similar? \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

5. How are the "lock and key" and "induced fit" models different? \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

6. What are 3 things that can affect the way enzymes work? Explain how each thing would affect an enzyme.

a. \_\_\_\_\_

\_\_\_\_\_

b. \_\_\_\_\_

\_\_\_\_\_

c. \_\_\_\_\_

\_\_\_\_\_