

## Enzymes

We've been talking about various biological molecules and that they are needed for reactions in the body (DNA, Protein synthesis, Cellular respiration etc.) and how molecules can change. You should know that it doesn't happen on its own. If you leave a blob of protein in a petri dish will it just break down to the amino acids? No. What will break down proteins? Enzymes! Enzymes are the biological substance (proteins) that act as **CATALYSTS** and help complex reactions occur everywhere in life.

A catalyst is a substance that increases the rate of a chemical reaction by reducing the amount of energy needed to start that reaction. This is called lowering the activation energy. **ACTIVATION ENERGY** can be thought of as a hill that must be gotten over. When a catalyst acts, it lowers the energy required to get over the HILL and the reaction can proceed. An enzyme is an organic catalyst meaning that it is a protein that catalyzes reactions in living organisms. Most reactions in the body require enzymes

### LOCKS AND KEYS

A door that is locked needs 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.

Here's the deal... 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** or products

### ENZYME CONTROLS

Enzymes sometimes need to be controlled when done with their function. Other times they are controlled because of poisons. **DENATURING** occurs when the control changes the enzymes shape

#### (1) TEMPERATURE:

Proteins change shape (denature) as temperatures change. 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) ACTIVATORS:

Sometimes you need an enzyme to work faster and your body creates an activator. Other times you might eat something that acts as an activator. Activators make enzymes work harder and faster. Activators can help the enzyme bind to the substrate

#### (3) pH LEVELS:

In the same way that temperature can change the shape of proteins, the pH of the environment does the same thing. The proteins denature if too acid or too basic

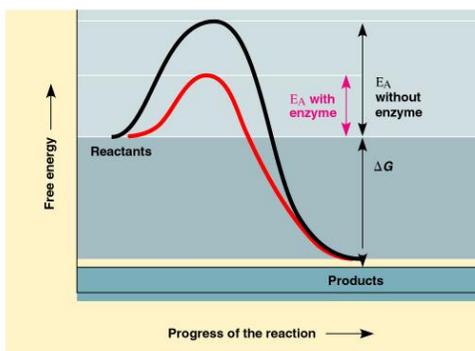
#### (4) INHIBITORS:

Inhibitors either slow down or stop the activity of an enzyme. An inhibitor can be a **COMPETITIVE INHIBITOR** and block the active site or it can be an **ALLOSTERIC INHIBITOR** and bond to another spot causing the shape to change Remember - When the shape changes, the enzyme will not work the same way. A nasty example of an inhibitor is snake venom or cyanide.

## Enzyme Worksheet

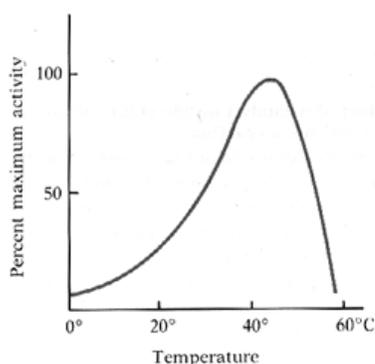
- 1) What is an enzyme? –
- 2) What is a catalyst? –
- 3) What is a substrate –
- 4) What is the active site? –
- 5) What is the product? –
- 6) What is denaturing -

Graph 1

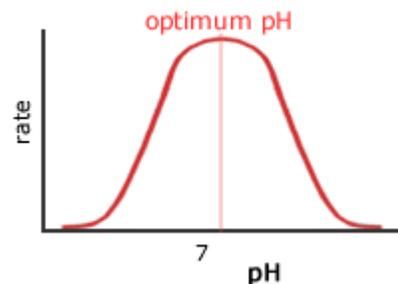


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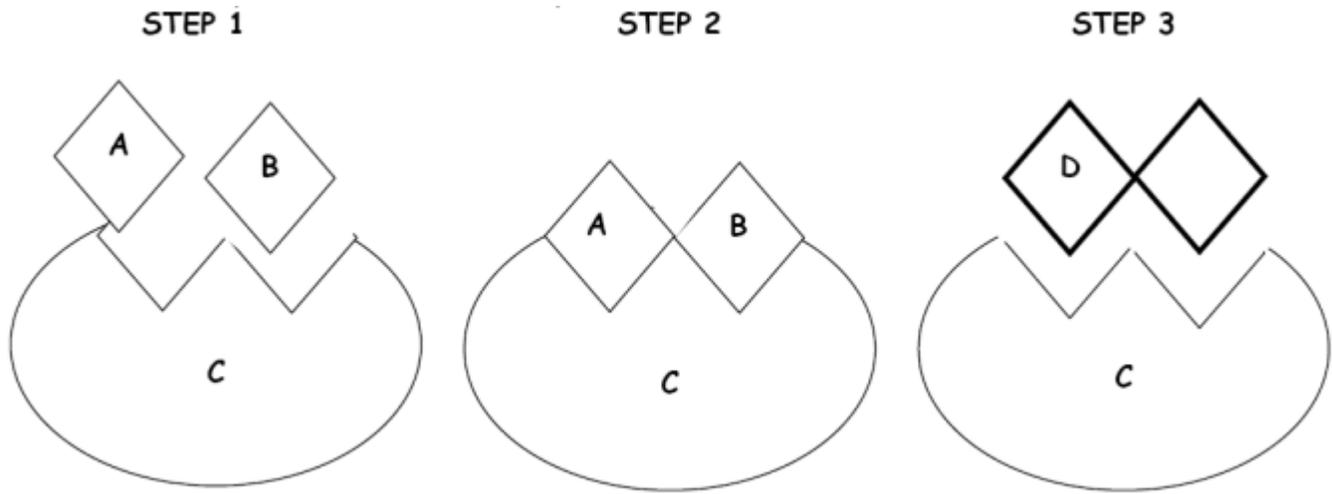
Graph 2



Graph 3



- 7) Using graph 1, Explain how enzymes work. Include the term activation energy and compare the two curves, explaining which is with the enzyme.
  
- 8) Using graph 2, explain how temperature affects enzyme activity. Use the word denature.
  
- 9) Using graph 3 – explain how pH affects enzyme activity. Relate to temperature effects.



**Step 1**

1. Molecule C is a large protein (or several proteins together) that we call an \_\_\_\_\_.
2. Molecules A and B are called substrate, and are usually \_\_\_\_\_ or building blocks of larger macromolecules.
3. Which of the four major biological macromolecules is C made of?

**Step 2**

4. Molecules A and B are now bound to molecule C's \_\_\_\_\_.
5. When C is bound to A and B, it is an \_\_\_\_\_.
6. Is molecule C breaking apart (decomposing) or building (synthesizing) a macromolecule?
7. If a solution is too acidic or basic, molecule C can \_\_\_\_\_ or change its shape so that A and B will no longer fit.

**Step 3**

8. What will happen to molecule C now that the reaction is complete?
9. What are three things that affect how fast molecule C works?

Molecule D is made of building blocks represented by A and B. If D represents a polysaccharide, A and B would represent \_\_\_\_\_.