

PHOTOSYNTHESIS

NOTE to STUDENTS and FACILITATORS: One of the main purposes of the Workshops is to allow free exchange of information by **having each member of a Learning Community in turn answer one part** of a discussion question. As each student explains a term or gives a definition in their own words, it should allow for free verbal EXCHANGE and promote learning by interaction. **Try to insure that everyone in your Learning Community does a question or two and the purpose of the exercise is that they must EXPLAIN THEIR ANSWERS to the rest of the community.**

IN THE GRAND SCHEME:

(Ask one member of your workshop to Fill-in the blanks below and everyone should check the answers.)

FILL-IN: In Photosynthesis plants convert _____ energy of the sun into _____ energy stored in _____ molecules. Plant are _____ organisms that “feed themselves”, in the sense that they make their own organic molecules from _____ raw materials. Some bacteria are _____, which means they use energy from oxidizing inorganic substances to produce organic compounds.

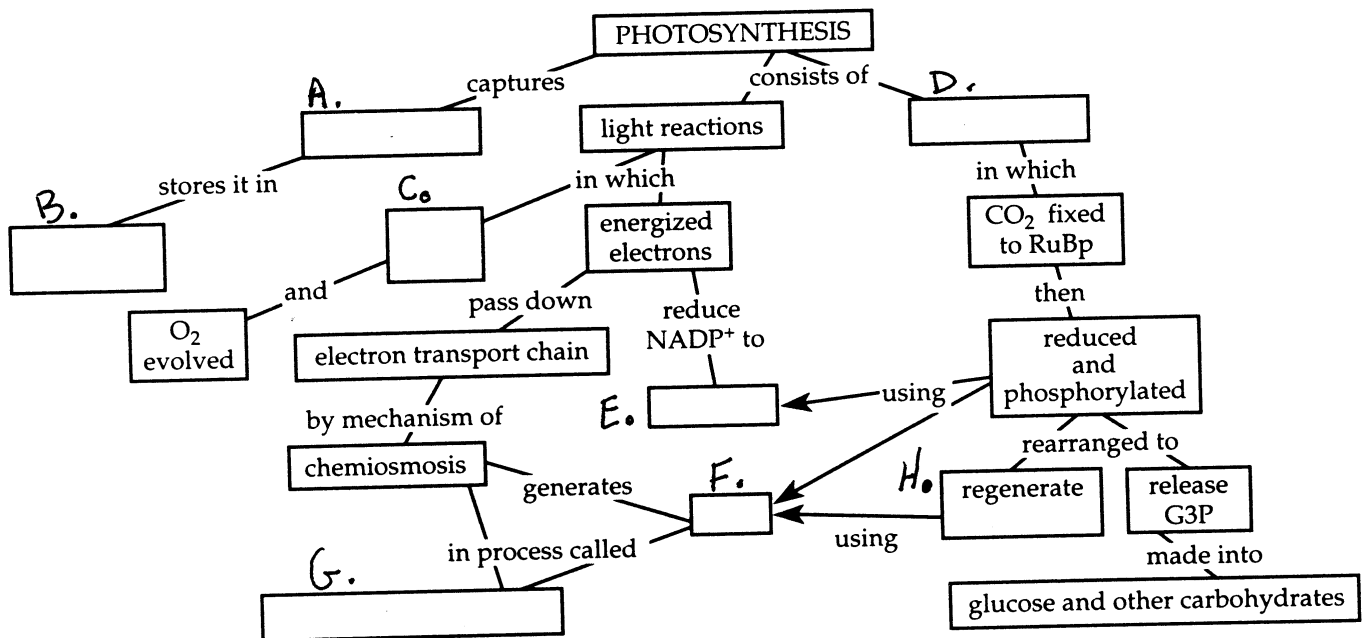
REVIEW:

Have one each member of your Learning Community, in turn, define a KEY TERM given below and tell how it may relate to the concepts of energy and metabolism. As a group, help each other answer any questions concerning any portion of the review section that any person does not understand before proceeding further.

- a) Thylakoid
- b) Chloroplast (Stroma)
- c) Calvin Cycle
- d) Electromagnetic energy
- e) Absorption spectra
- f) PEP Carboxylase
- g) CAM Plant
- h) Photosystem
- i) Cyclic electron flow
- j) Photorespiration
- k) Plastoquinone

CONCEPT MAPS:

Have one member each in turn fill in the following concept map that summarizes this section on Photosynthesis.

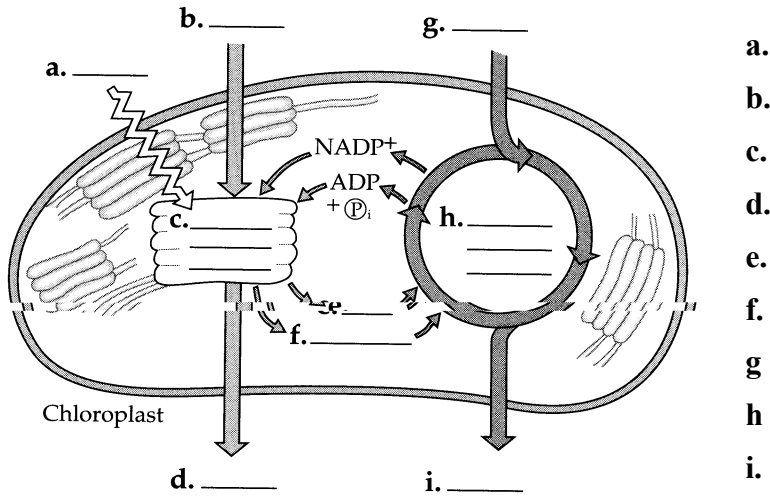


SOME MORE FILL-IN THE BLANKS:

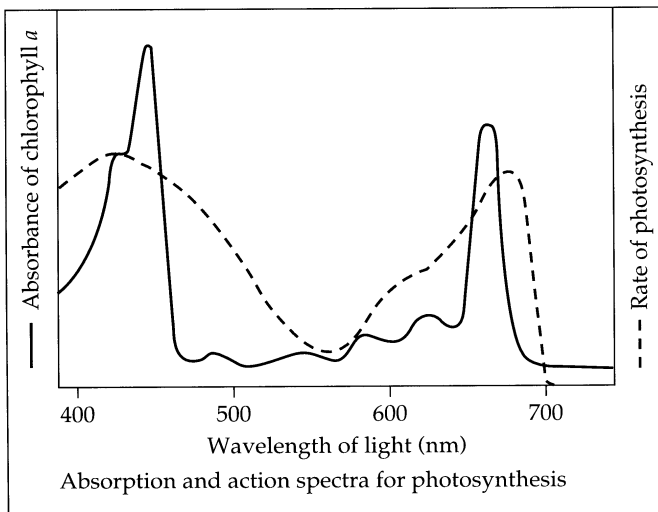
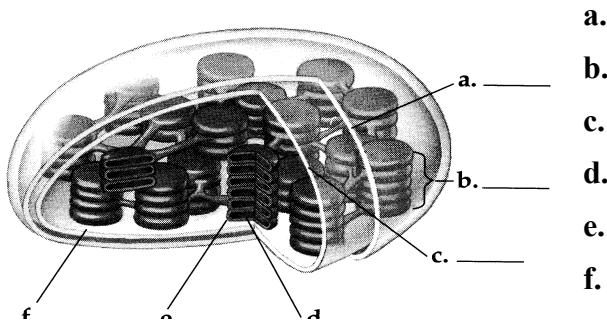
Chloroplasts are found primarily in the _____ tissues of a leaf, and contain the pigments _____, _____, _____. The gases _____ and _____ enter and leave the leaf through _____. Veins carry water from the roots to the leaves and distribute _____ made in the leaf to other non-photosynthetic tissues.

LABEL IDENTIFICATIONS:

1. Fill in the blanks in this overview of photosynthesis in a chloroplast.



2. Label the indicated parts in this diagram of the chloroplast.



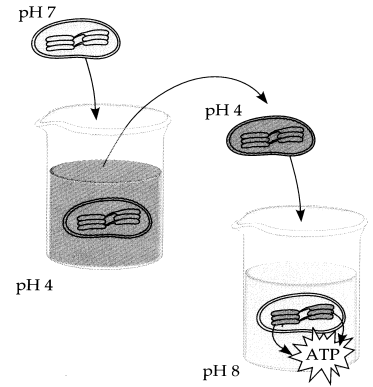
3. Label the **absorption spectra** and the **action spectra** in the graph to the left.

What is the difference between these two types of spectra?

On this plot draw an action spectra for rhodopsin, a human visual pigment.

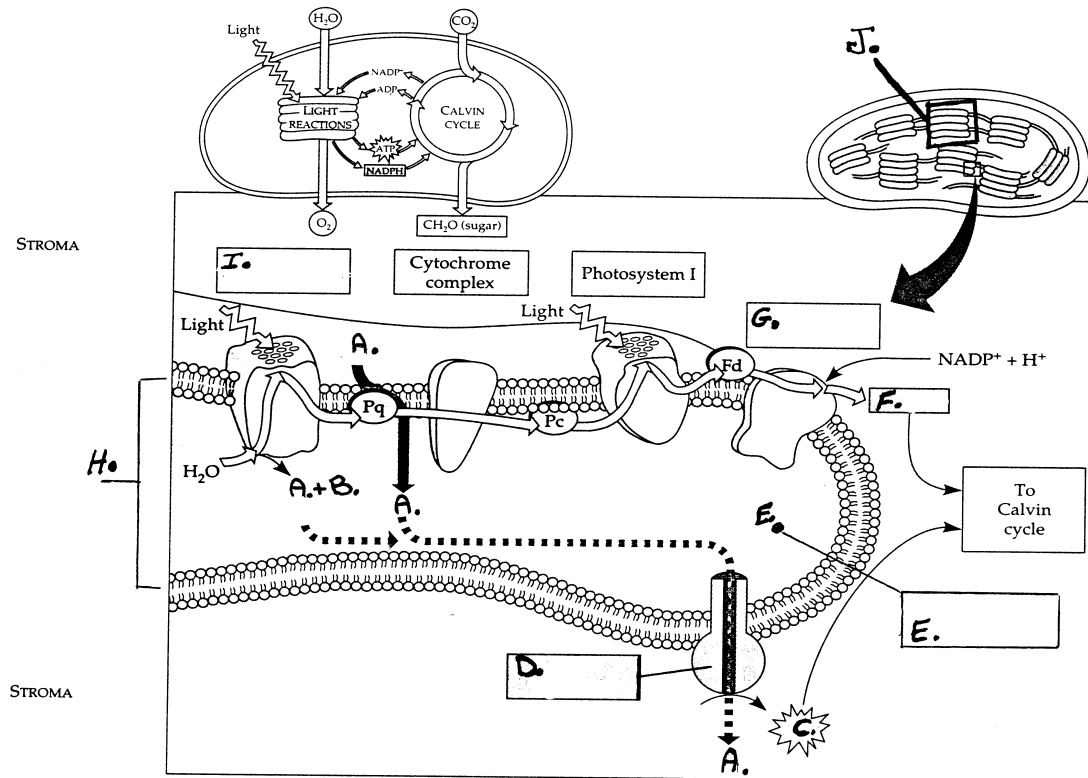
SOME INTERACTIVE THOUGHT QUESTIONS...

1. Why is no oxygen generated by cyclic electron flow?
2. During chemiosmosis in chloroplasts the proton gradient across the membranes is as great as 1.0 to 2.0 pH units. Name the side of the membrane with the lowest pH?
3. What possible explanation is there for photorespiration, a process that can result in the loss of as much as 50% of the carbon dioxide reduced in the Calvin Cycle?
4. Exactly where does the Calvin Cycle take place in C₄ plants?
5. In the figure to the right the isolated chloroplasts were first allowed to equilibrate in an acidic solution at pH 4.0. After the chloroplast's thylakoid compartments reached a pH of 4.0, the chloroplasts were collected and transferred to a basic solution at pH 8.0. This caused the chloroplasts to make ATP, even if placed in the dark. Explain?



ELECTRON FLOW IN THYLAKOID MEMBRANES:

Label the diagram below (a. to i.) with the molecules & components of electron flow in photosynthesis.



- a.
- b.
- c.
- d.
- e.
- f.
- g.
- h.
- i.

DARK REACTIONS OF PHOTOSYNTHESIS:

A little easier this time. Using the following terms to complete the diagram of the Calvin Cycle given below. A term may be used more than once.

1. $\text{ATP} \rightarrow \text{ADP} + \text{P}_i$

2. CO_2

3. glucose and other sugars

4. $\text{NADPH} \rightarrow \text{NADP}^+$

5. PGA

6. RuBP

