

**Standard:** Students will analyze the nature of the relationships between **structures and functions** in living cells.

**Element:** Explain how enzymes function as catalysts.

**EQ:** How do enzymes function as catalysts?

## Enzymes:

a molecule (protein) that speeds up chemical reactions

A **catalyst** is a substance that increases the rate of a chemical reaction.

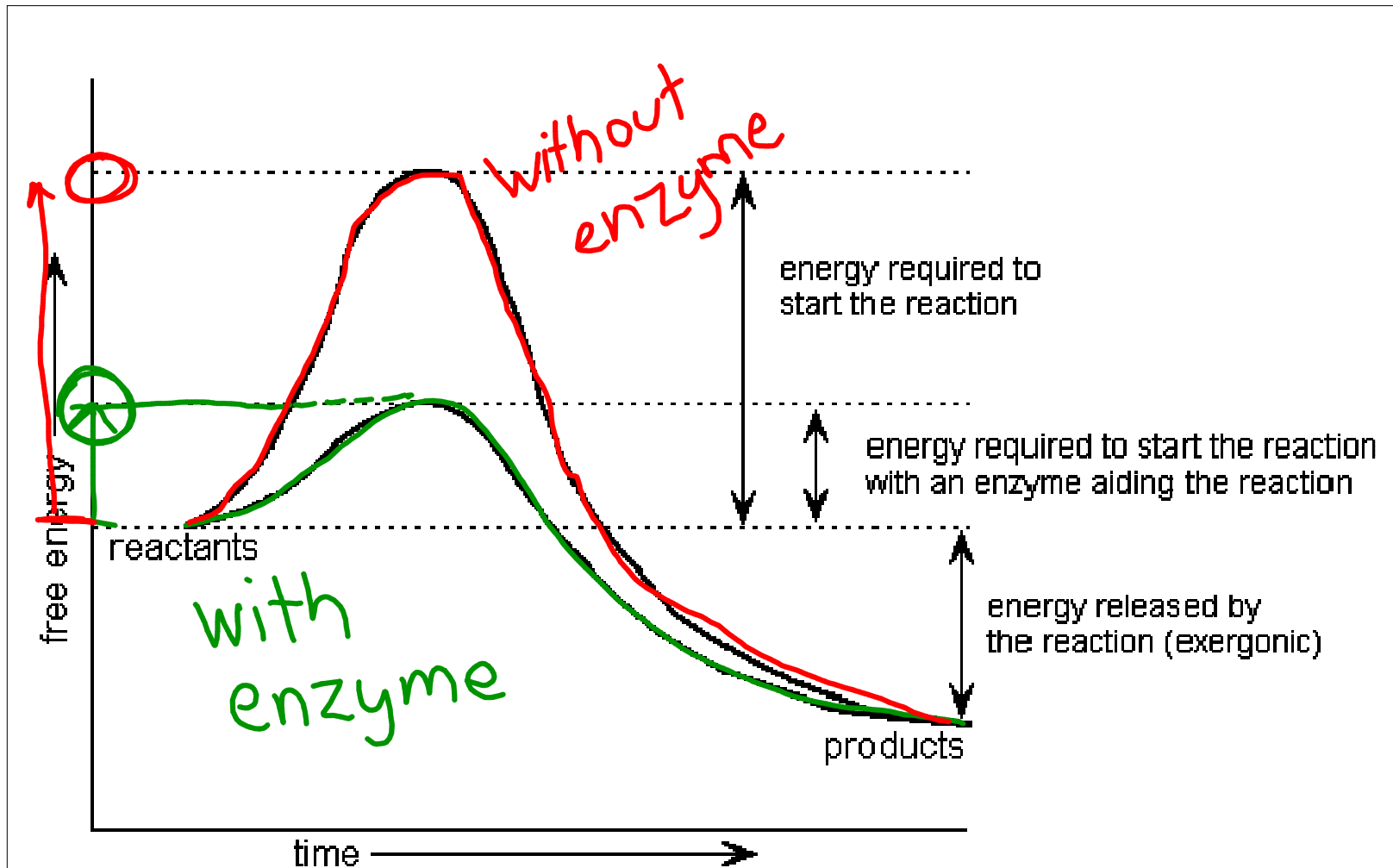
Enzymes are proteins that increase the speed of biochemical reactions by lowering the **activation energy** of a chemical reaction.

Activation energy is the minimum amount of energy required to start a chemical reaction.

Bottom Line:

**ENZYMES MAKE CHEMICAL  
REACTIONS HAPPEN FASTER.**

They do this by **lowering activation  
energy.**



Activation Energy Profile of a Reaction Aided by an Enzyme

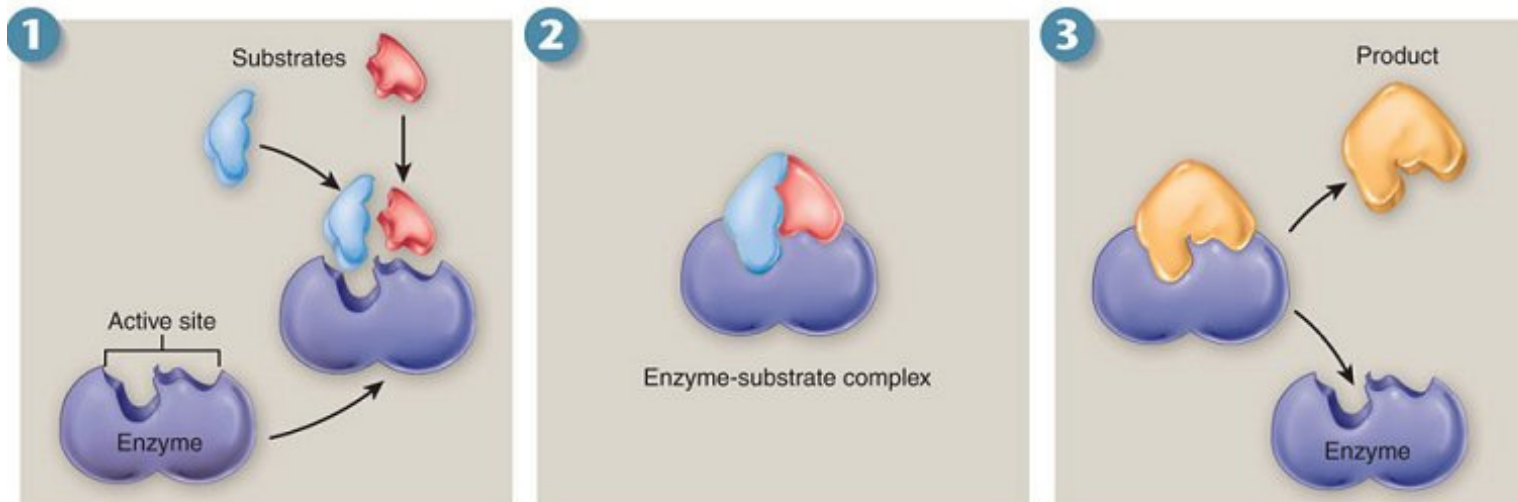
By assisting in various chemical reactions, enzymes help organisms maintain **homeostasis**.

A **substrate** is a substance that is changed by an enzyme during a chemical reaction.

A **product** is the new substance that is formed.  
Enzymes fit with substrates like a lock fits a key.

Each enzyme has an **active site**, which is the region where the reaction takes place.

Each enzyme acts on a specific substrate.

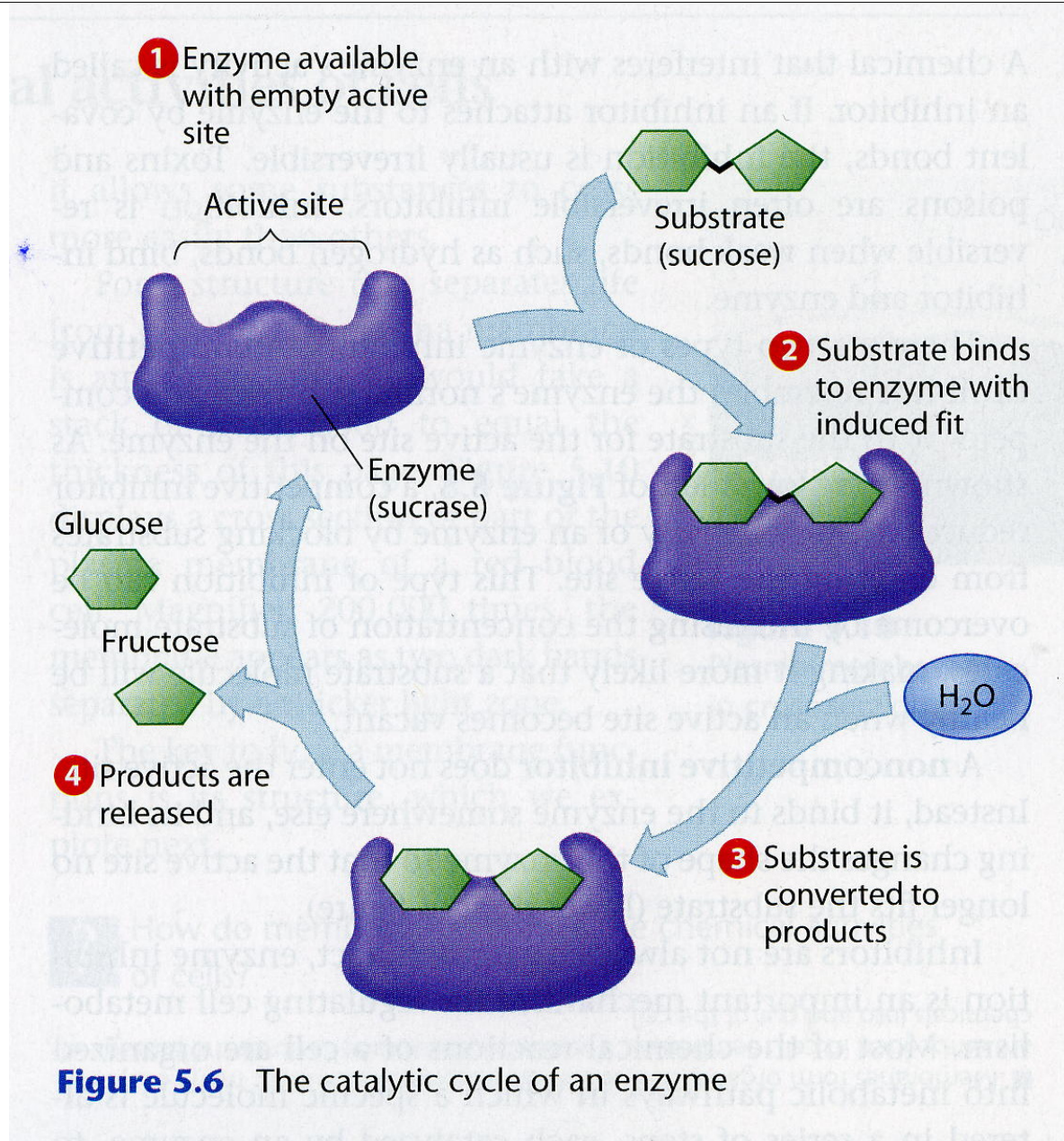


Enzymes have a complex three-dimensional surface to which particular reactants (called substrates of that enzyme) fit, like a hand in a glove.

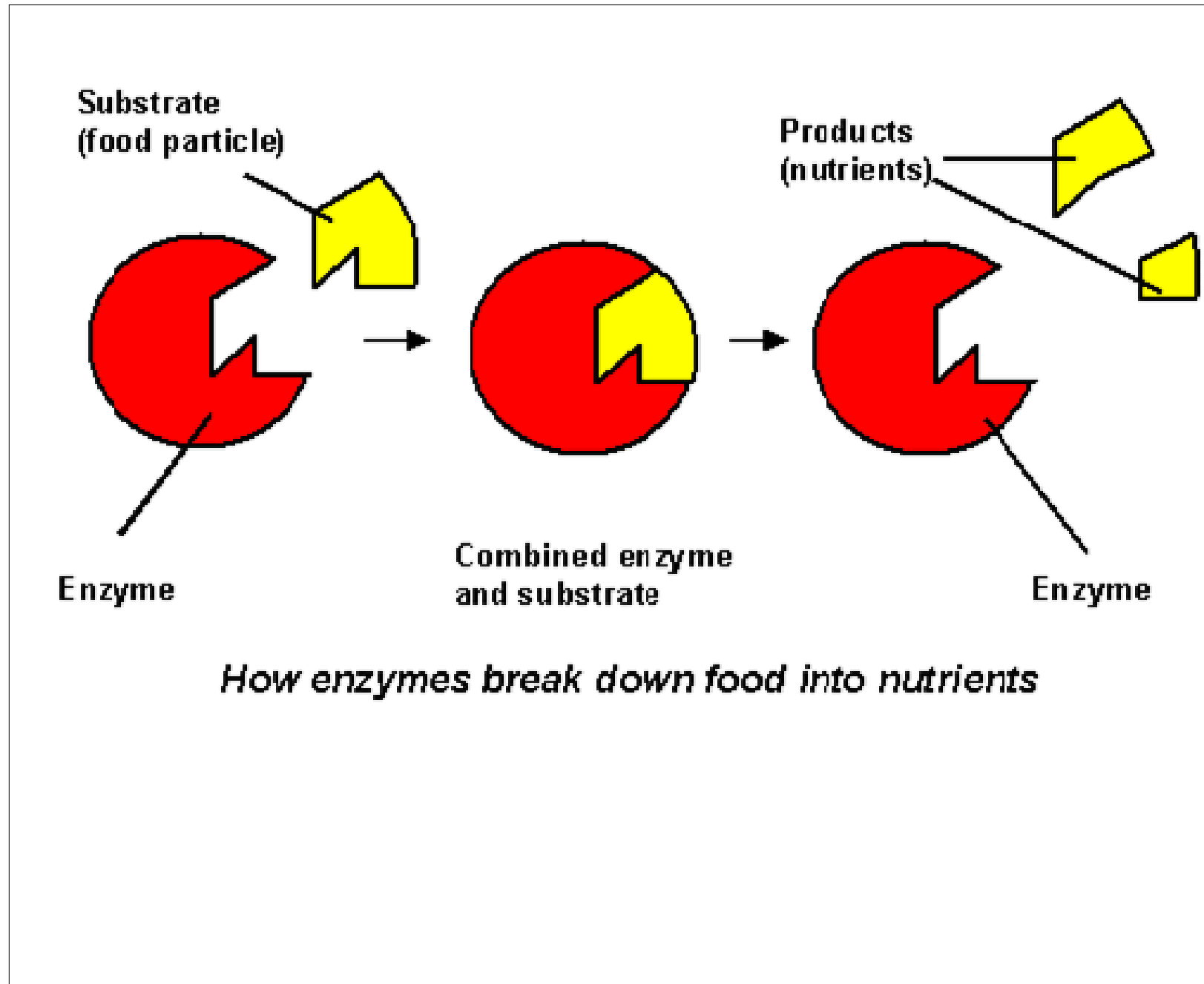
An enzyme and its substrate(s) bind tightly together, forming an enzyme-substrate complex. The binding brings key atoms near each other and stresses key covalent bonds.

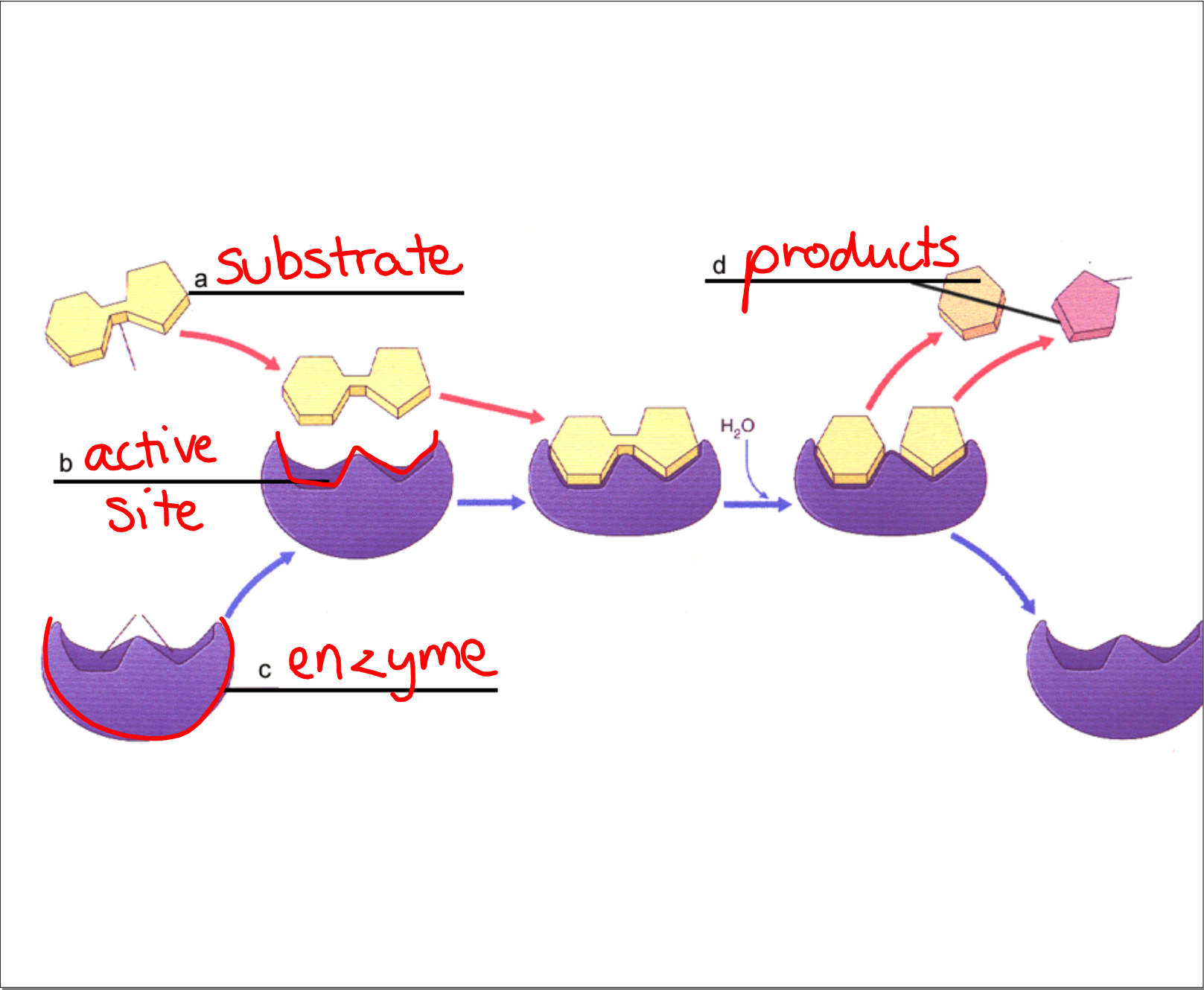
As a result, a chemical reaction occurs within the active site, forming the product. The product then diffuses away, freeing the enzyme to work again.





**Figure 5.6** The catalytic cycle of an enzyme





Changes in temperature and pH can change an enzyme's shape.

If an enzyme changes shape, it won't work well.

This is called **denaturation**.

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