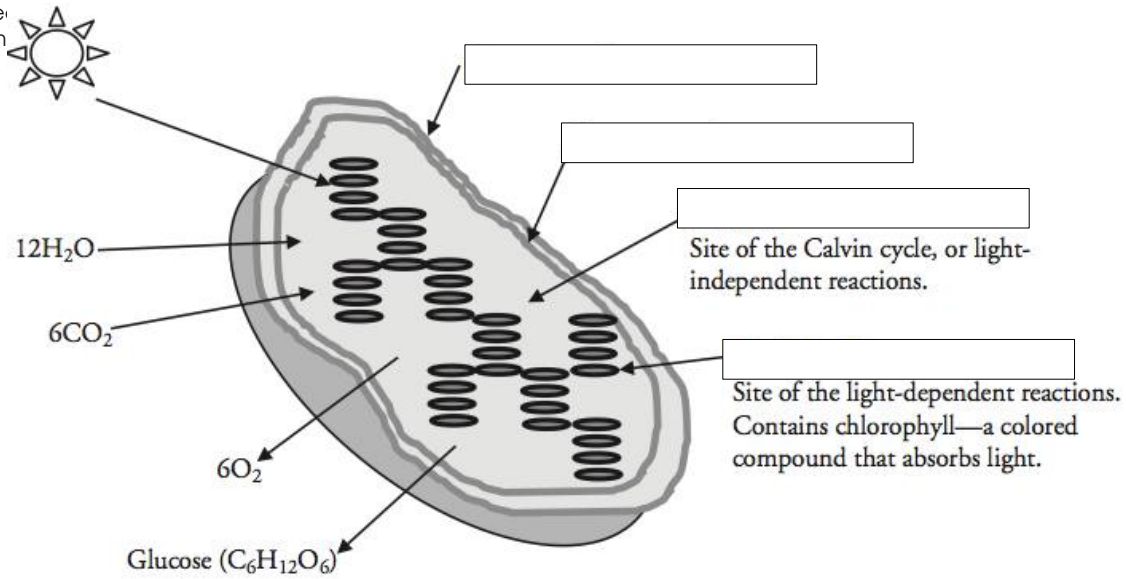
Name: _____ Date: _____ Per: _____

Photosynthesis Review (Remember Cells Unit test is Wednesday October 9)

Study Guides are the 4 packets that go over:
[1] Cell size (surface area), [2] The Plasma membrane [3]Enzymes & Respiration and this one [4] Photosynthesis Review

How do light-dependent and light-independent reactions provide food for a plant?

Plants are the original solar panels. Through photosynthesis a plant is able to convert electromagnetic (light) energy into chemical energy. This energy is used not only to ke
photosynthetic algae are also th
renewable energy resource.



1. Label the above organelles, What is it called?

2. What compound necessary for photosynthesis is contained in the thylakoids?

3. What is the equation for Photosynthesis?

4. What substances are the *reactants* in photosynthesis?

5. What is the energy source for photosynthesis?

6. Photosynthesis occurs in two parts—the light-dependent reactions and the light-independent Reactions.
a. In what part of the chloroplast do the light-dependent reactions occur?

b. In what part of the chloroplast do the light-independent reactions occur?

7. What substances are *produced* during photosynthesis?

8. Why is it necessary to have six CO_2 entering the chloroplast?

Referring to picture to the right

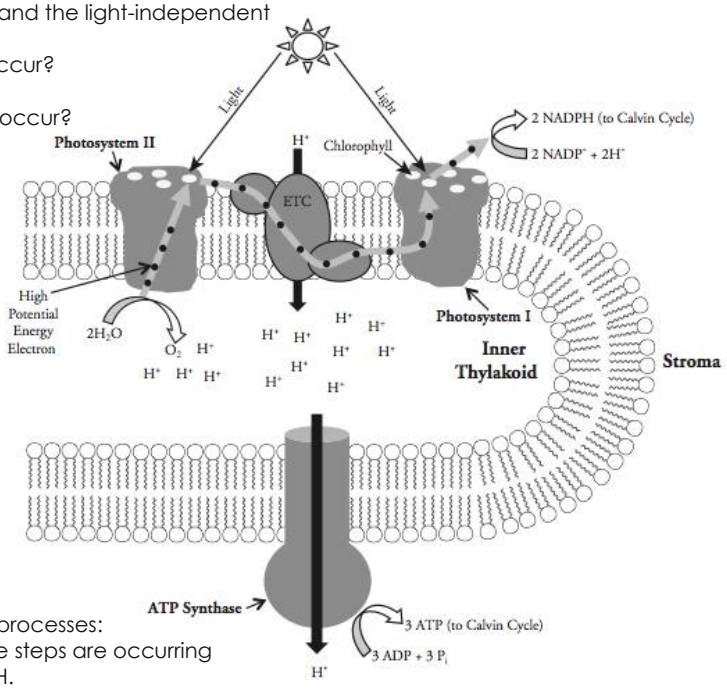
9. What stage of photosynthesis is depicted?

10. What shape or symbol represents a single electron?

11. In what two places are electrons released from chlorophyll by a photon of light coming from the Sun?

12. Where are electrons released from water molecules?

13. When the electrons are released from water molecules, what other products are formed?



The light-dependent reactions of photosynthesis include three major processes:
Label the **diagram** with "A," "B," and "C" to indicate where the three steps are occurring
A. Excited electrons leave chlorophyll and reduce NADP+ into NADPH.
B. Excited electrons moving through the electron transport chain provide the free energy needed to pump hydrogen ions into the inner thylakoid.
C. Hydrogen ions flowing out of the thylakoid via a protein channel provide the free energy needed to convert ADP to ATP.

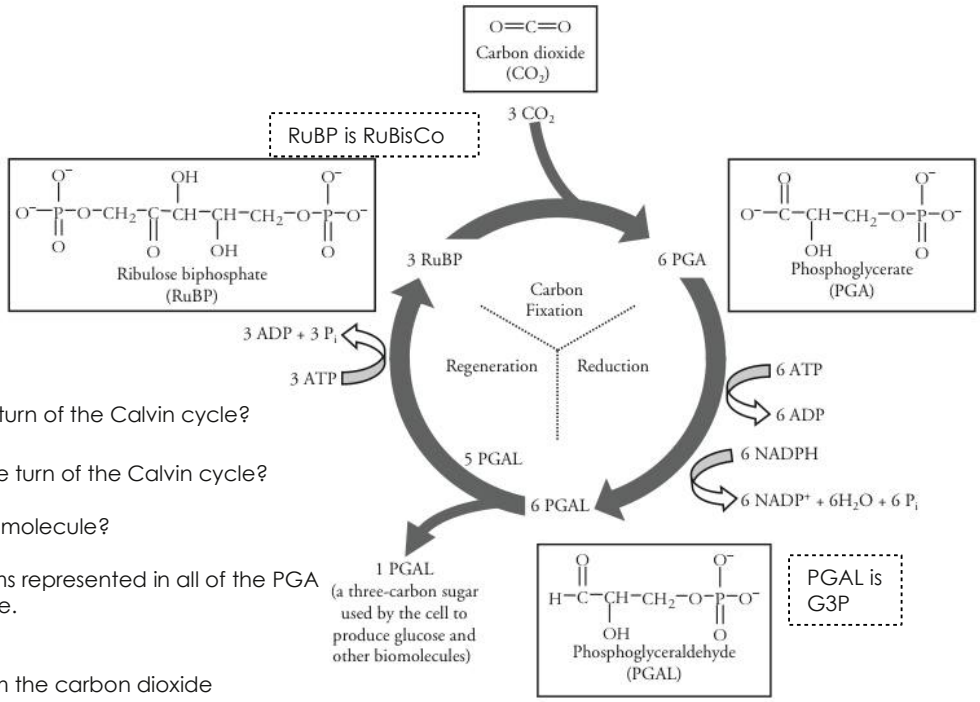
14. Referring to the diagram
a. Name the embedded protein complex found in the thylakoid membrane that uses excited electrons to reduce NADP+ into NADPH.

b. Name the embedded protein complex found in the thylakoid membrane that provides excited electrons to the electron transport chain.

c. Name the embedded protein complex found in the thylakoid membrane that converts ADP to ATP using free energy from a flow of hydrogen ions.

15. Where do the ATP and NADPH produced during the light-dependent reactions go when the process is complete?

16. What is the diagram to the right?
what are the three phases of this process?



17. Find the compound ribulose biphosphate (RuBP), How many RuBP molecules are used in one turn of the Calvin cycle?

18. Ribulose biphosphate (RuBP) combines with carbon dioxide (CO2) to form phosphoglycerate (PGA) during the carbon fixation phase of the Calvin cycle.
a. How many CO_2 molecules are used in one turn of the Calvin cycle?

b. How many PGA molecules are made in one turn of the Calvin cycle?

c. How many carbon atoms are in each PGA molecule?

d. Calculate the total number of carbon atoms represented in all of the PGA molecules used in one turn of the Calvin cycle.

19. What happened to the carbon atoms from the carbon dioxide molecules that entered the Calvin cycle?

Read This!
The diagram above is a simplified version of the Calvin cycle. Each of the three phases in the cycle consist of multiple reactions that are catalyzed by enzymes specific to that reaction. These enzymes have names like RuBisCo, phosphoglycerate kinase, and PGAL hydrogenase.
20. Refer to the reduction phase of the Calvin cycle
a. What molecule does the PGA molecule turn into during this phase of the Calvin cycle?

b. Describe specifically how the structures of the two molecules are different.

c. Identify the types and numbers of molecules that provide the free **energy** necessary for the reduction of the PGA molecules.

Read This!
As you have learned from your careful study of the Calvin cycle illustrated in Model 3, three atoms of car- bon enter the cycle as carbon dioxide and three carbon atoms leave the cycle as PGAL (G3P). It is easy to assume that the three atoms that leave are one and the same with the three that entered, but that is incorrect. It may be that none of the carbon atoms from the carbon dioxide become incorporated into a molecule of PGAL (G3P) that leaves the cycle. Alternatively, it is also possible that one of the carbon atoms from the carbon dioxide will become part of a PGAL (G3P) molecule that leaves the cycle. Eventually all of the carbon atoms that enter the cycle will leave as part of a PGAL (G3P)molecule, but they must wait their turn.

21 The equation for photosynthesis shows glucose (C6H12O6) as a product of photosynthesis.
a. How many PGAL molecules will it take to make one molecule of glucose?

b. How many turns of the Calvin cycle will it take to make one molecule of glucose?

c. Calculate the total number of ATP and NADPH molecules used in the production of one molecule of glucose.

22. Explain how the two reactions (light-dependent and light- independent) depend on each other.

23. Under each molecule in the equation below, indicate whether it is involved (either used or produced) in the light-dependent reactions or the Calvin cycle.

$$6CO_2 + 12H_2O \rightarrow C_6H_{12}O_6 + 6O_2 + 6H_2O$$

24. Throughout photosynthesis, energy is transferred from light to several molecules with increasingly higher potential energy. Use the words below to summarize the order in which the energy flow occurs.

electrons ATP glucose sunlight