6.2- Chemical Reactions

All living things are driven by chemical reactions.

Humans release the energy needed to grow, breathe, think, and even dream through the chemical reactions that occur when we metabolize food.

A **chemical reaction** is a process that changes one set of chemicals into another by changing the chemical bonds.

Mass and energy are conserved during chemical reactions.

Clues for chemical reactions:

- heat or light
- a new gas, liquid, or solid (bubbles, or precipitate)
- Change of color

Substances can also undergo **physical changes**

crushing, melting, breaking, ripping,

Chemical equations

The **reactants** are the elements or compounds that are **used** for the reaction.

The **products** are the elements or compounds **produced** by a chemical reaction.

$$2\,H_2 + O_2 \rightarrow 2\,H_2O$$

Reactants → Products

Balanced equations

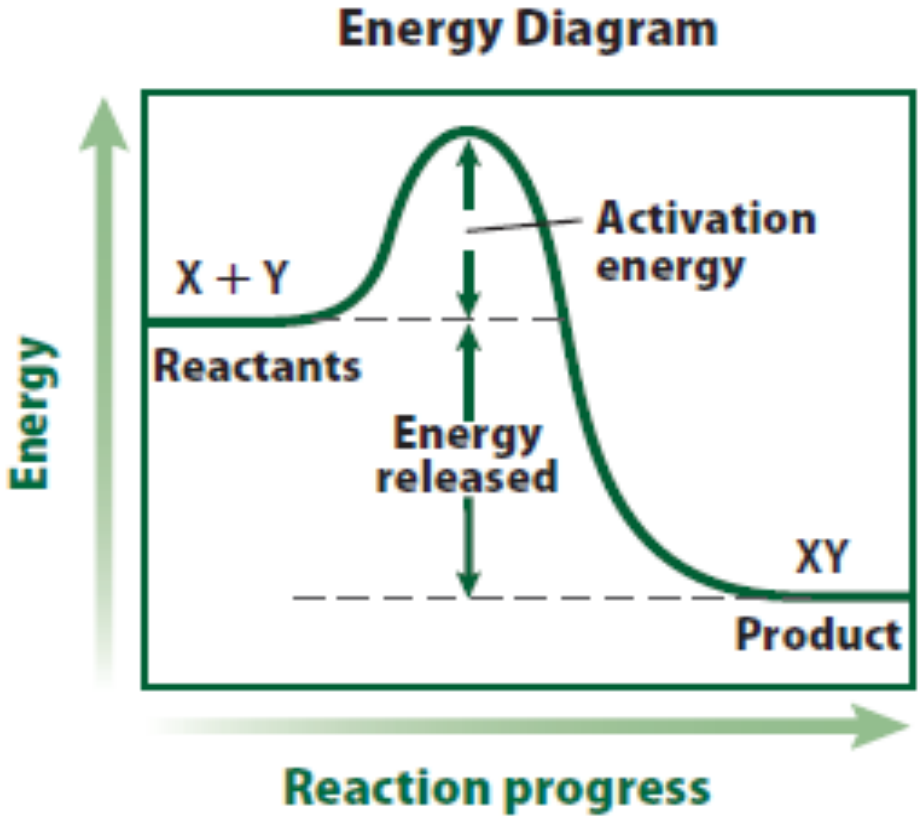
$$C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$$

The atoms on the reactant side must equal the atoms on the product side.

Activation energy-

the energy needed to get a reaction started.

Some reactions are rare due to the high activation energy required.

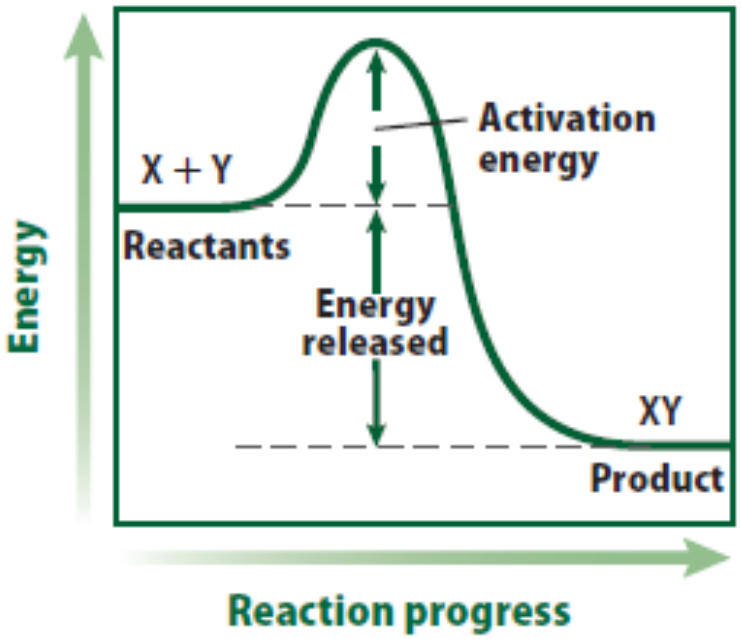


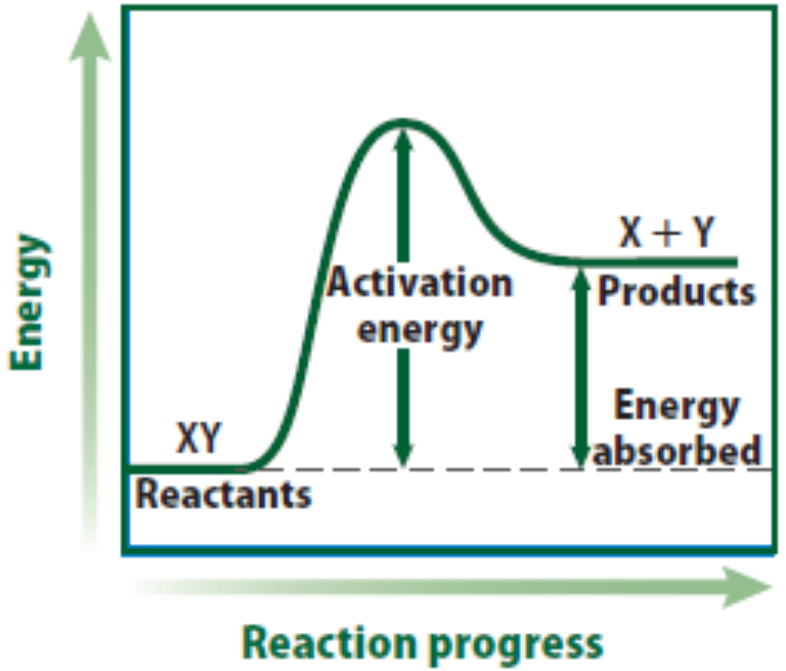
Energy is released or absorbed when chemical bonds are formed or broken.

Energy changes are one of the most important factors in determining whether a chemical reaction will occur.

Reactions that **release** energy are **exothermic**.

Reactions that **absorb** energy are **endothermic**.

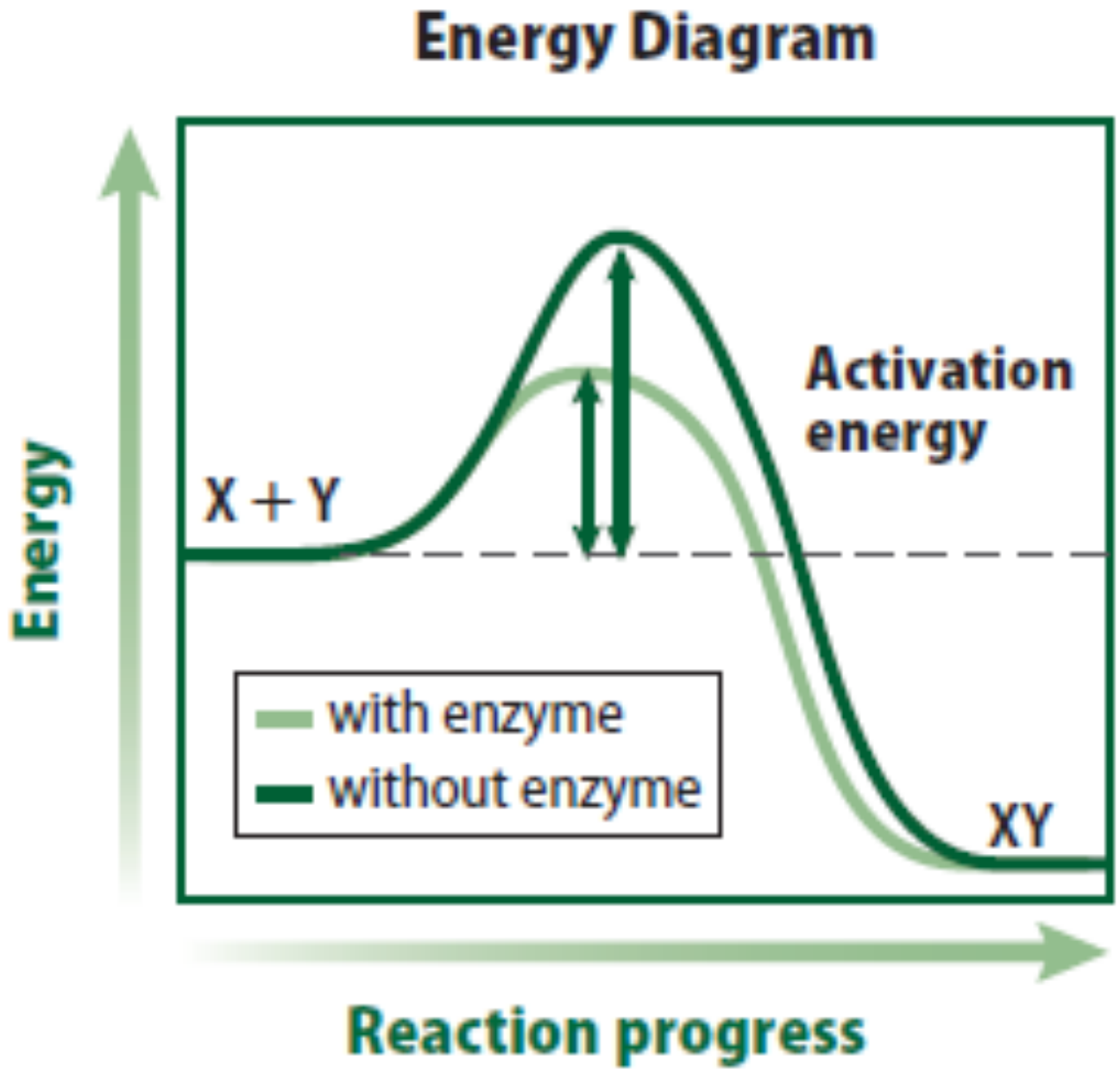




Catalyst- speeds up a chemical reaction by lowering a reaction's activation energy

-do not change the amount of product

-not used up during the reaction


Energy Diagram
Energy
X + Y
Activation energy
with enzyme
without enzyme
XY
Reaction progress

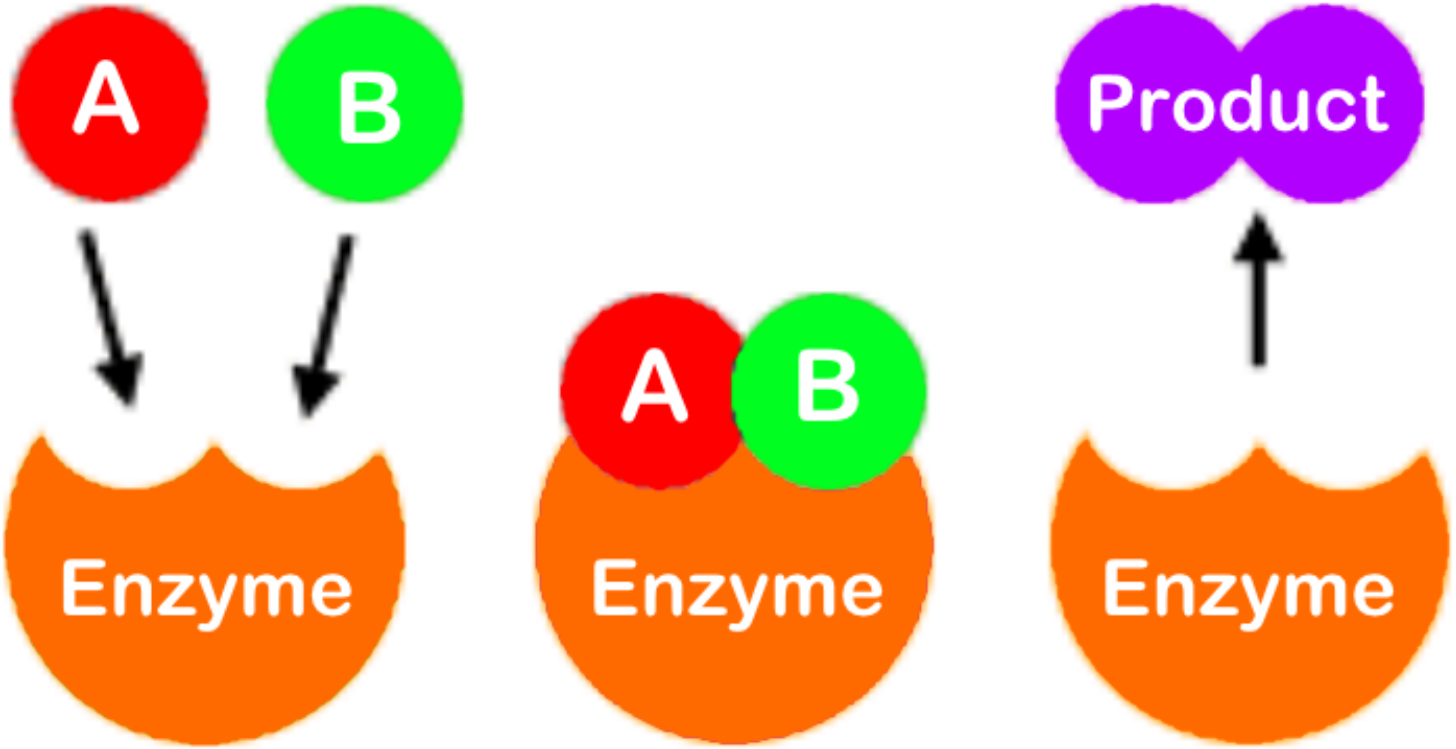
Enzymes are biological catalysts

Enzymes provide a location where reactants can be brought together to react.

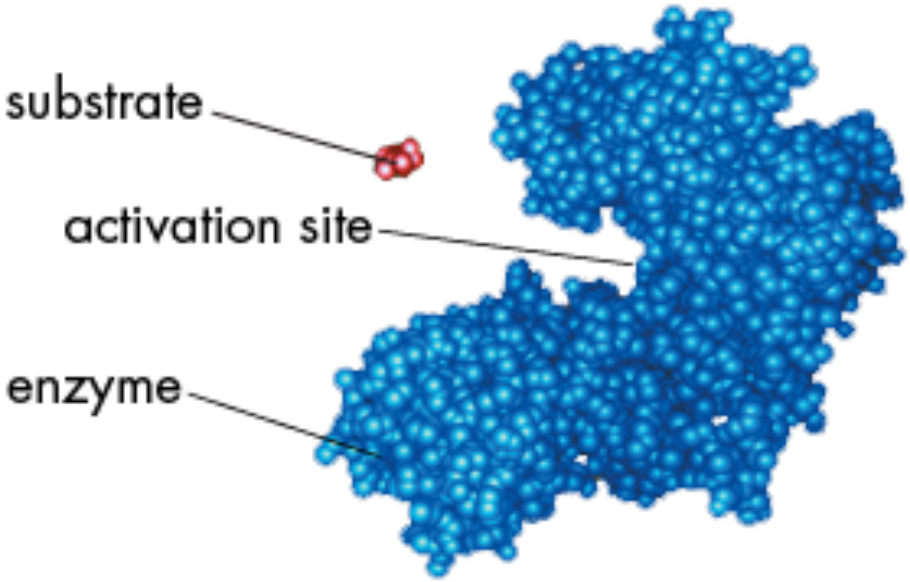
This reduces the energy needed for reaction.

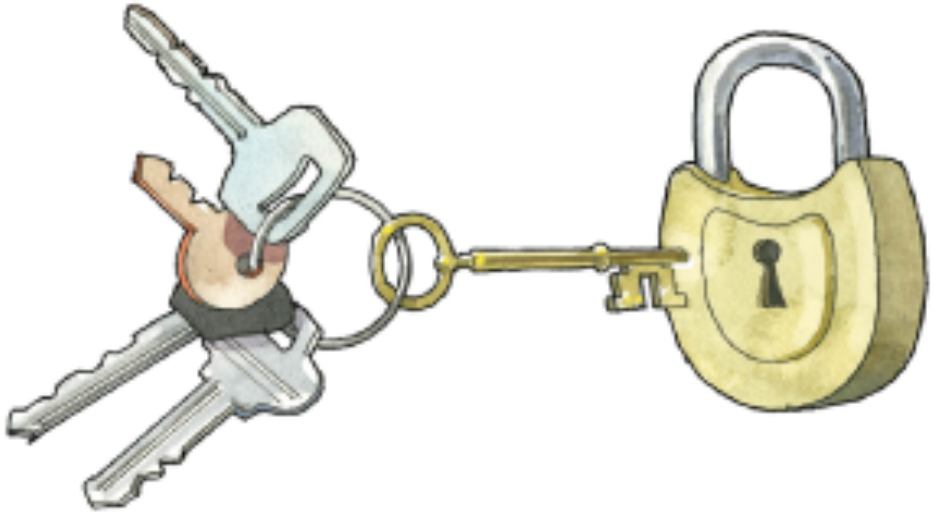
Substrates are the reactants.

The **substrates** bind to a place on the enzyme called the **active site**.

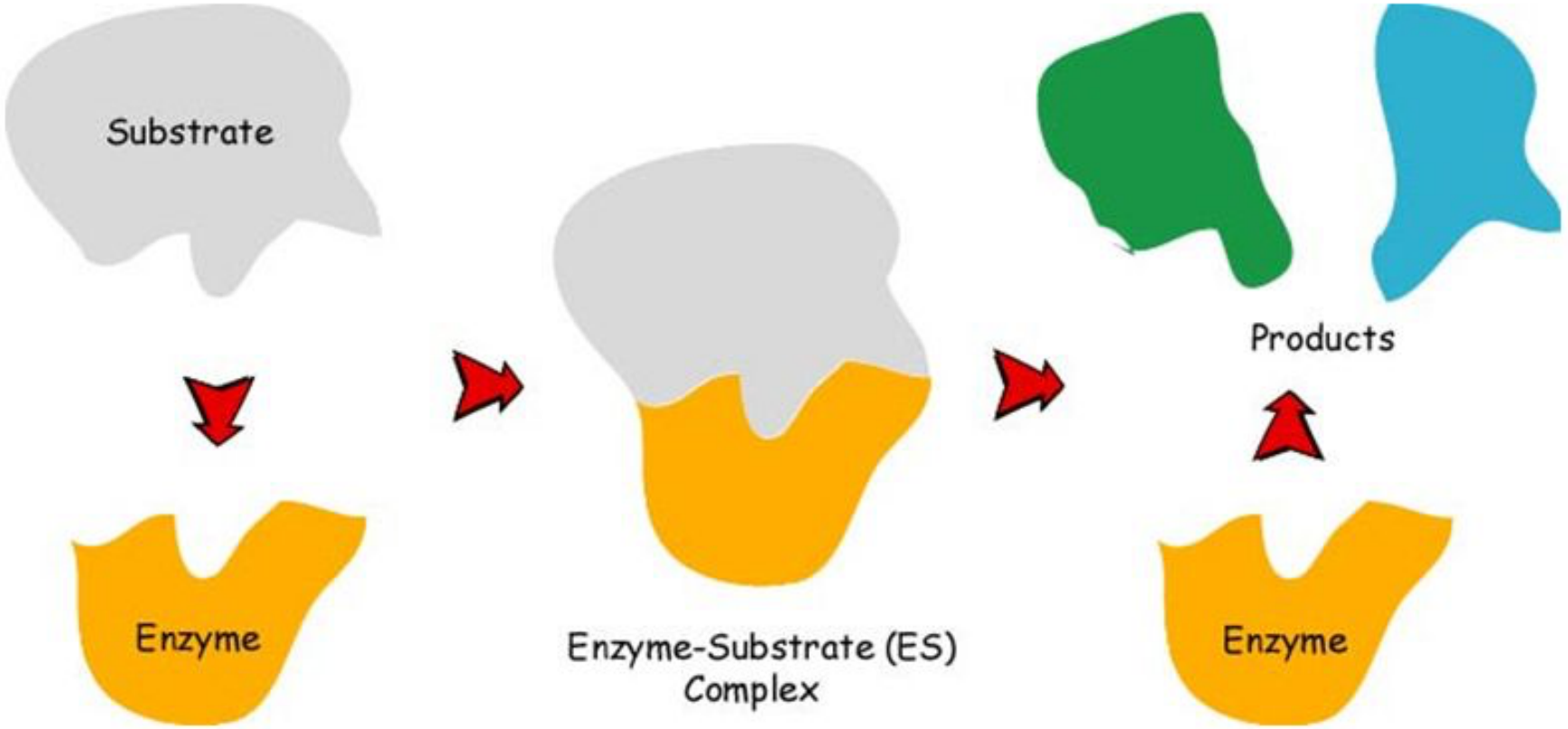


The active site and the substrates have complementary shapes like a lock and key.

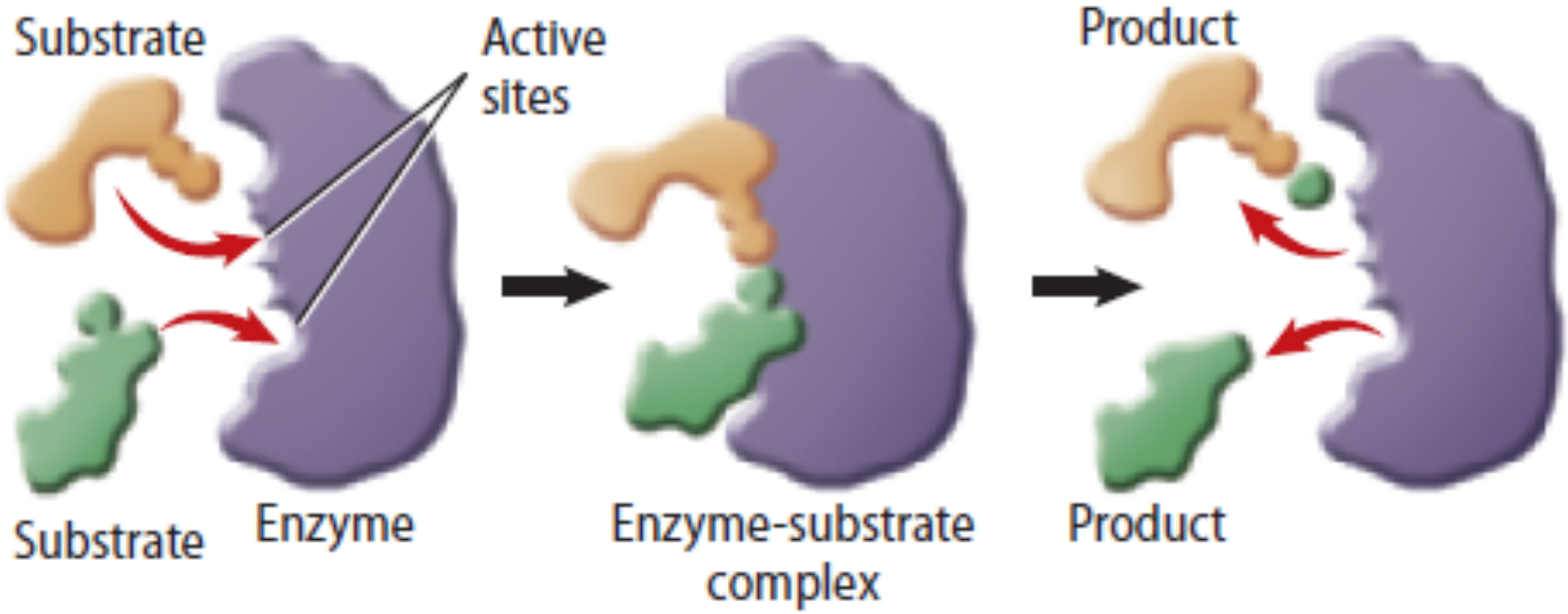


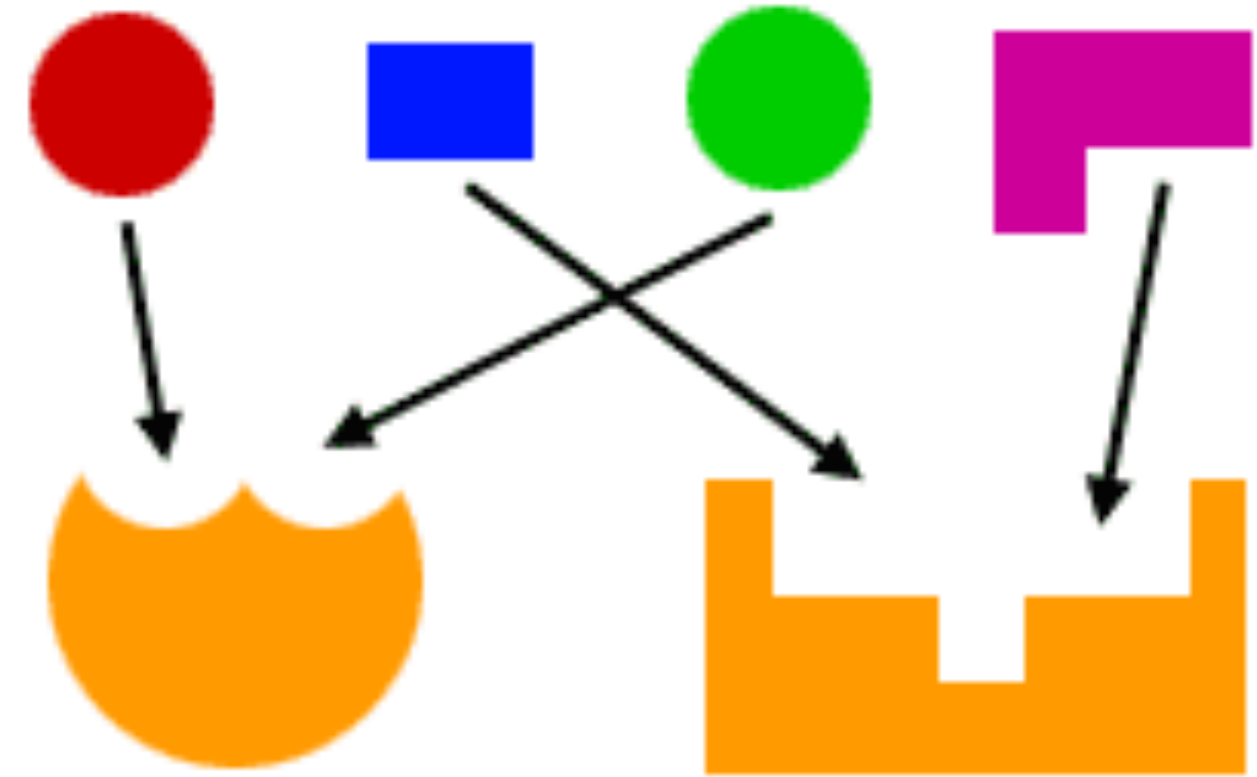


Enzyme reactions



enzyme + substrate → enzyme-substrate complex → enzyme + products


Substrate
Active sites
Product
Substrate
Enzyme
Enzyme-substrate complex
Product



ENZYMES ARE VERY SPECIFIC
AND ONLY WORK WITH
CERTAIN SUBSTRATES

Factors such as pH, temperature, and other substances can speed up or slow down enzyme activity.