What’s an ENZYME!?

Let Us Break It Down!

Enzymes and Chemical Reactions

Chemical Reactions

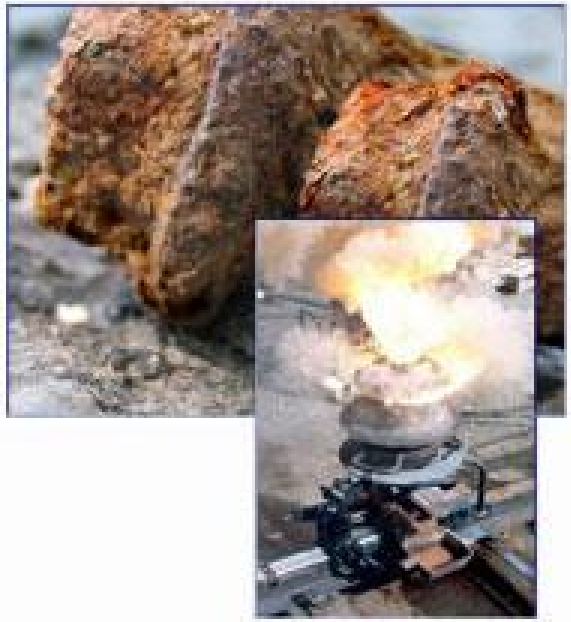
- Process that changes or transforms one set of chemicals into another

What is a Chemical Reaction?

A chemical reaction is a process that results in some chemical **change** to one or more substances.

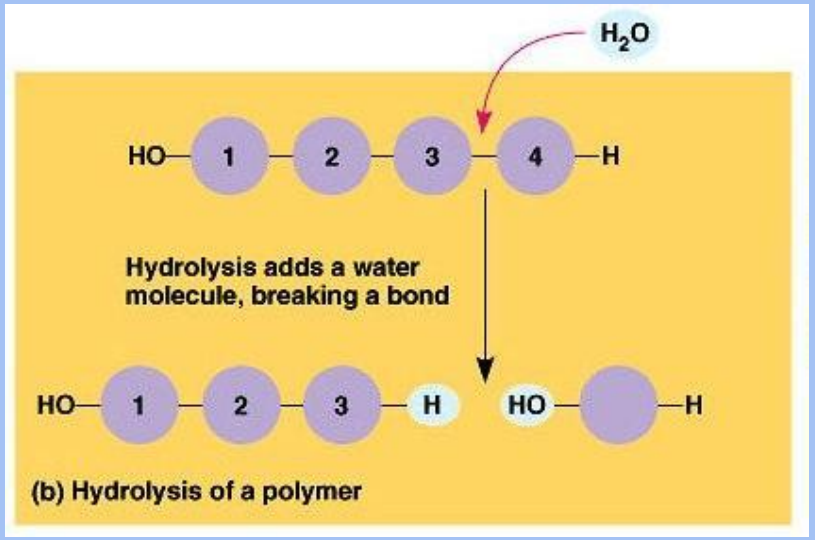
If a substance changes in a way **other than** a change to its state of matter (solid, liquid or gas), then a chemical reaction must have taken place.

The chemicals that are used in a chemical reaction are known as **reactants**. Those that are formed are known as **products**.



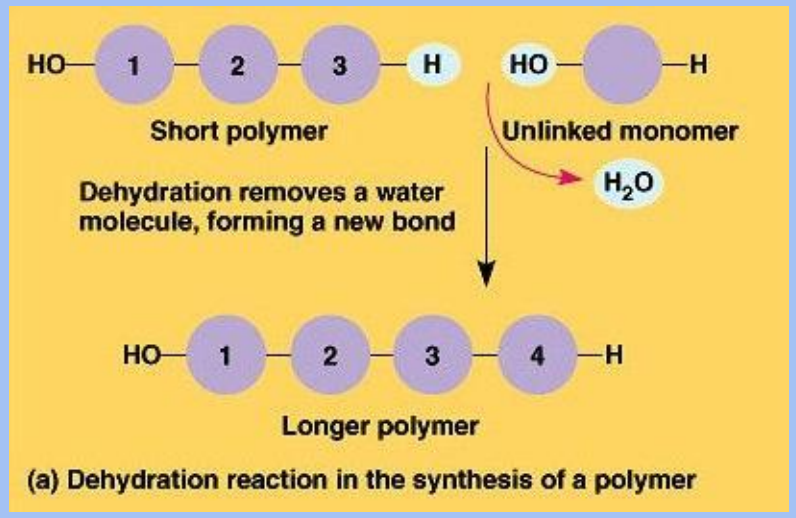
Hydrolysis

- When water is added to a polymer:
  - –bonds are broken
  - –energy released and
  - –polymer breaks into smaller polymers or monomers



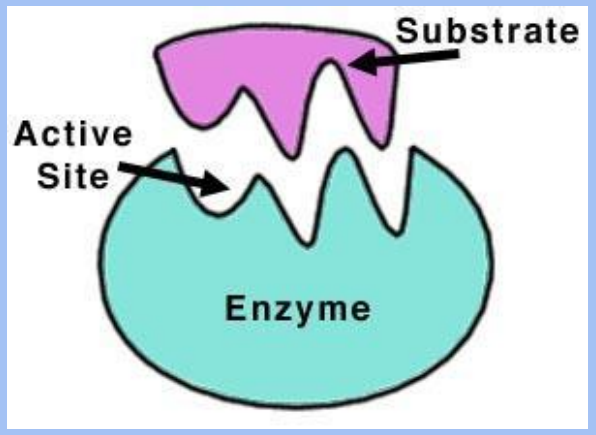
Dehydration

- When water is removed:
  - –Energy is used
  - –Bonds are formed
  - –Monomers come together to make polymers



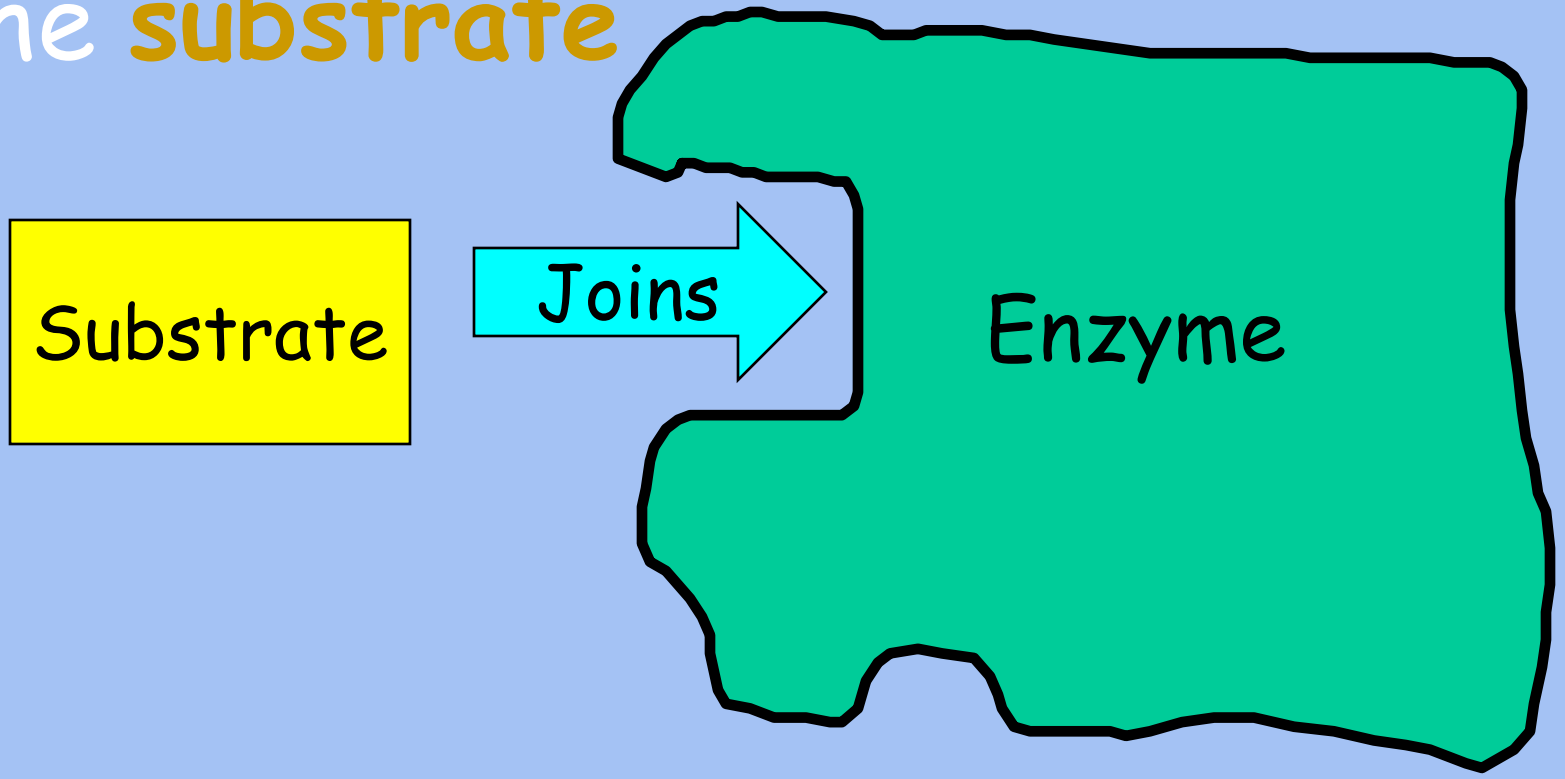
What IS an enzyme?

- Enzymes speed up or slow down chemical reactions without being used up in the process
  - –Made up of:
    1. Proteins
    2. Amino Acids



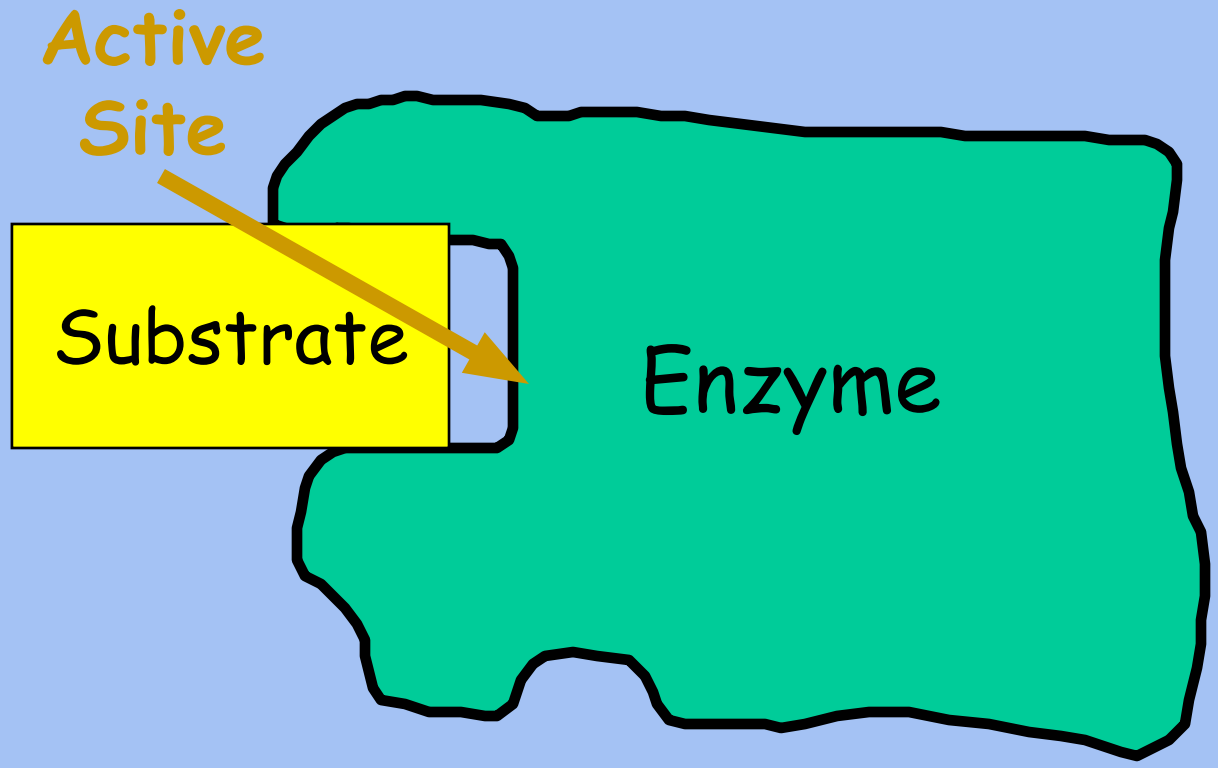
Enzyme-Substrate Complex

The **substance** (reactant) an **enzyme** acts on is the **substrate**



Active Site

- A **restricted region** of an **enzyme** molecule which **binds** to the **substrate**.



What Affects Enzyme Activity?

- Three factors:
  1. Environmental Conditions
  2. Cofactors and Coenzymes
  3. Enzyme Inhibitors

1. Environmental Conditions

1. Extreme **Temperature** are the most dangerous
 - **high temps** may **denature** (unfold) the **enzyme**.

2. **pH** (most like 6 - 8 pH near neutral)
3. **Ionic concentration** (salt ions)

2. Cofactors and Coenzymes

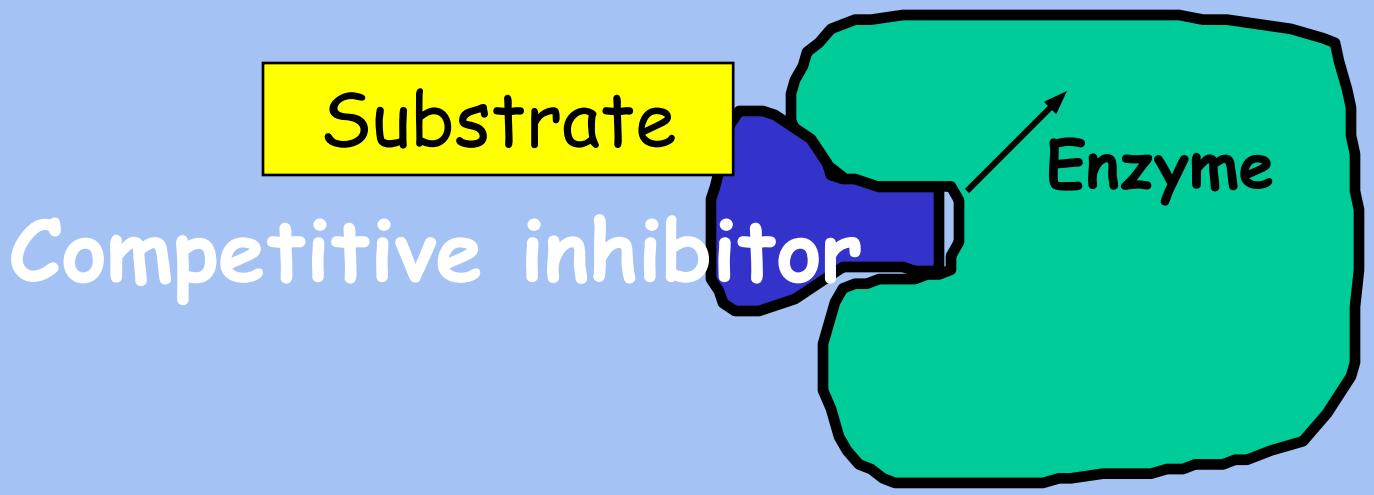
- Inorganic substances (zinc, iron) and vitamins (respectively) are sometimes need for proper enzymatic activity.

- Example:

  Iron must be present in the quaternary structure - hemoglobin in order for it to pick up oxygen.

Two examples of Enzyme Inhibitors

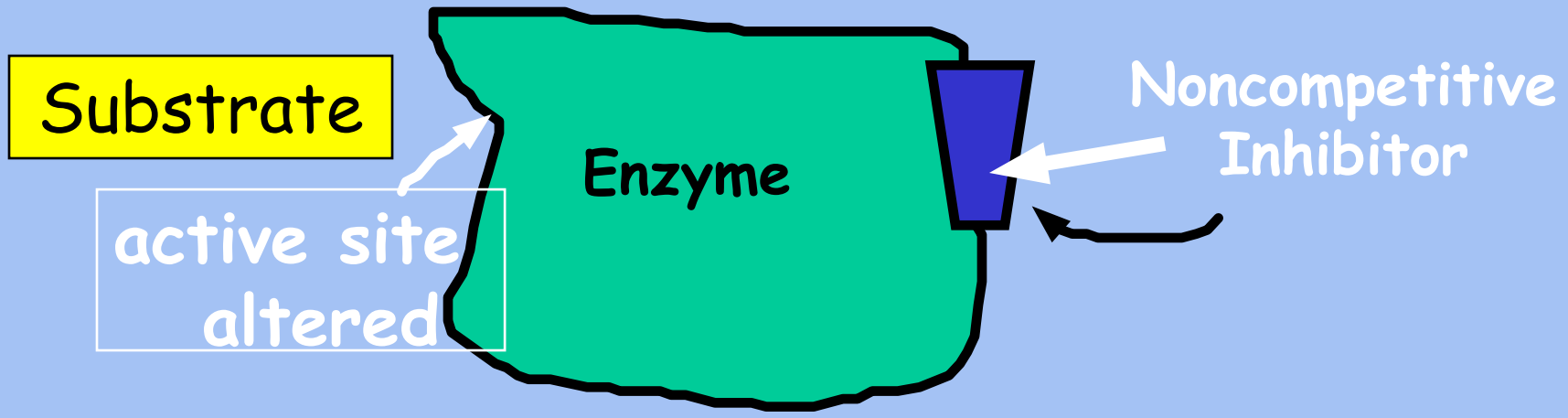
a. Competitive inhibitors: are chemicals that resemble an enzyme's normal substrate and compete with it for the active site.



Inhibitors

b. Noncompetitive inhibitors:

Inhibitors that do not enter the active site, but bind to another part of the enzyme causing the enzyme to change its shape, which in turn alters the active site.

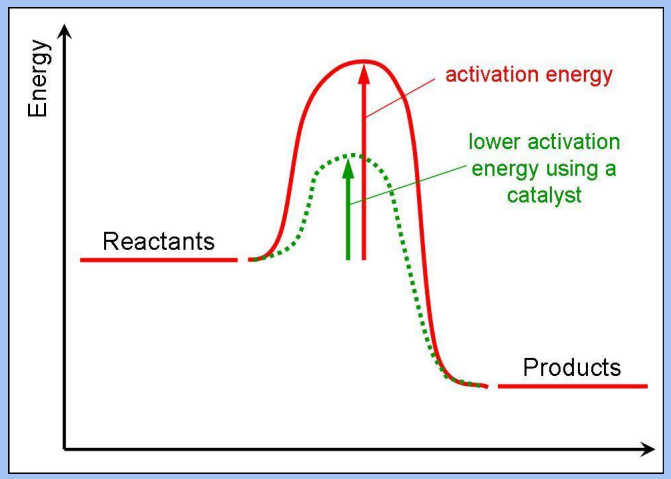


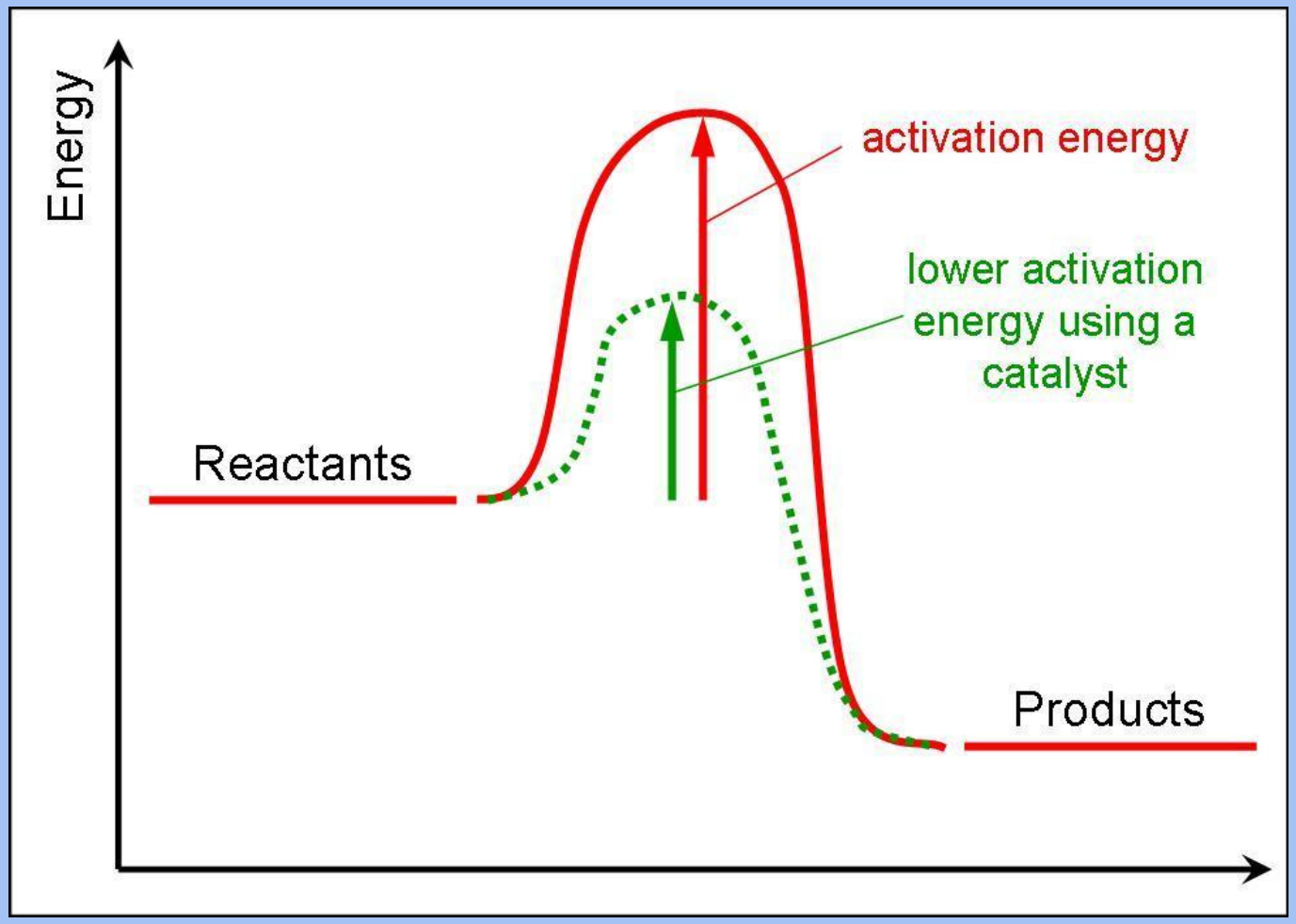
Think-Pair-Share

– How can a poison that acts as an enzyme inhibitor (e.g., cyanide) cause death?

Activation Energy

- Energy to ***start*** reactions
- Energy is needed to start up anything!
  - Examples?
- Enzymes can lower the amount of activation energy needed to speed up a reaction




Energy
activation energy
lower activation energy using a catalyst
Reactants
Products

So…The Functions of Enzymes

1. Synthesize (make) materials needed by cells
2. Help release energy
3. Regulate chemical reactions
4. Are involved in:
   - Reproduction
   - Digestion (break down of foods, use of energy)
   - Respiration
   - Making other enzymes

Examples!

- Enzymes can be identified because of the suffix or ending of a word: ***-ase***
- ***Lipase*** (breaks down lipids)
- ***Sucrase*** (breaks down sucrose
- ***Lactase*** (breaks down lactose
- ***DNA Polymerase*** (builds up polymers—*DNA* Molecules!!)