Guided Reading: Chapter 6

(p.87) **1.** Define **metabolism**.

Metabolism is the total of an organisms chemical reactions.

(p.88) **2.** There are two types of reactions in metabolic pathways: **anabolic** and **catabolic**.

a. Which reactions release energy? catabolic

b. Which reactions consume energy? anabolic

c. Which reactions build up larger molecules? anabolic

d. Which reactions break down molecules? catabolic

e. What type of reaction is photosynthesis? anabolic

f. What type of reaction is cellular respiration? catabolic

3. Define the following terms:

(p.88) **Energy** - The capacity to do work.

(p.88) **Kinetic Energy** - Energy of motion.

(p.89) **Potential Energy** - Energy that matter possesses because of its location or structure.

(p.89) **Thermodynamics** - The study of energy transformations that occur in a collection of matter.

(p.89) **First Law of Thermodynamics** - The energy of the universe in constant.

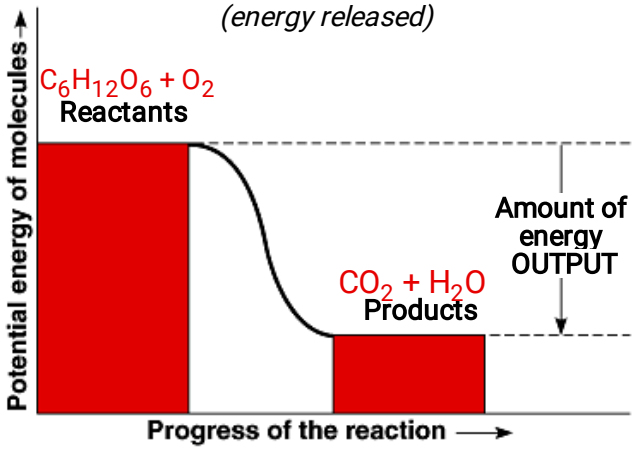
Energy can be transferred and transformed, but it cannot be created or destroyed.

(p.89)4. Label the diagram below and use it to contrast **exergonic** and **endergonic** reactions in terms of free energy (G).

(Video)

Exergonic

(energy released)

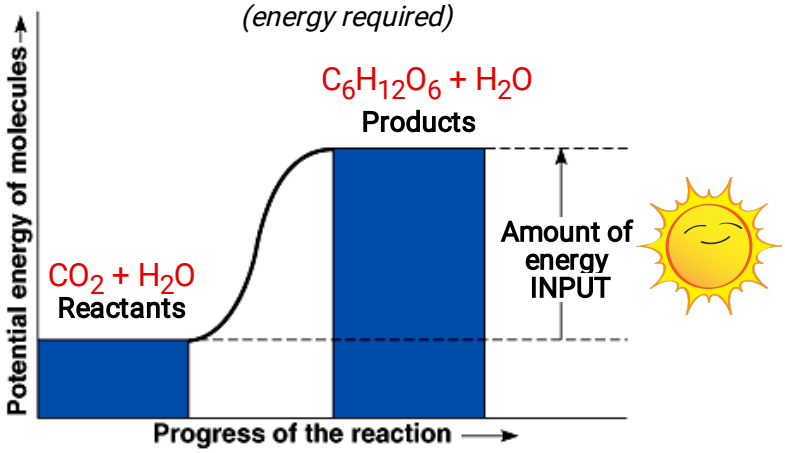


$C_6H_{12}O_6 + 6O_2 \longrightarrow 6CO_2 + 6H_2O$

[AEROBIC CELLULAR RESPIRATION]

Endergonic

(energy required)



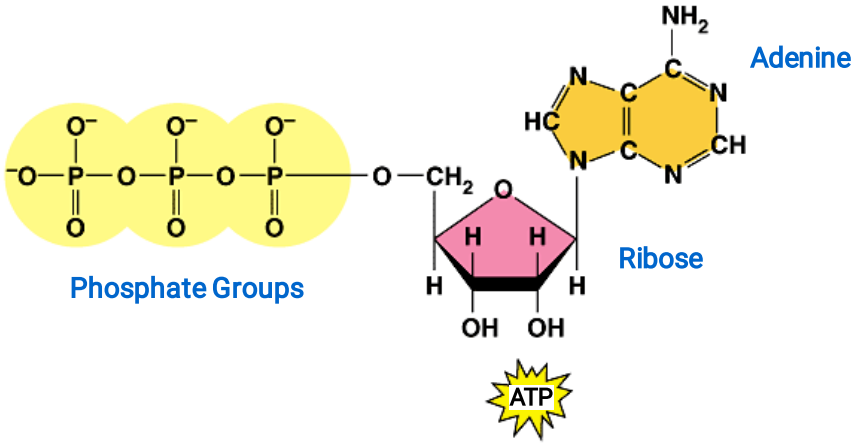
$6CO_2 + 6H_2O \longrightarrow C_6H_{12}O_6 + 6O_2$

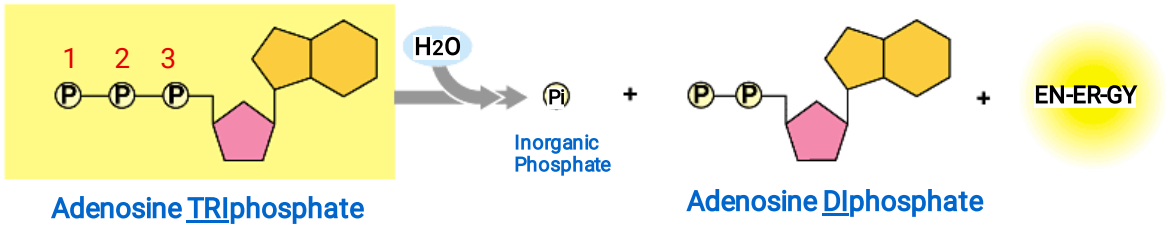
[PHOTOSYNTHESIS]

(p.91-92). How do you know if a reaction is **spontaneous**?

Spontaneous reactions have more potential energy stored in the reactants than the products and so release energy.

(p.94-95). Label the structure of ATP below and indicate how cellular work is done by ATP.





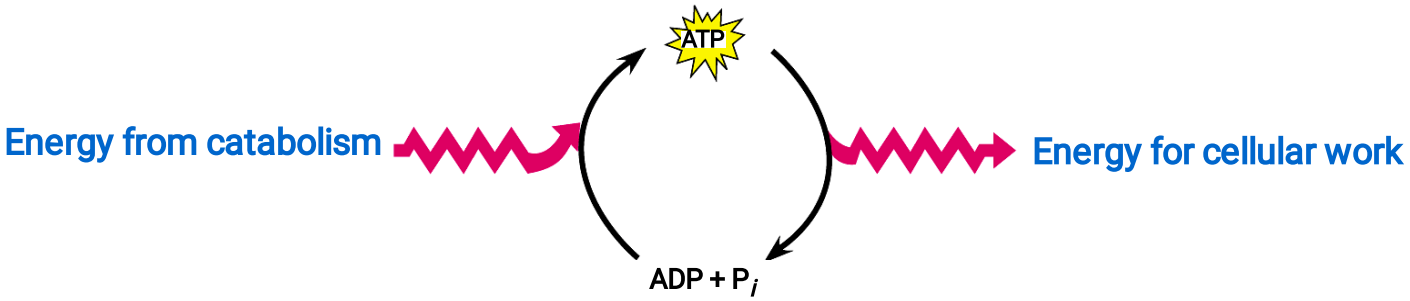
The hydrolysis of ATP is an exergonic (*energy releasing*) reaction which yields inorganic phosphate, ADP and energy which is then used to perform cellular work.

(p.87) **7.** In your own words, explain the concept of **coupled reactions** and ATP doing work.

(p.95) **8.** Define **phosphorylated**.

Phosphorylated is what happens when a molecule receives a phosphate group.
The reaction is called *phosphorylation*.

(p.95) **9.** Label the diagram below and use it to describe the regeneration of ATP?

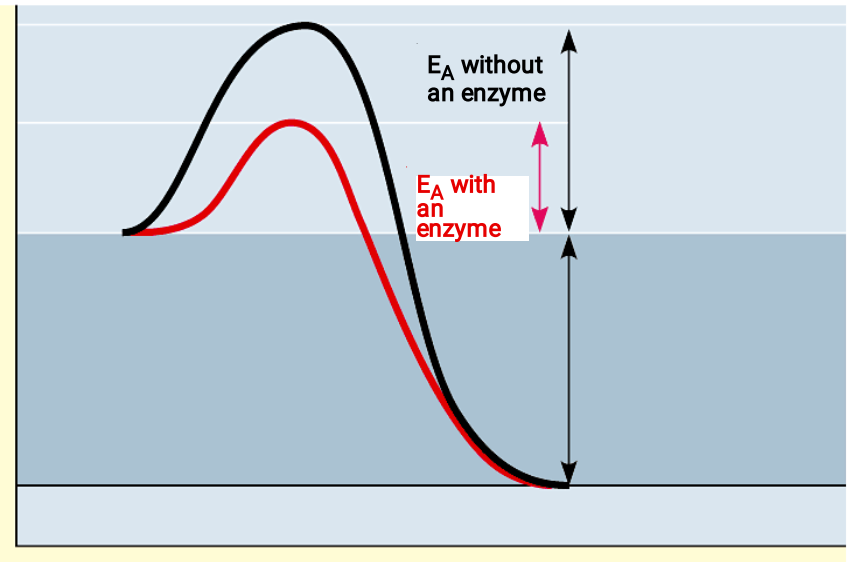


The energy released by breakdown reactions (catabolism) in the cell is used to phosphorylate ADP, regenrating ATP. Energy stored in ATP drives most cellular work. Thus, ATP couples the cell's energy-yielding processes to the energy-consuming ones.

(p.96) **10.** What is **activation energy**?

Activation energy is the initial investment of energy for starting a reaction.
or
The energy required to break the bonds in the reactants.

(p.97) **11.** Label the diagram below and use it to explain how enzymes affect the **activation energy** of a chemical reaction.



An enzyme (catalyst) lowers the activation energy required to initiate a chemical reaction.

12. Define the following terms:

(p.96) **Catalyst** - a chemical agent that changes the rate of a reaction without being consumed by the reactions. *(reused and recycled)*

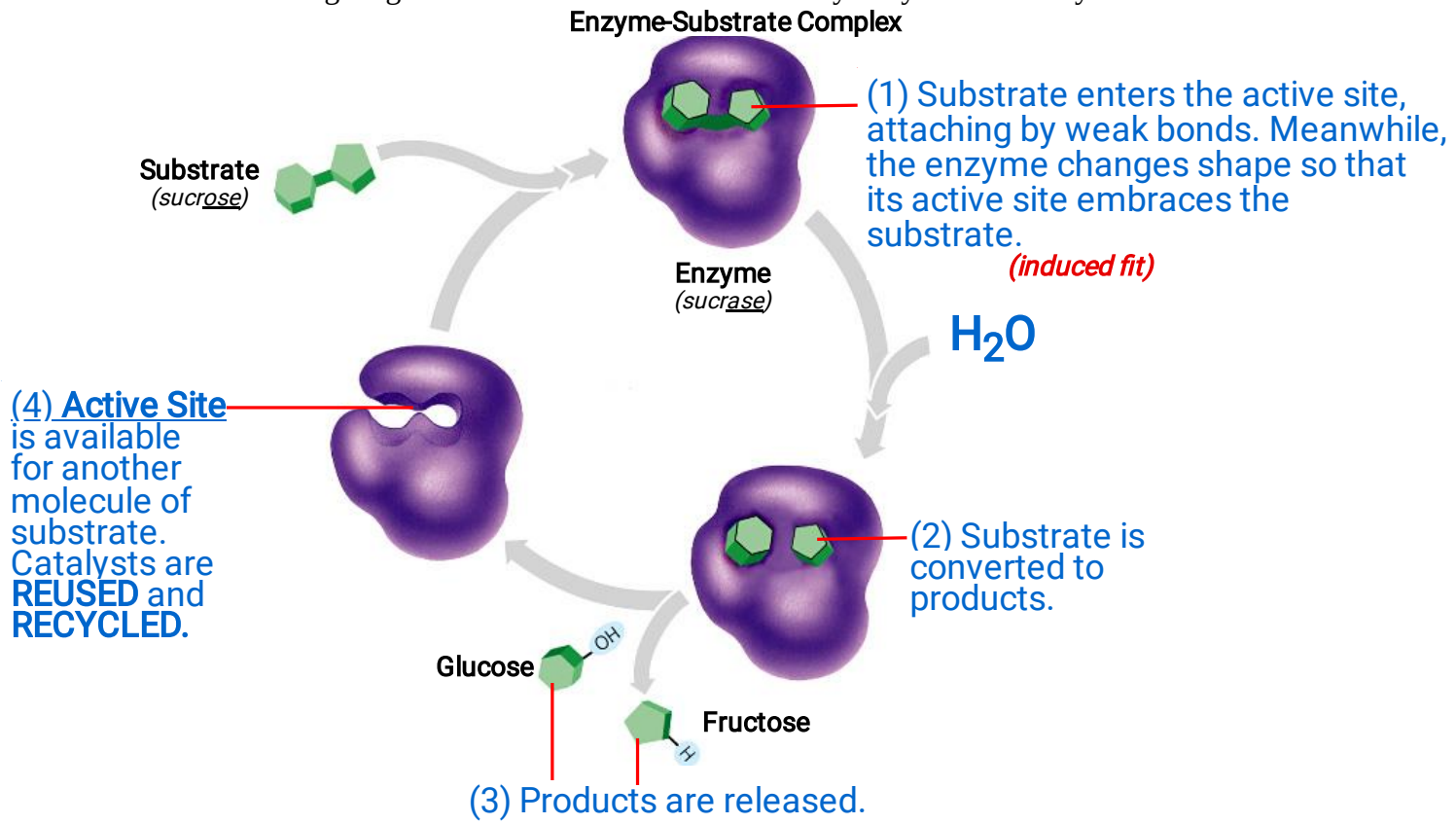
(p.97) **Substrate** - the reactant an enzyme acts on

(p.99) **Enzyme Substrate Complex** - structure formed when an enzyme binds to a substrate

(p.98) **Active Site** - the restricted region on an enzyme where the substrate binds.

(p.98) **Induced Fit** - the slight change in shape of an enzyme that occurs when a substrate binds to it enhancing it's ability to catalyze the reaction
(lower the activation energy)

(p.87) **13.** Label the following diagram and use it to describe the catalytic cycle of an enzyme.

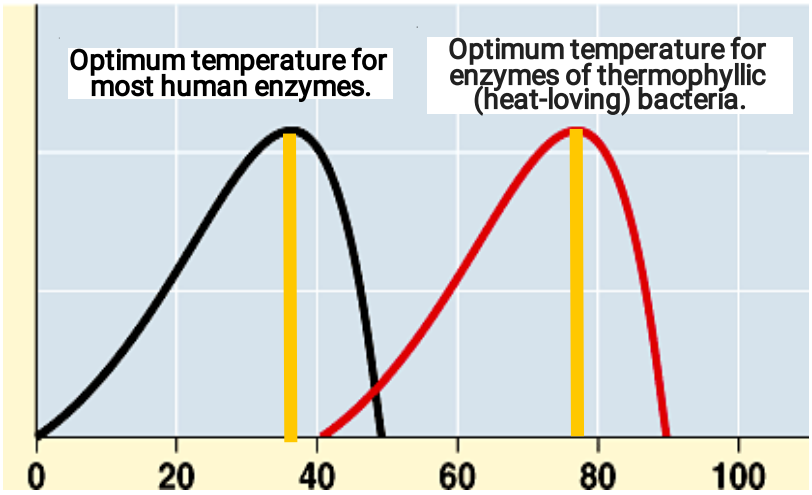


(p.100) **14.** Label the graph below and use it to describe how SPECIFICALLY temperate affects enzyme activity?

(a) Graph Title: Optimum temperature for two enzymes.

Environmental factors affecting enzyme activity:

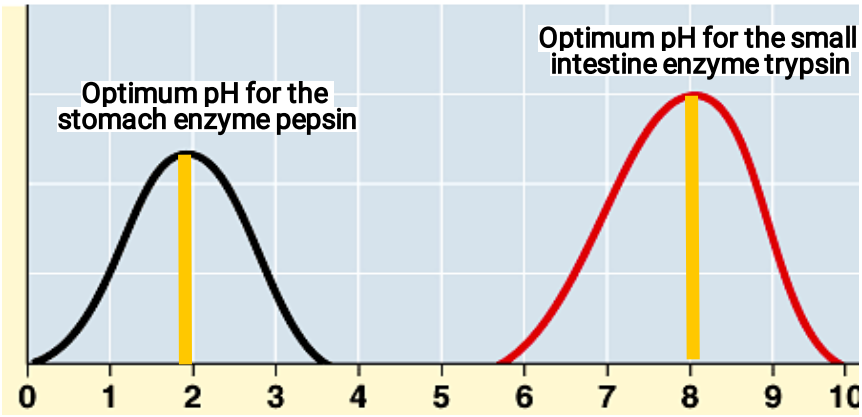
Each enzyme has an optimal (a) temperature and (b) pH that favor the active conformation of the protein molecule.



(Effects of Temperature and pH on Enzyme Activity)

(p.100)**15.** Label the graph below and use it to describe how pH SPECIFICALLY affects enzyme activity?

(b) Graph Title: Optimum pH for two enzymes.



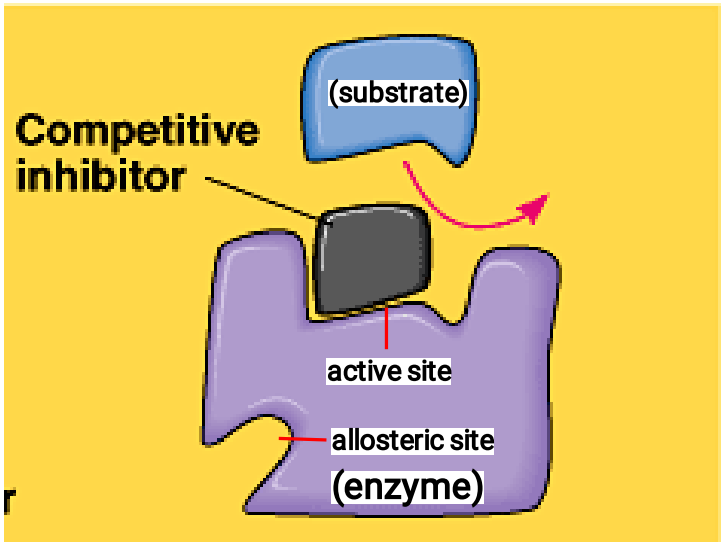
16. Define the following terms:

(p.100) **Cofactors** – inorganic, nonprotein helpers that assist enzymes with their catalytic activities
Examples: zinc (Zn), iron (Fe) and copper (Cu).

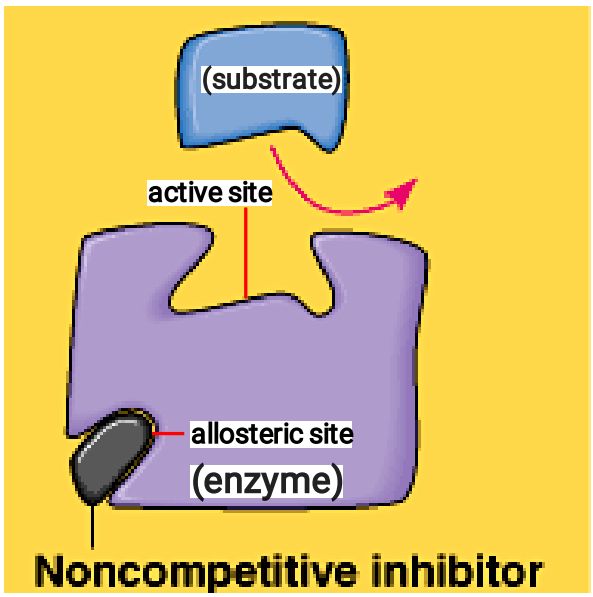
(p.100) **Coenzymes** – organic helpers that assist enzymes with their catalytic activities
Example: vitamins

(p.101) **Allosteric Site** - a specific receptor site on some part of the enzyme molecule remote from the active site

17. Use the diagrams below to help you compare and contrast **competitive** and **noncompetitive inhibitors**. Video



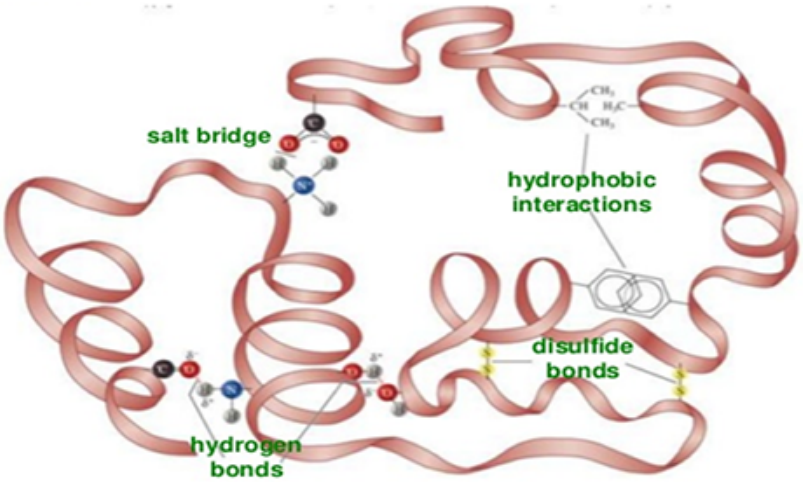
A competitive inhibitor mimics the substrate and competes for the active site.



A noncompetitive inhibitor binds to the enzyme at a location away from the active site, but alters the conformation of the enzyme *(tertiary, globular proteins)* so that the active site is no longer fully functional.

Structure dictates Function!

Most enzymes are tertiary (globular) in structure.



(Side Chain Interactions)