

Equation

$$6\text{CO}_2 + 12\text{H}_2\text{O} + \text{light} \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2 + 6\text{H}_2\text{O}$$

•you should memorize this equation!! you will see it again

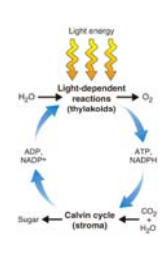
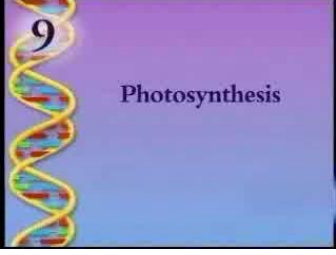
O_2 ← = oxygenic photosynthesis

- ### Steps
- 
- Light strikes leaf
 - Light enters chloroplasts – captured by chlorophyll in grana
 - Inside grana some energy used to split water into hydrogen and oxygen
 - Oxygen released into air
 - Hydrogen taken to the stroma with grana's remaining light energy

- Carbon dioxide enters the leaf and passes into the chloroplast
- Remaining light energy is used to combine hydrogen and carbon dioxide to make carbohydrates
- Energy rich carbohydrates are carried to the plant's cells
- These carbohydrates are used to drive plants life processes

- ### Two Main Stages
- Water molecules are split into hydrogen and oxygen, and oxygen is released into the atmosphere.
 - Hydrogen combines with carbon dioxide to form the carbohydrate glucose.

Video Clip

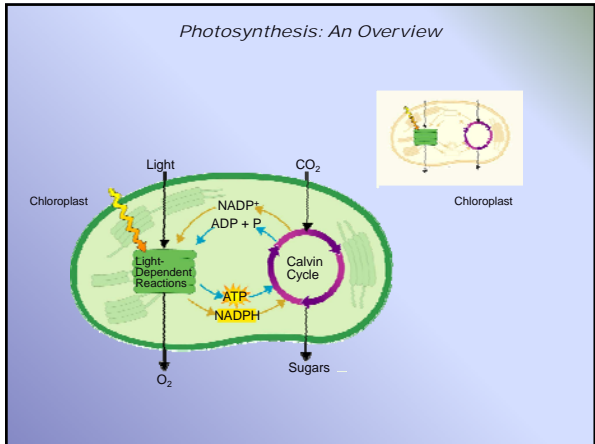



How does photosynthesis work?

2 stages of photosynthesis

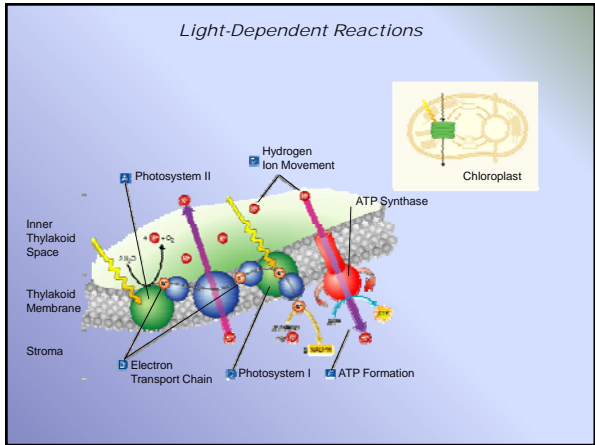
- Light reactions and Dark reactions

- **Light reactions** convert sunlight into chemical energy (ATP + NADPH)
- **Dark reactions** use those products to form sugars (aka: stored chemical energy)



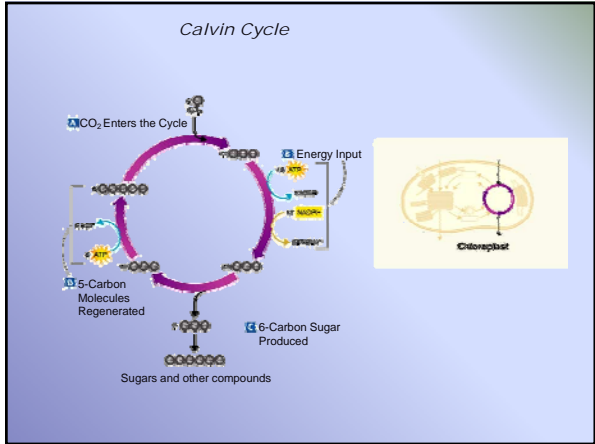
Two Steppin' with Photosynthesis

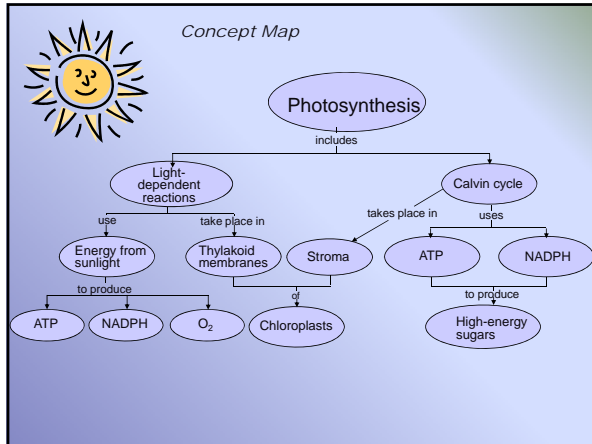
- Light Reactions (**Light Dependent Process**) require the direct energy of light to make energy carrier molecules that are used in the second process.
- Light Reactions occur in the grana



Light Independent Reactions

- (aka Dark Reactions)
- Occurs when the products of the Light Reaction are used to form C-C covalent bonds of carbohydrates.
- The *Dark Reactions* can usually occur in the dark if the energy carriers from the light process are present.
- take place in the **stroma** of the chloroplasts





What produces photosynthesis?

- Prokaryotes**
 - Prokaryotes have both anoxygenic and oxygenic
 - Cyanobacteria have oxygenic
 - Photosynthesis on thylakoids (from plasma membrane)
- Eukaryotes**
 - Oxygenic only
 - Takes place in **chloroplasts**

Factors Affecting Photosynthesis

- Many factors affect the rate at which photosynthesis occurs.
- Because **water** is one of the raw materials of photosynthesis, a shortage of water can slow or even stop photosynthesis.
- Plants that live in dry conditions, such as desert plants and conifers, have a waxy coating on their leaves that reduces water loss.

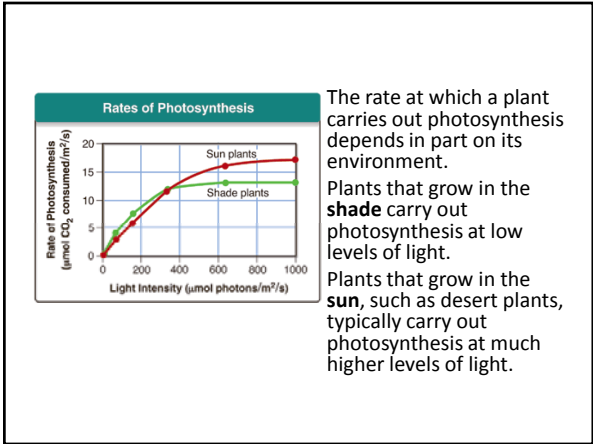
(Prentice Hall)

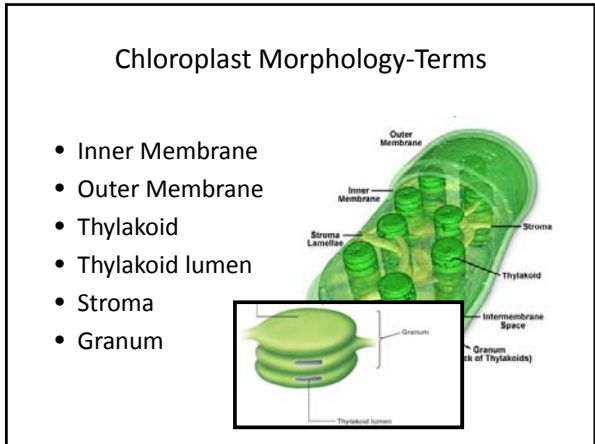
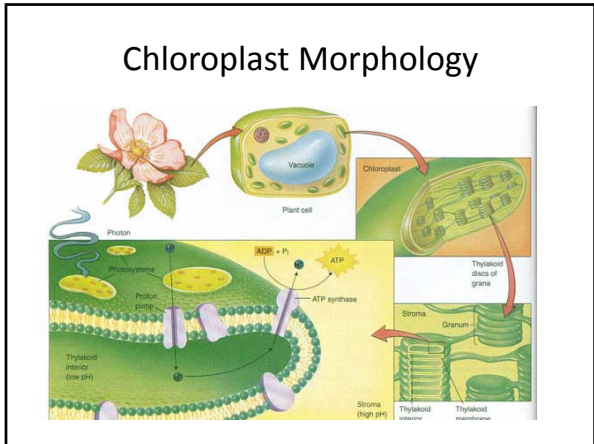
- Temperature is also a factor.
 - Photosynthesis depends on enzymes that function best between 0°C and 35°C.
 - Temperatures above or below this range may damage the enzymes, slowing down the rate of photosynthesis.
 - At very low temperatures, photosynthesis may stop entirely.

(Prentice Hall)

- The intensity of light also affects the rate at which photosynthesis occurs.
 - increasing light intensity increases the rate of photosynthesis.
 - After the light intensity reaches a certain level, however, the plant reaches its maximum rate of photosynthesis.
 - The level at which light intensity no longer affects photosynthesis *varies* from plant type to plant type.

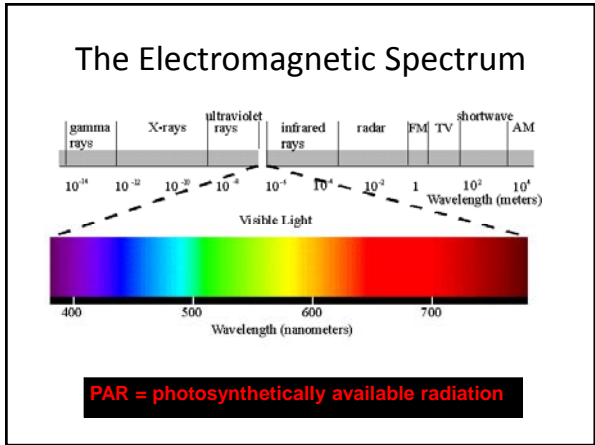
(Prentice Hall)





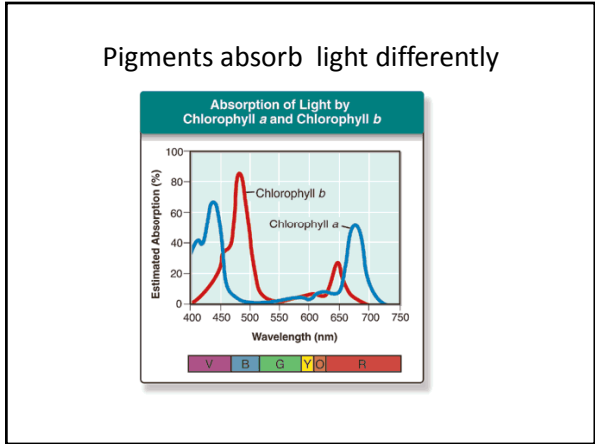
How can light provide energy for plants?

- Light is composed of particles: photons
- Light behaves like a wave
 - Can be described w/ wavelength & frequency
 - Only a small portion of the electromagnetic spectrum.

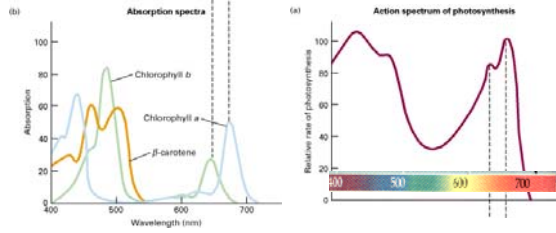


What Are Pigments

- Pigment
 - A light absorbing molecule
 - Associated with the thylakoid membranes
- Chlorophyll
 - Chl **a** and Chl **b** (Chl **c** in some algae)
- Xanthophylls
- Carotenoids
 - β -carotene



Pigments absorb light differently



Why are plants green?

...because they **absorb** all of the colors of the visible spectrum **except** the green color (aka they reflect the green wavelengths).



The screenshot shows a web browser window with a page titled "Photosynthesis". The page has a green background and contains several menu items in a list:

- How Plants Grow
- Gases Involved in Photosynthesis
- The Role of the Leaf in Photosynthesis
- The Function of Glucose in Plant Growth
- The Role of the Root in Photosynthesis
- The Importance of Green Plants in the Environment
- Photosynthesis Quizzes
- Teacher Notes for Photosynthesis

At the bottom right of the page is a "Science Index" button. The browser's address bar shows "http://www.ck12.org/...".