

IN THE GRAND SCHEME (Fill-in some blanks)

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.

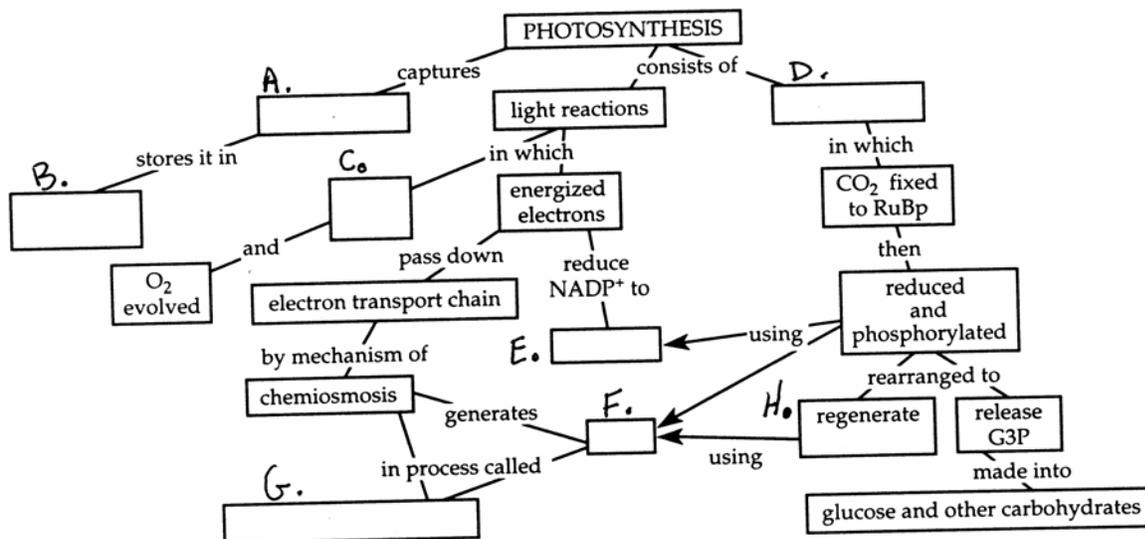
FOR REVIEW

Have each member of your Learning Community, in turn, define the KEY TERMS 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              | i) Photosystem          |
| b) Stroma                 | j) Cyclic electron flow |
| c) Calvin Cycle           | k) Chemiosmosis         |
| d) Electromagnetic energy | l) Phosphorescence      |
| e) Absorption spectra     | m) Photorespiration     |
| f) PEP Carboxylase        | n) Phycobilin           |
| g) Pigment                | o) Plastoquinone        |
| h) CAM Plant              |                         |

CONCEPT MAPS

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

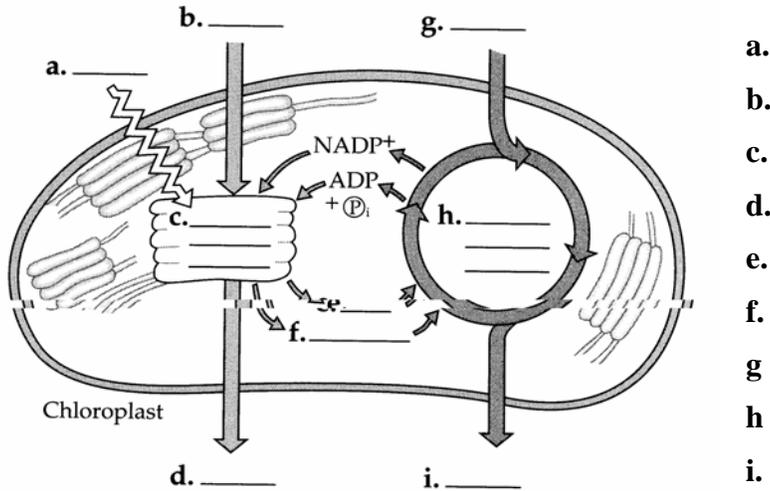


MORE FILL-IN THE BLANKS

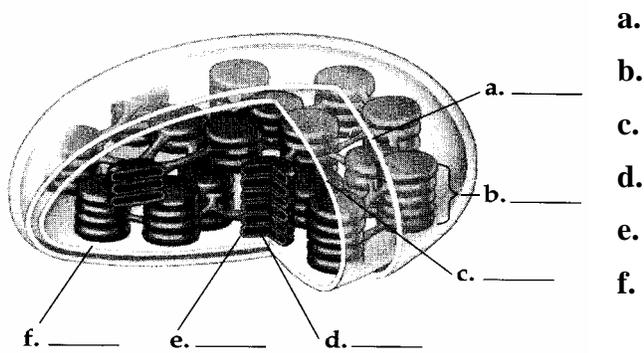
Chloroplasts are found primarily in the \_\_\_\_\_ tissues of a leaf, and contain the pigments \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_. The gases \_\_\_\_\_ and \_\_\_\_\_ enter and leave the leaf through \_\_\_\_\_. Veins carry water from the roots to the leaves and distribute \_\_\_\_\_ made in the leaf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

**LABEL IDENTIFICATIONS...**

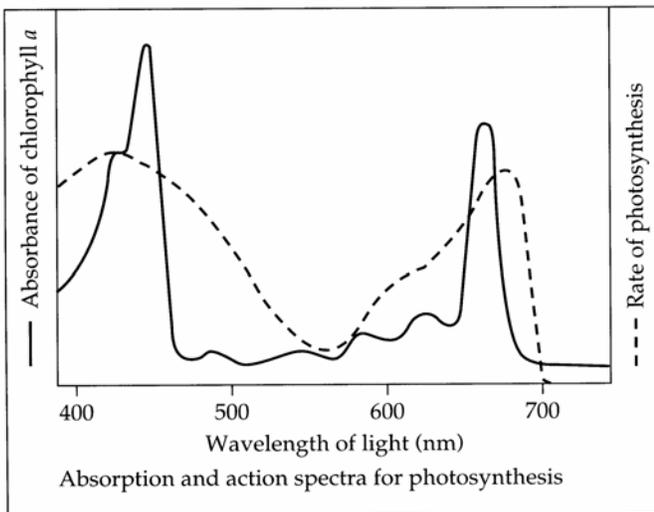
1. Fill in the blanks in this overview of photosynthesis in a chloroplast.



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



C. Label the absorption spectra and the action spectra in the graph to the left.

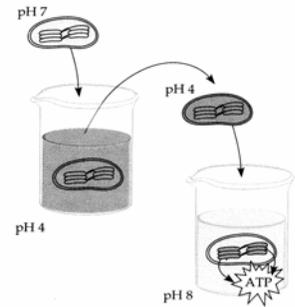


What is the difference between these two types of spectra?

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

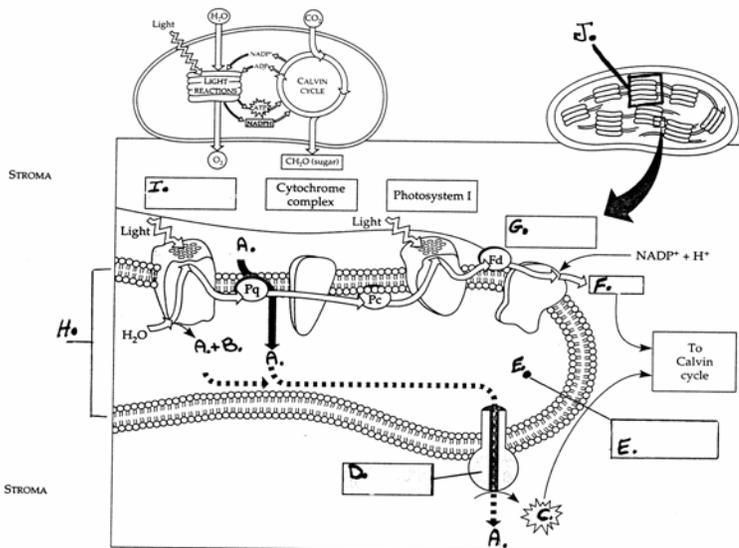
SOME INTERACTIVE THOUGHT QUESTIONS...

1. Why is no oxygen generated by cyclic electron flow?
2. Where do the electrons from P<sub>700</sub> go during non-cyclic electron flow?
3. 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?
4. Name 3 things which contribute to the formation of a large pH difference across thylakoid membranes?
5. 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?
6. Exactly where does the Calvin Cycle take place in C<sub>4</sub> plants?
7. Why are C<sub>4</sub> plants able to photosynthesize in arid, dry conditions, while C<sub>3</sub> plants would be undergoing Photorespiration?
8. 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.



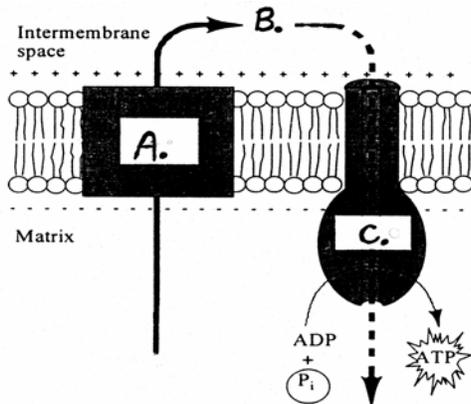
- a.
- b.
- c.
- d.
- e.
- f.
- g.
- h.
- i.

A PROBLEM: Given the following data:

1. the maximum rate of photosynthesis of green plants is about  $20 \text{ mg glu/dm}^{-2}/\text{hr}^{-1}$
2. the heat of combustion of glucose is  $686 \text{ Kc/mole}$
3. the gram molecular weight of glucose is  $180 \text{ gm}$ ,

How much energy, in Kcal/mole, could theoretically be made over a 18 hr lighted period, by a green plant, which has a leaf surface area of  $2000 \text{ dm}^{-2}$ .

CHEMIOSMOSIS AGAIN..... Questions a. to f. use the figure on the left.



- a. What is the molecule at label B. is figure to the left?
- b. What is the name of the system identified by label A?
- c. What is label C. identifying ?
- d. What is the name of the cellular process identified by the labels A., B., & C.?  
1. in photosynthesis? 2. in mitochondria
- e. What is the name of the space labeled D.  
1. in the chloroplast 2. in the mitochondria
- f. What is the name of the space labeled E.  
1. in the chloroplast 2. in the mitochondria

### 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.  $\text{CO}_2$
3. glucose and other sugars
4.  $\text{NADPH} \rightarrow \text{NADP}^+$
5. PGA
6. RuBP

