Honors Biology Bellringer:

What do the terms *autotroph* and *heterotroph* mean?

self feeding

different feeding

Autotrophs make their own food.

Heterotrophs consume other organisms for food.

Standard: Students will derive the relationship between single-celled and multi-celled organisms and the increasing complexity of systems.

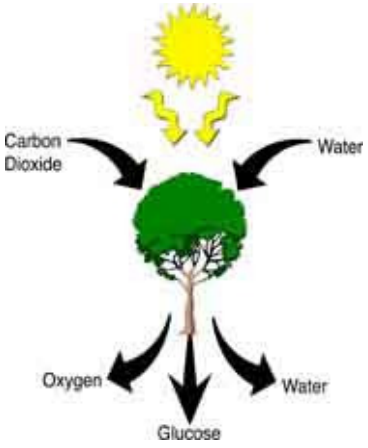
Element: Explain the cycling of energy through the processes of photosynthesis and respiration.

EQ: What is photosynthesis?

I) The Reaction:

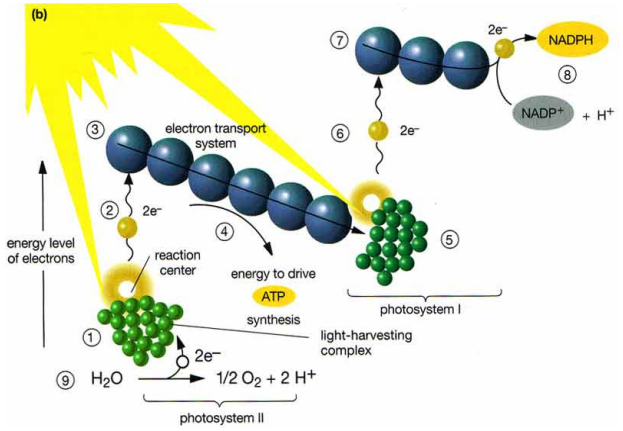
$$6CO_2 + 12H_2O + \text{energy (light)} \rightarrow C_6H_{12}O_6 + 6O_2 + 6H_2O$$

In words: Carbon dioxide and water combine in the presence of energy to form glucose, oxygen, and water.

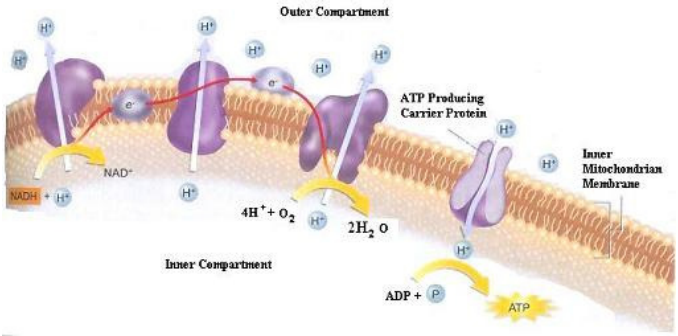


A) Light-Dependent Reactions

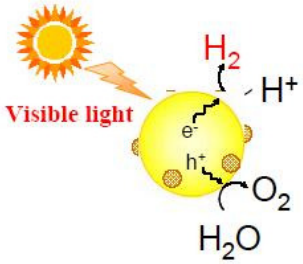
1) Sunlight is absorbed by the photosynthetic pigments, causing the excitation of electrons.



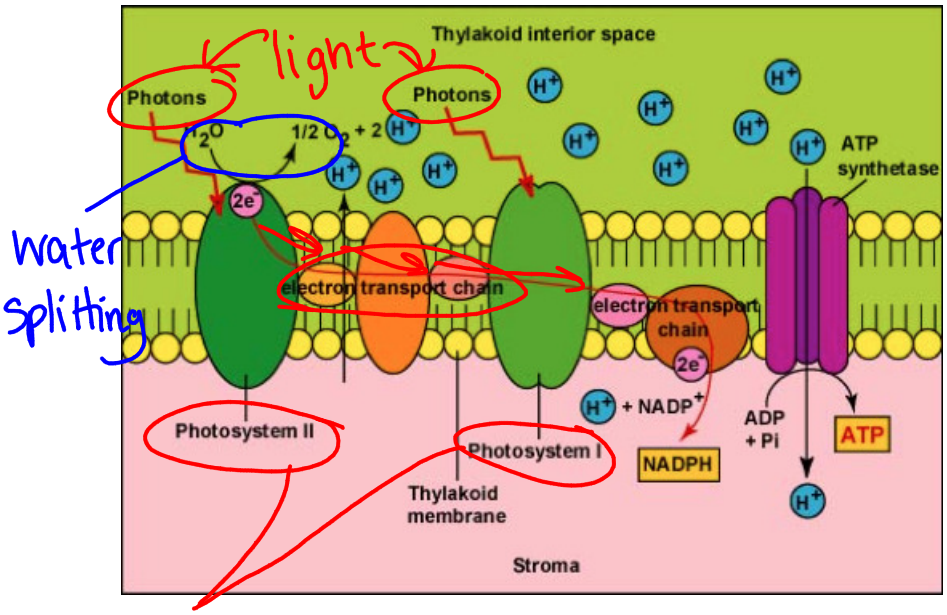
2) Electrons are passed from one molecule to the next along an **electron transport chain (ETC)**, which is a series of reactions that ultimately produce an energy rich molecule, such as ATP.



3) Water molecules are split apart in order to provide new electrons that will then become excited by sunlight and passed down the ETC.

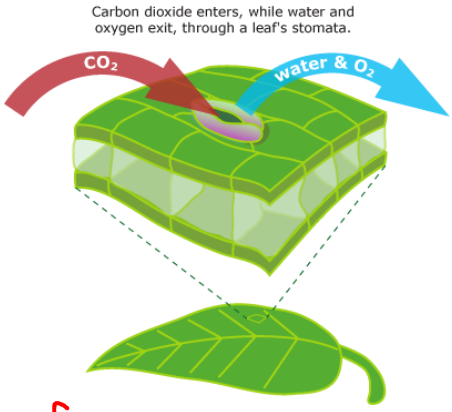


Summary of Light Dependent Reactions



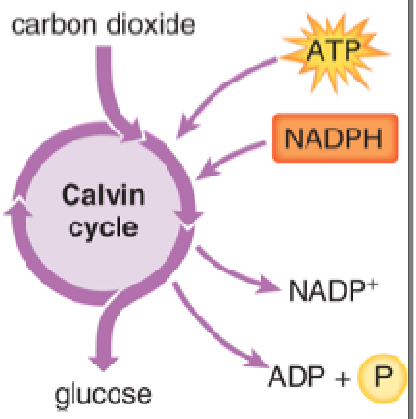
B) Light-Independent Reactions (also called the *dark reactions, Calvin Cycle,* or *carbon fixation*)

1) Carbon dioxide (CO_2) from the atmosphere is added to carbon compounds in the chloroplasts.

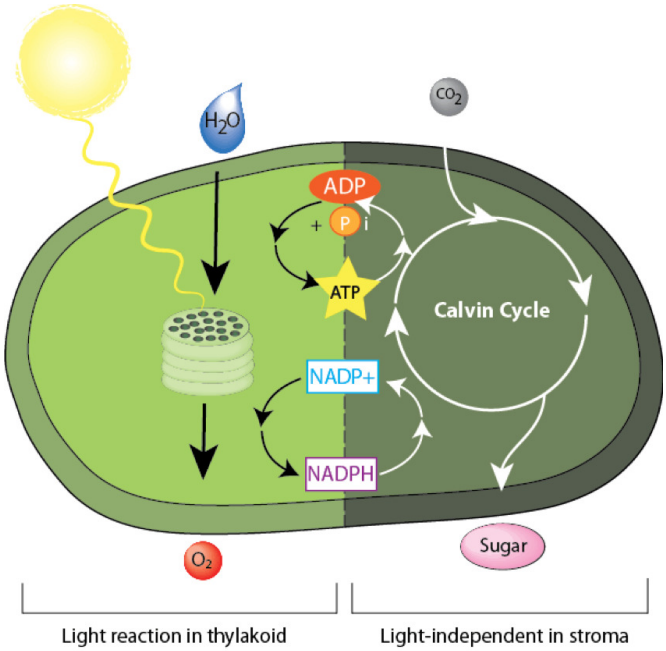


Stomata: openings in leaf

2) High-energy molecules (ATP) produced by the electron transport chain convert carbon compounds into simple sugars.
3) One of these sugars is used by the plant to store energy while the other sugars are rearranged back into the original carbon compound and the cycle repeats.



Summary of photosynthesis:



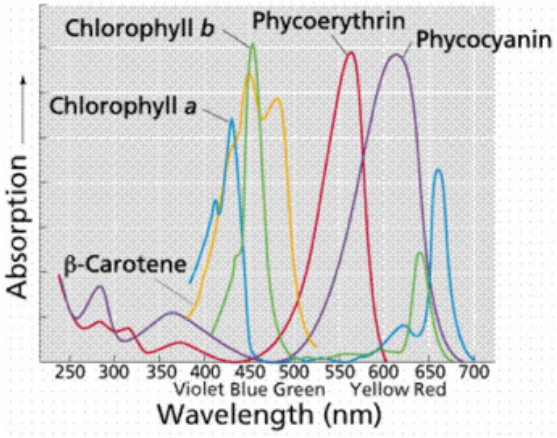
II) Photosynthetic Pigments

1) Chlorophyll: green pigment found in plants that absorbs light energy, which is used during photosynthesis

Chlorophyll **reflects green light, which is why it appears green. The light wavelengths **absorbed** by chlorophyll, predominately red and blue, are the wavelengths that provide the energy needed for photosynthesis.**

B) Accessory Pigments: other pigments that are specialized for capturing different wavelengths (or colors) of light, may also offer protection from UV radiation

Examples:
Carotenoids
Phycocyanin
Xanthophyll
Phycoerythrin



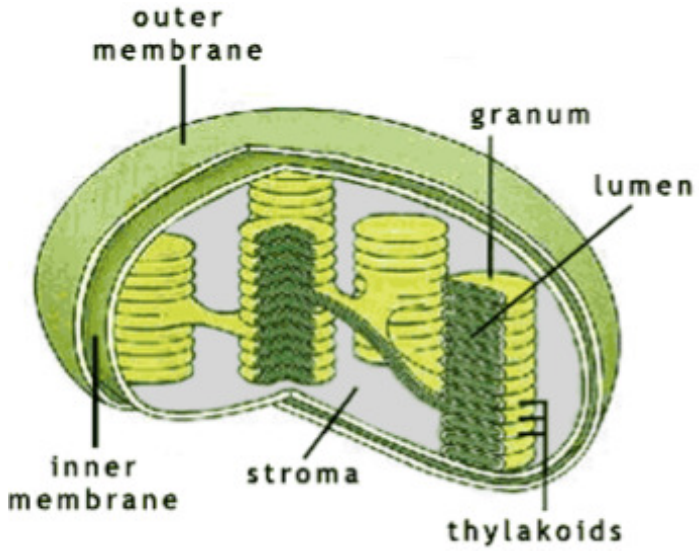
III) The Chloroplast

A) Double membrane-bound organelle that contains photosynthetic pigments and is the site of photosynthesis

B) Contains DNA separate from nucleus and can replicate on its own

C) Interior structure of a chloroplast:

1) Thylakoid: membranous sac within a chloroplast (space inside is called the *lumen*)
   a) light-dependent reactions take place in the membrane of the thylakoid
   b) light-independent reactions take place in the lumen and can occur even after the sun goes down
2) Grana (singular, *granum*): stacks of thylakoids found throughout the chloroplast
3) Stroma: fluid that surrounds the grana

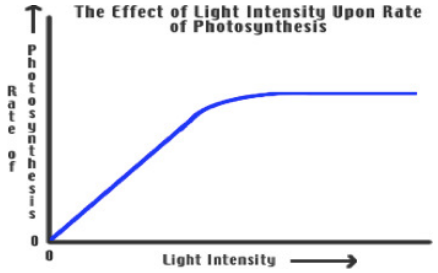


IV) Limiting Factors

A) Light intensity

1) Photosynthesis generally increases as the amount of light increases

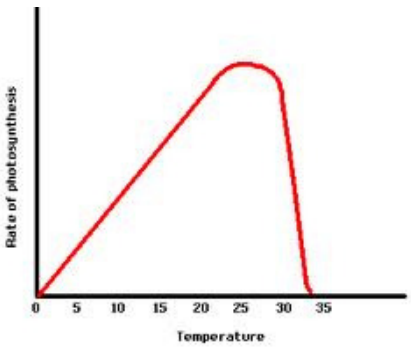
2) Maximum rate is reached when all pigments are being used to absorb light. At this point increasing light energy will no longer increase the rate of photosynthesis.



B) Temperature

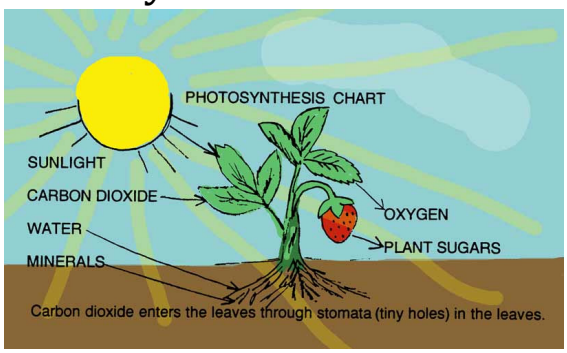
1) Photosynthesis generally increases as the temperature increases

2) There is a point when the temperature is too warm and necessary enzymes are denatured. At this point the rate of photosynthesis decreases dramatically.

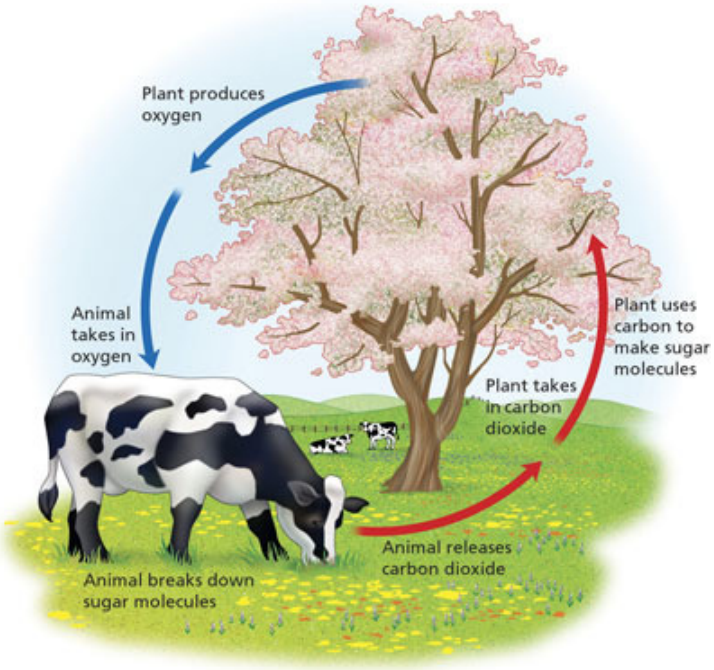


C) Availability of carbon dioxide (CO_2)

1) Carbon dioxide from the atmosphere is necessary to provide the carbon needed for the plant to make carbohydrates.



2) Many organisms (including all animals) release carbon dioxide as a waste product of cellular respiration. The waste products of respiration are the starting materials for photosynthesis, and the waste products of photosynthesis (mainly the oxygen) are necessary for cellular respiration, therefore matter is constantly being cycled between plants and animals.



3) Under appropriate temperature and light conditions, increased concentration of CO_2 will increase the rate of photosynthesis until a maximum rate is reached.