Enzymes & Chemical Reactions

What are Chemical Reactions?

– A **chemical reaction** is a process that changes one set of chemicals into another set of chemicals.

- The elements or compounds that enter into a chemical reaction are known as **reactants**.
- The elements or compounds produced by a chemical reaction are known as **products**.

This is a chemical reaction:

Reactant + Reactant = Product

CO_2 + H_2O → H_2CO_3

carbon dioxide water carbonic acid

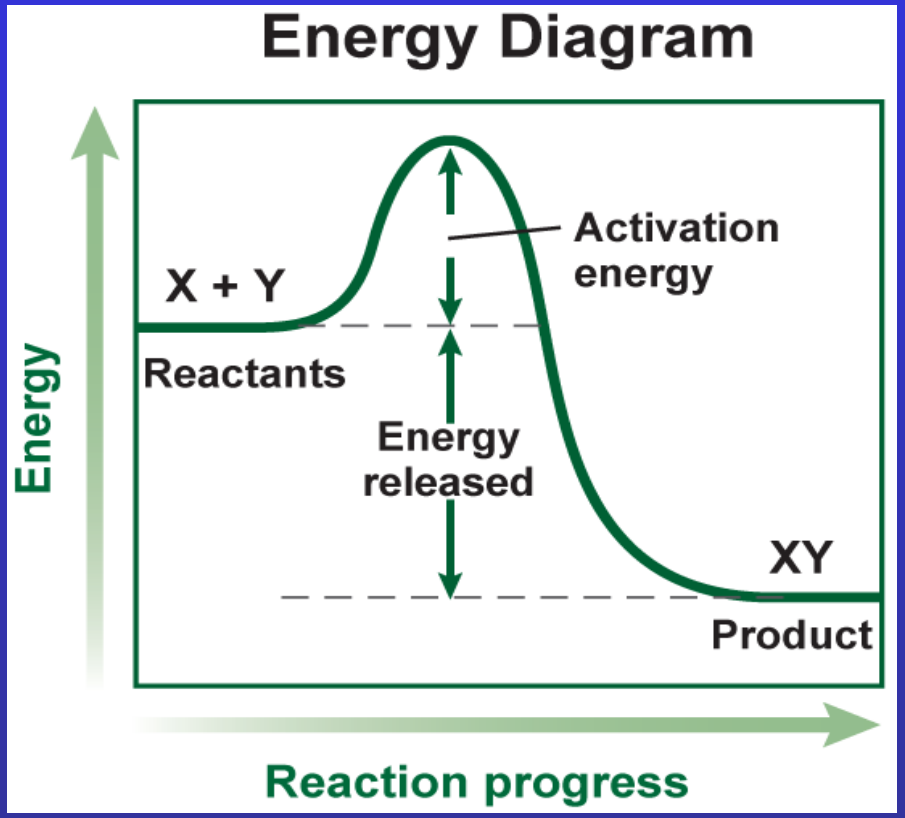
CHEMICAL REACTIONS

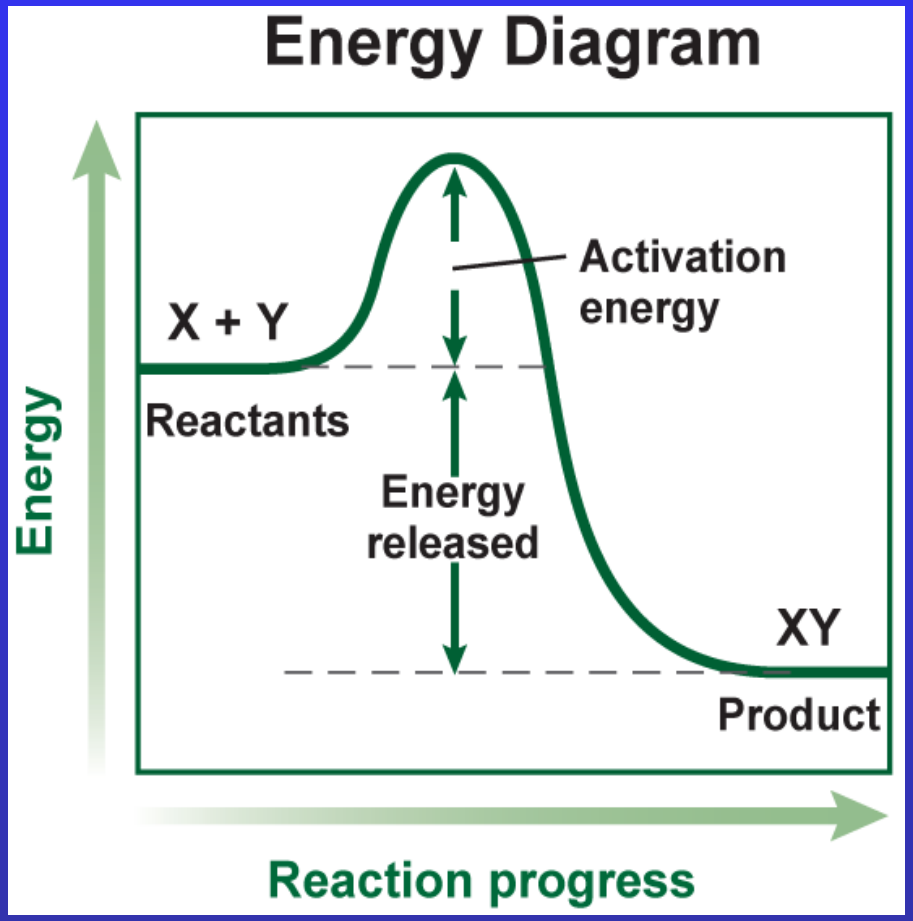
How do you know when one takes place?

- Releases heat or absorbs heat (gets cold)
- Color change
- Releases gas (bubbles)

Activation Energy

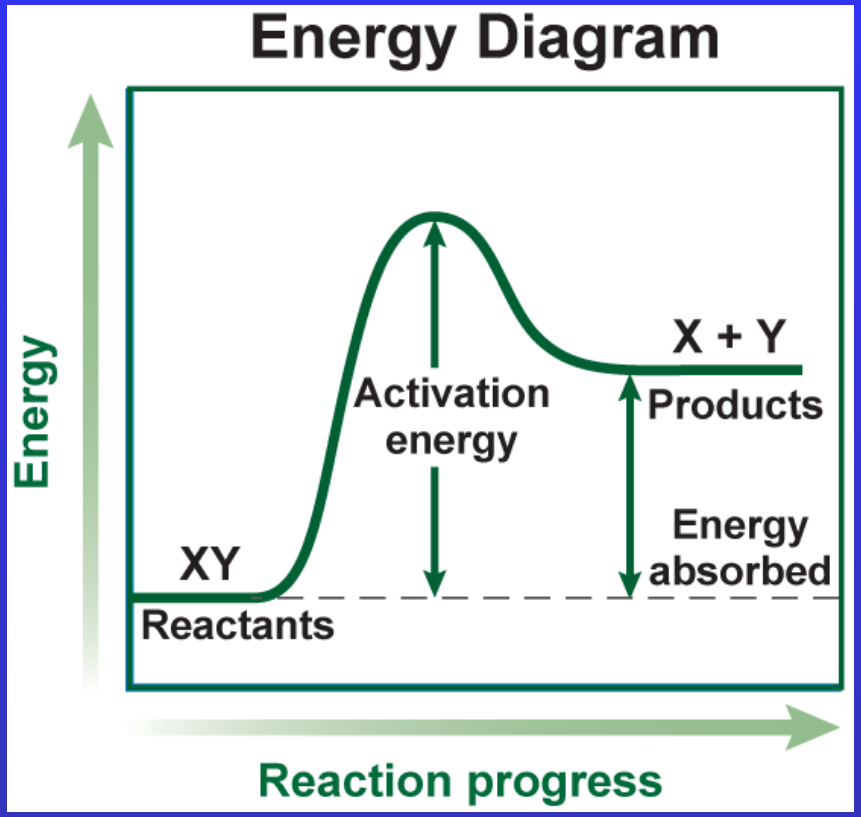
- **Activation energy-** the minimum amount of energy needed for a chemical reaction to happen





- This reaction is **exothermic** and *released energy*
- The energy of the products is lower than the energy of the reactants

- This reaction is **endothermic** and *absorbed heat energy*.
- The energy of the products is higher than the energy of the reactants.



Word Endings

Sugars end in -ose

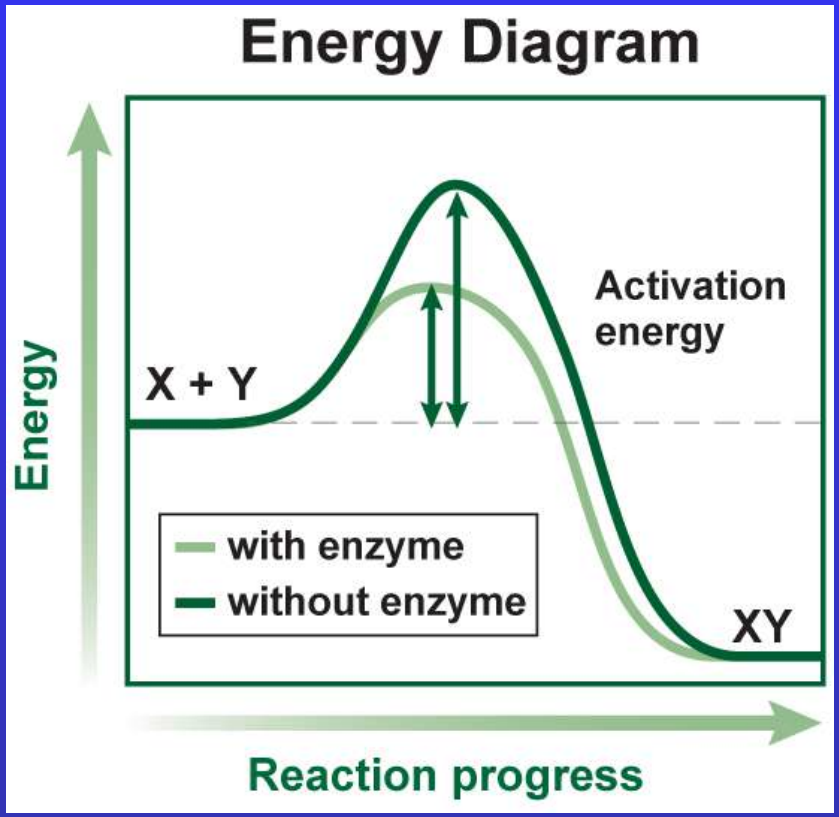
- **glucose**
- **fructose**
- **maltose**

Enzymes end in *-ase*

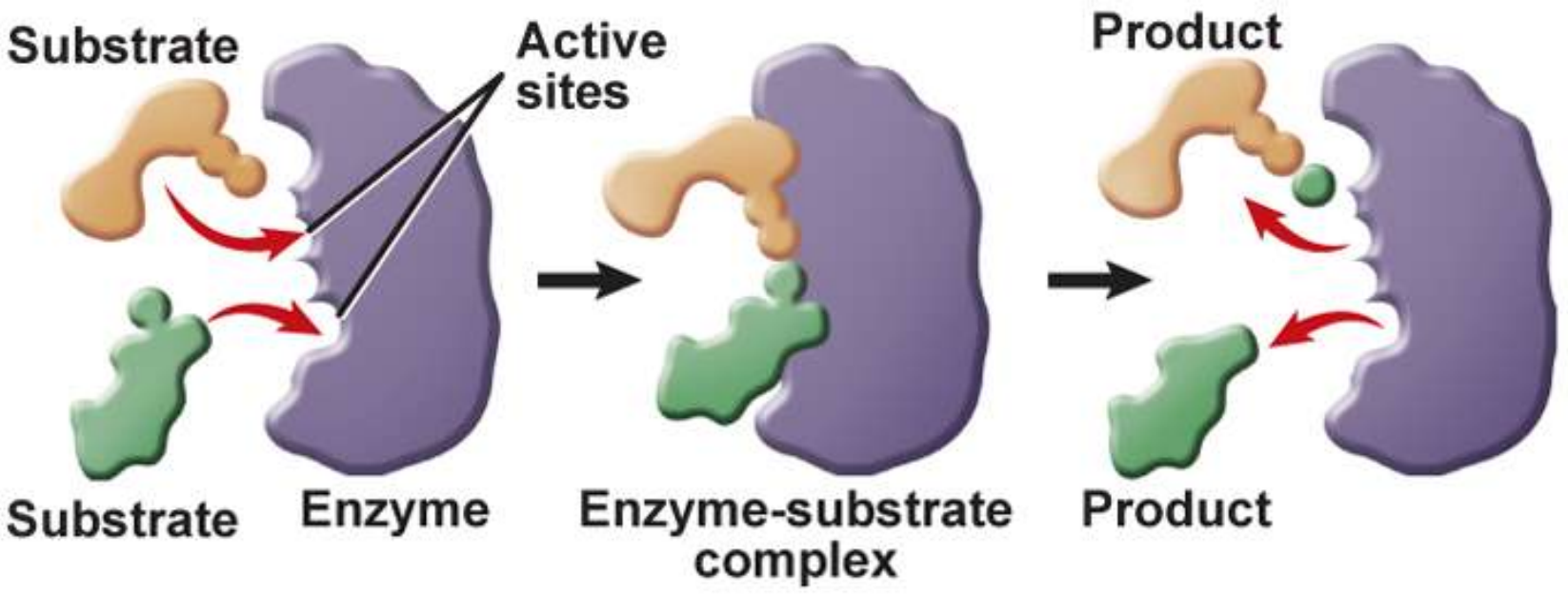
- **maltase**
- **protease**
- **lactase (folks that are lactose intolerant don't produce this enzyme)**

Enzymes

- Enzymes are biological catalysts
- A catalyst is a substance that lowers the activation energy needed to start a chemical reaction.
- It does not increase how much product is made and does not get used up in the reaction



- The reactants that bind to the enzyme are called substrates.
- The specific location where a substrate binds on an enzyme is called the active site.



Steps of Enzyme Activity

1) The substrates bind to the active site on an enzyme
2) The active site changes shape and forms the enzyme-substrate complex
3) The enzyme-substrate complex breaks the chemical bonds in the reactants and allows the substrates to form products
4) The enzyme releases the products

ENZYMES (PROTEINS)

Work like a LOCK AND KEY - the substrate is the lock and the enzyme is the key

SPECIFIC - they only work with one particular substrate (remember a key only fits one lock)

REUSABLE - can be used over and over (the same key can fit a lock again and again)

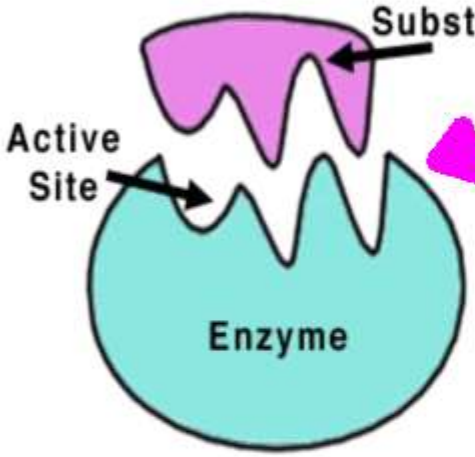
AFFECTED BY TEMPERATURE - can "denature" at high temperatures (the key gets bent and won't work in the lock any longer)

AFFECTED BY pH - can "denature" at extreme pH

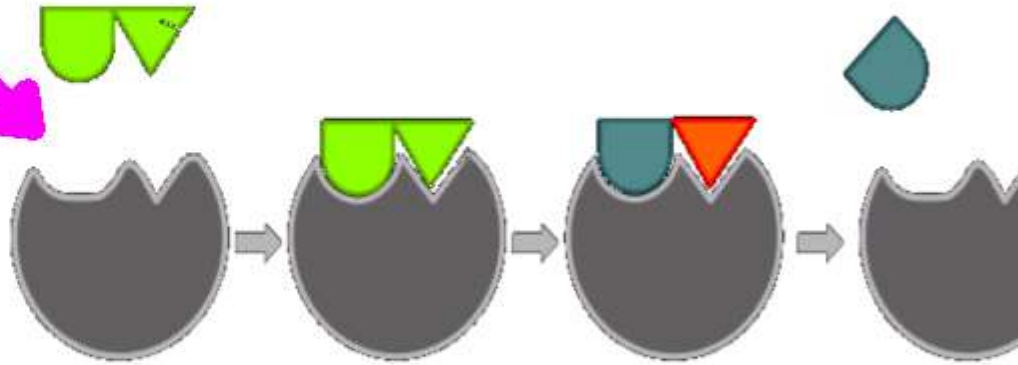
CATALYST - speeds up a chemical reaction (the quickest way to get in your house is by using the lock & key - not the only way, but the quickest way)

FORM & FUNCTION

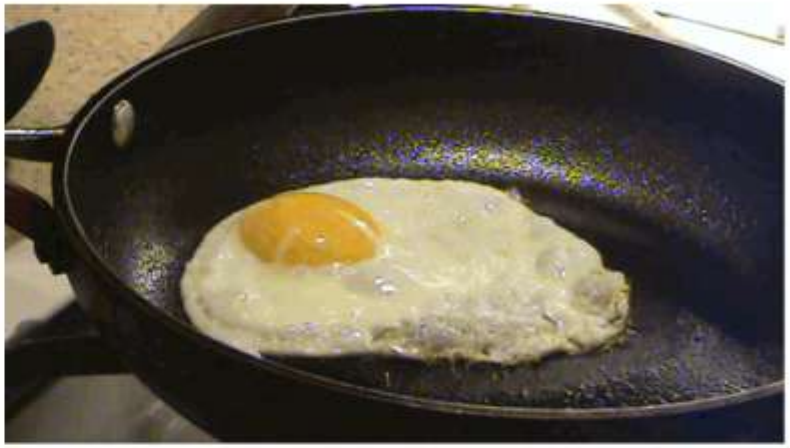
-Because enzymes are specific, this means that an enzymes shape determines its function!



...this enzymes active site (shape/form) is different from this one



this means they would each be responsible for breaking apart or putting together different substrates.



Enzymes affect many biological processes

- Enzymes in snake venom break down the membranes of a person's red blood cells
- Hard green apples ripen due to the action of enzymes
- Photosynthesis and cellular respiration provide energy for the cell with the help of enzymes

Daily Warm-Up

Please write each question and answer it:

- According to the graph, what do enzymes do during a chemical reaction?
- What are two factors that affect enzyme activity?