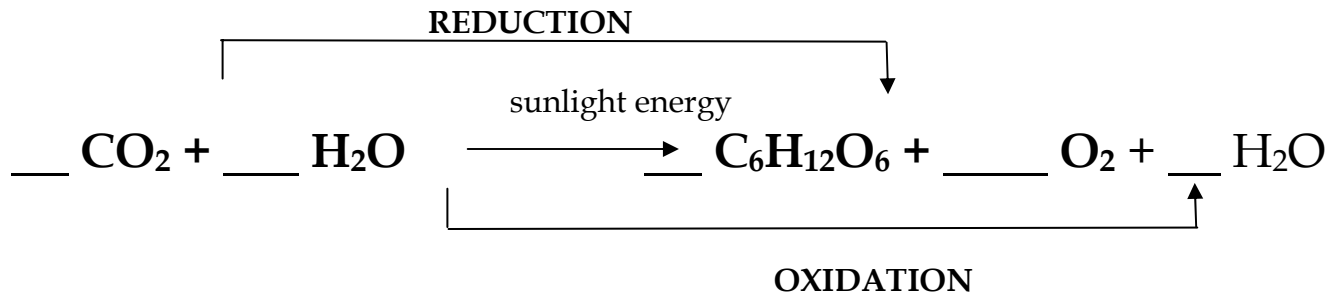


## Biology 20 Photosynthesis

### Photosynthesis:

Chemical equation for photosynthesis: (p. 99)

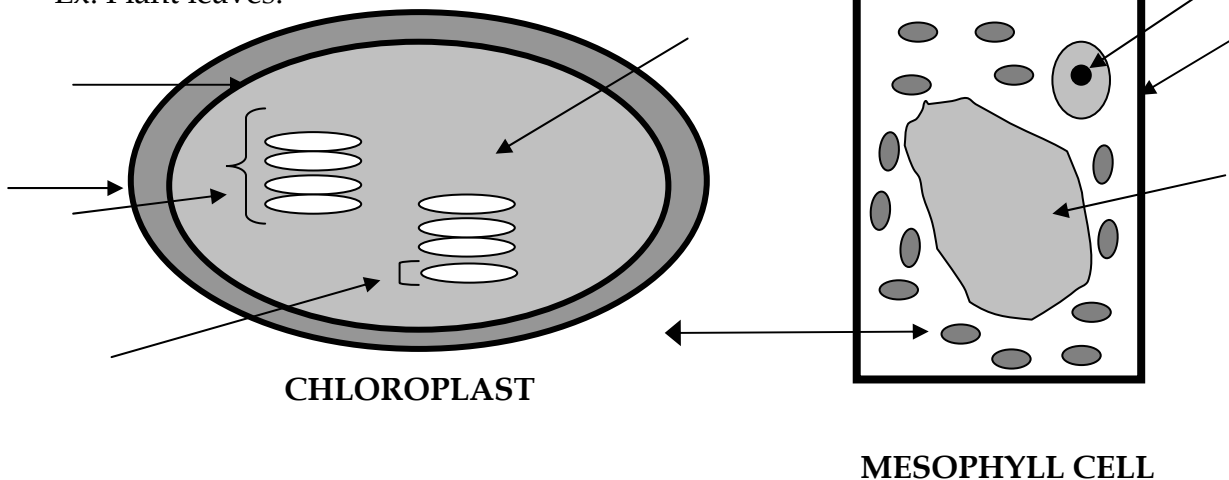


What organisms undergo photosynthesis?

### Autotrophs:

Where does photosynthesis take place? (p. 104, Fig. 6.7)

Ex. Plant leaves:



### Chloroplasts:

#### Components of the chloroplast:

- **Inner & outer membrane** (like the mitochondria)
- **Stroma:**
- **Thylakoid:**
  - Granum (grana):
  - Photosynthetic pigments: a)
  - b)
- **Chlorophyll:**

Why are many plants green in color? (p. 102; Fig. 6.4)

What are the most important colors for chlorophyll a?

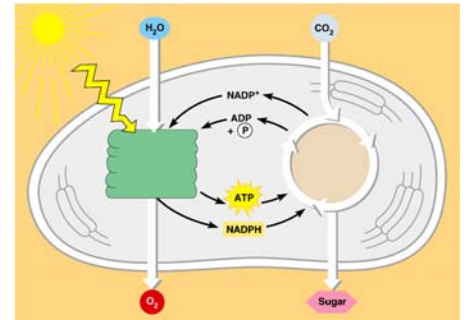
During the fall, why do you see less green, but more reds, oranges & yellows?

How does CO<sub>2</sub> enter and O<sub>2</sub> exit the leaves? (p. 104; Fig. 6.7)

**Overview of photosynthesis:** (p. 105; Fig. 6.9)

**1. Light reaction (light dependent reaction)**

- Occurs:
- Converts:
- Produces energy for the plant:  
Produces \_\_\_\_\_ from the splitting of \_\_\_\_\_.



**2. Calvin cycle (light independent reaction, carbon fixation, dark reaction)**

- Occurs:
- Incorporates \_\_\_\_\_ to produce \_\_\_\_\_.
- Uses the \_\_\_\_\_ & \_\_\_\_\_ from the light reaction
- Does not require light directly

**LIGHT REACTION:**

**Components of a photosystem:** (p. 104; Fig. 6.8)

- **Reaction center:** Chlorophyll a molecule (P700 or P 680)
- **Antenna assemble:**
- **Primary electron acceptor:**

Where do you find a photosystem located in the chloroplast?

**Two types of electron for the production of energy to drive photosynthesis:**

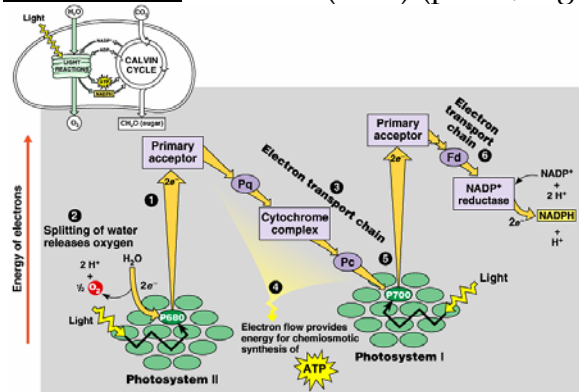
**1) Noncyclic electron flow:** electrons released are not returned to owner (PS II) (p. 106; Fig. 6.10)

Occurs:

Uses both PS II (P 680) & PS I

Uses the ETC

Generates:



**NOTE: OXYGEN comes from the splitting of H<sub>2</sub>O! REMEMBER THIS!!!!**

ATPs are produced via **chemiosmosis**, like in ETC of the mitochondria

What is **Chemiosmosis**? (p. 107; Fig. 6.11)

**Photophosphorylation:**

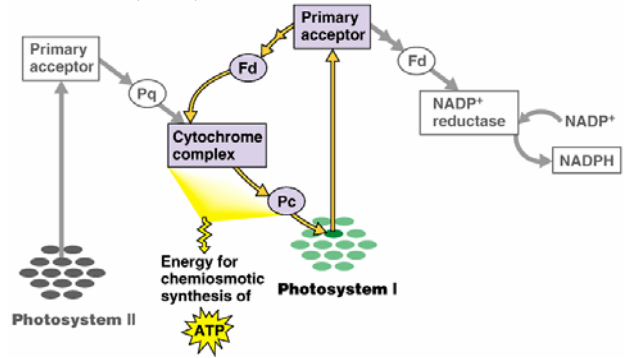
2) **Cyclic electron flow:** electrons released are returned to owner (PS I)

Occurs:

Use only Photosystem I (P700)

Uses the electron transport chain (ETC)

Generates:



**CALVIN CYCLE:** (p. 110; Fig. 6.12)

Occurs:

Energy required:

Uses \_\_\_\_\_ to produce \_\_\_\_\_.

How many CO<sub>2</sub> would it take to make 1 glucose molecule (C<sub>6</sub>H<sub>12</sub>O<sub>6</sub>)?

**Four major steps in the Calvin cycle:**

1) Carbon fixation: each CO<sub>2</sub> is attached to a 5C RuBP (ribulose biphosphate) molecule

2) Use of ATP & NADPH

Amount of energy required? \_\_\_\_\_ ATP & \_\_\_\_\_ NADPH

3) Release of one molecule of G3P, which is a sugar with 3C (referred to as a C3 plant).  
Where have you seen G3P before?

4) Regeneration of RuBP

What is the fate of the sugar that is produced?

## Photorespiration:

Occurs:

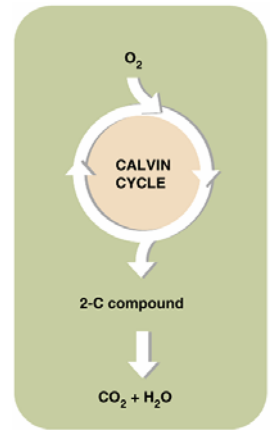
Why does it occur?

What happens when this occurs?

Produces no sugar (unlike photosynthesis)

Produces no ATP (unlike respiration)

Actual products:



## Two adaptations to photorespiration: (p. 113; Fig. 6.14)

1) **C<sub>4</sub> Plants:** alternate form of carbon fixation => 4C compound formed first (organic acid)

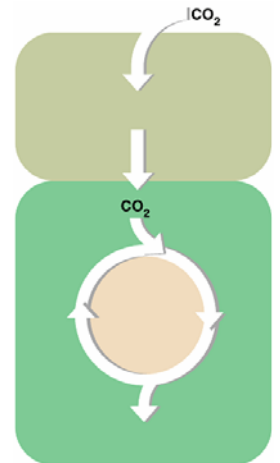
Occurs:

10% of plants, Examples:

Divides carbon fixation spatially (separate areas)

a) Mesophyll cell:

b) Bundle sheath cell:



2) **CAM Plants (crassulacean acid metabolism)** (p. 113; Fig. 6.14):

Occurs:

10% of plants; Examples

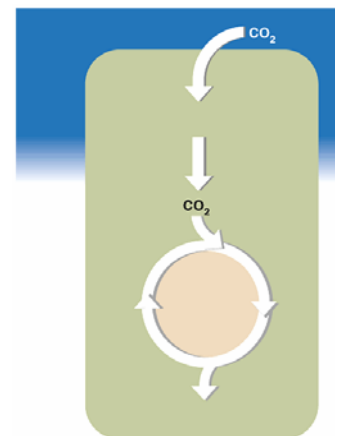
Divides photosynthesis temporally (time)

Stomata closed during the \_\_\_\_\_.

Light reaction occurs & Calvin cycle occurs:

Stomata open during the \_\_\_\_\_.

CO<sub>2</sub> incorporated into organic acids & stored in vacuoles



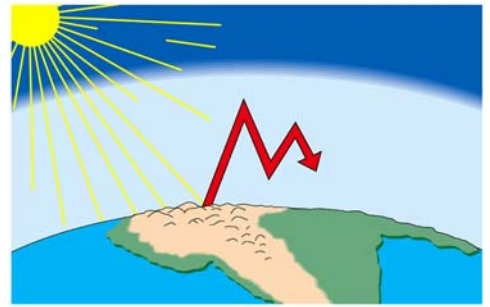
Why would these plants close their stomates during the day?

How are C<sub>4</sub> and CAM plants similar?

How are C<sub>3</sub>, C<sub>4</sub> and CAM plants similar?

What is the **Greenhouse effect**?

What is currently happening to the amount of atmospheric CO<sub>2</sub>?



What role do plants have with the greenhouse effect?

What happens to atmospheric oxygen when it rises, high into the atmosphere?

What is the role of our ozone?

What is happening to our ozone layer?