

# Enzymes 101 *by Mrs. B.*

## What is an enzyme?

- Simple definition = organic catalyst
- More complex definition = an organic substance (usually a globular protein) that lowers the activation energy needed for a reaction to occur
- **Substrate** = the substance that the enzyme acts upon.

## Enzyme Structure

- An enzyme's *3 dimensional structure* is critical to its function. The "lock and key" analogy is often used; a substrate fits an enzyme like a key fits a lock. The *Induced Fit Model* is more informative as it states that when an enzyme binds to its appropriate substrate, certain changes in the active site occur. This modification of the active site is referred to as an induced fit. Induced fit helps the enzyme convert substrate into product.
- The site on the enzyme that "fits" the substrate is called the **active site**.

## Basic Information

- An enzyme has only one function; it catalyzes only one reaction or one specific type of reaction. There are thousands of enzymes in living things, each doing only one thing.
- Enzymes are not used up in the reaction.
- Enzymes work on a variety of reactions; synthesis, lysis, energy transfers, etc.
- Enzymes do not change the equilibrium state of the reaction; they just *speed up the time to equilibrium*.
- Enzymes cannot cause a reaction to occur that does not otherwise occur.
- The suffix **-ase** is often used in enzyme names. (EX: maltase, catalase, reverse transcriptase, etc.)

## Factors affecting the rate of enzyme-catalyzed reactions

- Enzyme concentration
- Substrate concentration
- Product concentration
- pH
- Temperature: Too high → Denaturation. Too low → Induced fit is difficult and less K.E. leads to fewer collisions between enzyme and substrate.
- Concentration of salts
- Presence of cofactors (inorganic) and coenzymes (organic)
- Presence (or absence) of enzyme inhibitors

## Enzyme Inhibition

- Enzyme inhibitors are substances that inactivate the enzyme by changing the shape of the enzyme molecule or blocking the active site.
- **Competitive inhibitors** block the active site (they "compete" with the substrate). These competitive inhibitors resemble the shape of the substrate and fit into the active site.
- **Noncompetitive inhibitors** change the shape of the enzyme by binding to the molecule at a site *other than* the active site.
- Many poisons are enzyme inhibitors (e.g. pesticides, antibiotics, cyanide, etc.)