

Key Teaching Points for the Enzymes in Action Kit®

Overall Student Learning Objective: How Do Specialized Proteins (Enzymes) Catalyze Reactions?

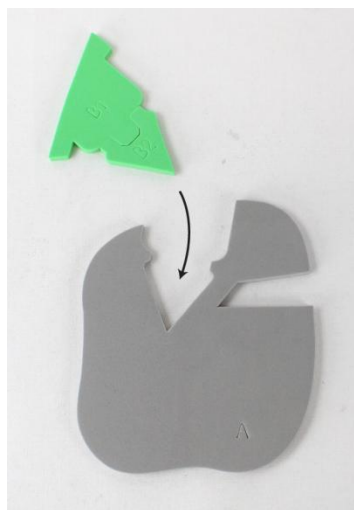
- Enzymes are specialized proteins.
- Enzymes can catalyze anabolic or catabolic reactions without being consumed in the reaction.
- Enzymes exhibit specificity in that they cannot bind to substrates whose conformation is not compatible with the active site of the enzyme.
- Inhibitors regulate enzymatic activity.

★ For a more complete lesson guide, please visit:
http://www.3dmoleculardesigns.com/3DMD-Files/Enzyme-in-Action/PDFs/EnzymeTeachersKey_forWeb1.pdf

Enzyme Action – Modeling Catabolism

Catabolism is the metabolic process where substances are broken down from complex molecules into simpler molecules. The part of the enzyme that binds the substrate to be acted upon is referred to as the **active site**.

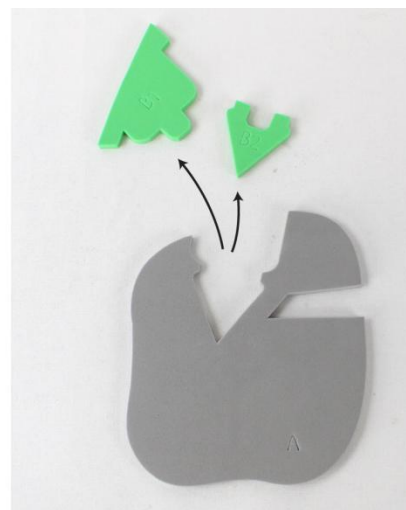
1. Identify the enzyme, substrate, active site and products in the model.



Step 1



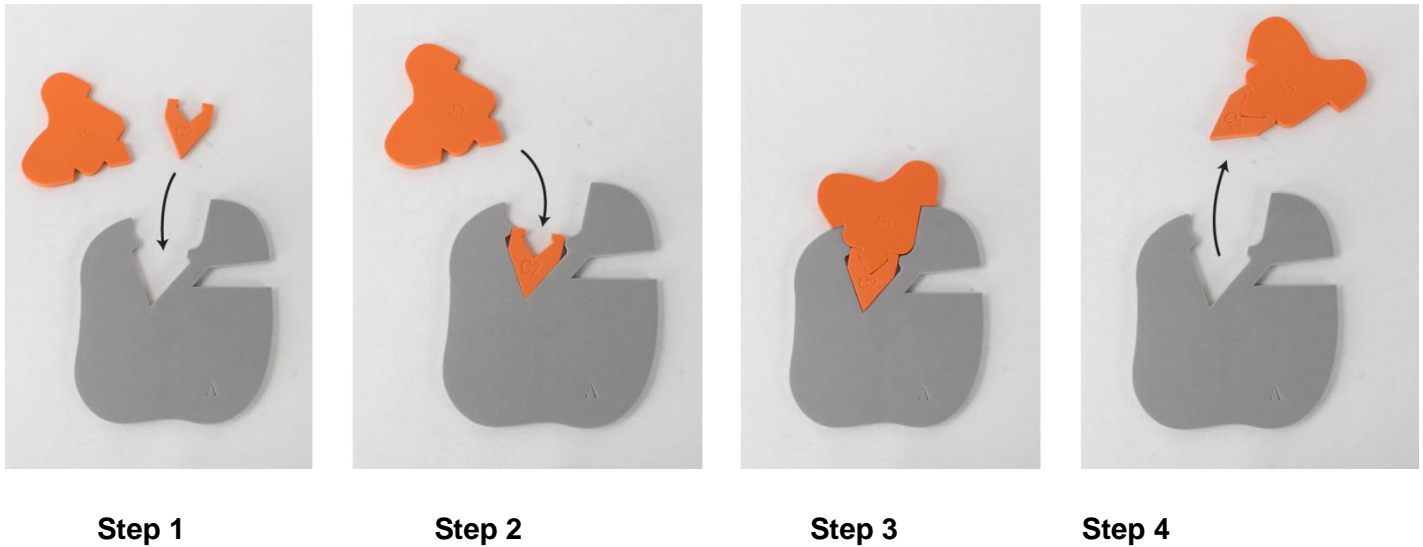
Step 2



Step 3

Enzyme Action – Modeling Anabolism

Enzymes may also bring substrates together to form a final product. This metabolic process is called **anabolism** (the building of complex molecules from simpler molecules).



2. How does anabolism differ from catabolism?

Enzyme Specificity

Reactions catalyzed by enzymes are very specific. Most enzymes are proteins with unique three-dimensional configurations based on their amino acid sequence. The specificity of an enzyme can be attributed to the compatibility between the shape of the enzyme's active site and the shape of the substrate.

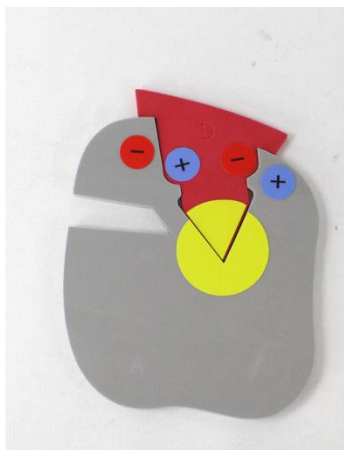


Figure 1: Enzyme-substrate complex

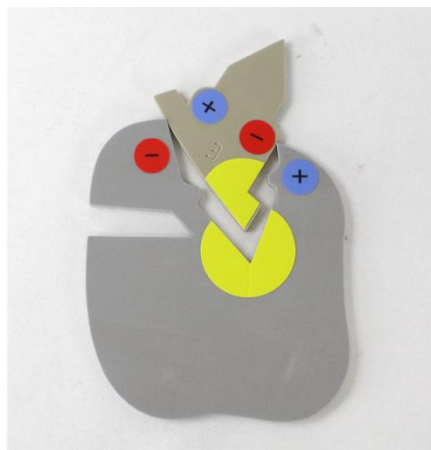


Figure 2: The charges align between the enzyme and the substrate; however, the enzyme's shape will not "fit".

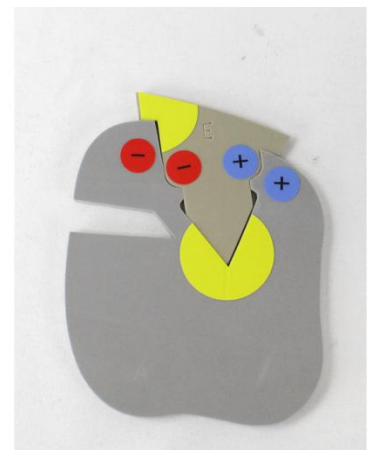
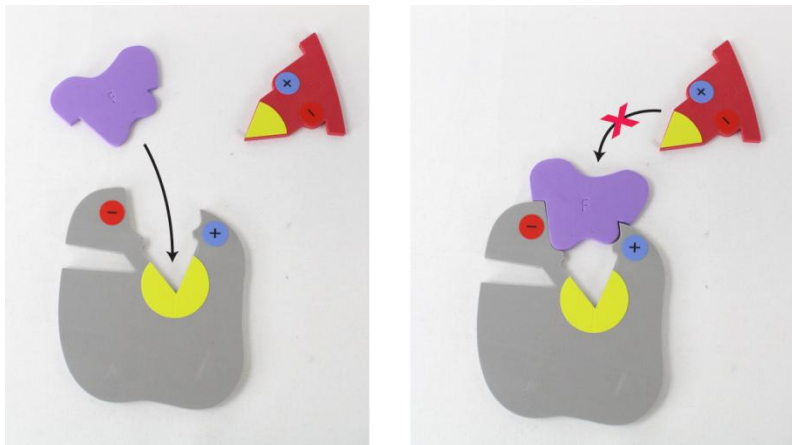


Figure 3: The shape of the substrate appears to fit but the charges do not align in the active site of the enzyme.

Enzyme Inhibition



Competitive Inhibition

A substance which binds in the active site and prohibits a substrate from binding to the enzyme is called a **competitive inhibitor**.



Noncompetitive Inhibition

A **noncompetitive inhibitor** impedes enzymatic action by binding to another part of the enzyme. This second site, known as the allosteric site, is the place on an enzyme where a molecule that is not a substrate may bind, thus changing the shape of the enzyme and influencing its ability to be active.