

Advisement Teacher & Room # \_\_\_\_\_

Student Name \_\_\_\_\_ Tutor: \_\_\_\_\_

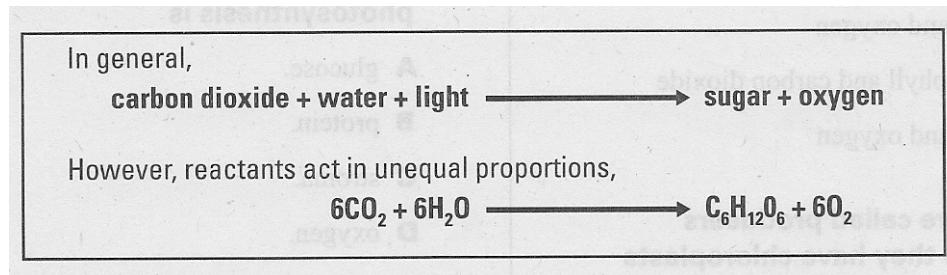
## Biology Tutorial #8

Biology Teacher's Name \_\_\_\_\_ Period \_\_\_\_\_

CA State Standard 1f – Students know usable energy is captured from sunlight by chloroplasts and is stored through the synthesis of sugar from carbon dioxide.

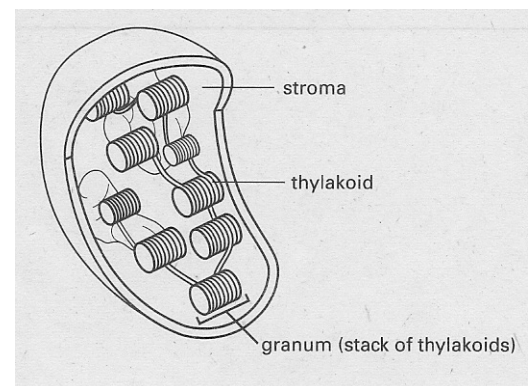
### WHAT IS PHOTOSYNTHESIS?

**Photosynthesis** is a process that uses energy absorbed from visible light to produce carbohydrate molecules, or sugars. The process requires water and carbon dioxide (CO<sub>2</sub>), and it releases oxygen (O<sub>2</sub>) as it forms sugars that store chemical energy. Plants, some bacteria, and some protists can carry out photosynthesis. Photosynthesis allows these organisms to meet their energy needs by making their own food.



### WHERE DOES PHOTOSYNTHESIS TAKE PLACE?

In plants photosynthesis takes place in **chloroplasts**, shown in the diagram. Chloroplasts contain membrane-bound compartments called **thylakoids**. The stroma is the fluid inside a chloroplast, but outside of the stacks of thylakoids, called grana. Parts of photosynthesis take place in the stroma, and parts in the thylakoids, which contain chlorophyll. Chlorophyll is the main light-absorbing pigment in chloroplasts,



### WHAT REACTIONS ARE NECESSARY FOR PHOTOSYNTHESIS?

Photosynthesis has two stages.

The first is a series of **light-Dependent reactions**, which capture some of the energy in sunlight. In these reactions, light energy is absorbed by chlorophyll, and then transferred along the **thylakoid membrane**. Water is also broken down into hydrogen ions, electrons, and O<sub>2</sub>. The hydrogen ions are used to drive adenosine triphosphate (ATP) production. Energy from electrons is used in the transport of hydrogen ions, and electrons are eventually transferred to a molecule called NADP to make a molecule called NADPH. NADPH is a molecule that, along with ATP, transfers energy to the second stage of photosynthesis.

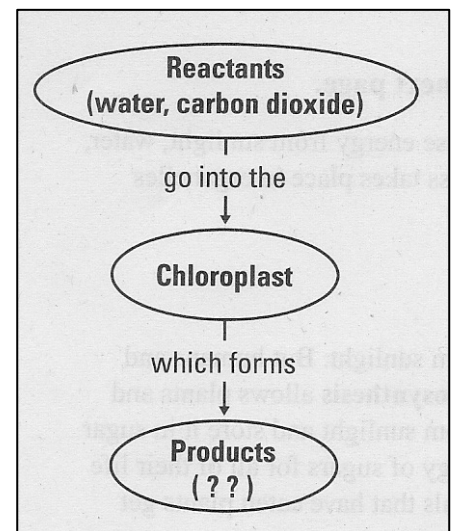
The second stage is a series of reactions that **occur in the stroma** and can take place without light. These are the **light-Independent reactions**, which include the **Calvin cycle**. These reactions use energy from the ATP and NADPH produced during the light-dependent reactions and CO<sub>2</sub> from the atmosphere. Through the chemical reactions of the Calvin cycle, sugars are built.

Overall, the process of photosynthesis uses six molecules of CO<sub>2</sub> and six molecules of water in combination with light to produce six molecules of O<sub>2</sub> and one simple sugar, such as glucose.

Complete the questions that follow:

1. Describe the structure of a chloroplast:
2. What are the products of photosynthesis?

3. Where do light-Dependent reactions take place?
4. Where do light-Independent reactions take place?
5. For which stage of photosynthesis is Water necessary?
6. For which stage of photosynthesis is CO<sub>2</sub> necessary?
7. What is the overall function or purpose of photosynthesis?
8. The diagram on the right illustrates photosynthesis occurring within a chloroplast. What products are formed by photosynthesis?
  - a) carbon dioxide and energy
  - b) water and oxygen
  - c) chlorophyll and carbon dioxide
  - d) sugar and oxygen



9. Plants are called producers because they have chloroplasts that
  - a) release energy from sugars.
  - b) produce heat needed to keep the plant warm.
  - c) use energy from sunlight to produce the plant's own food.
  - d) use oxygen to make water.
10. Which of the following is a true statement about how plants interact with their environment during photosynthesis?
  - a) They remove carbon dioxide from the atmosphere.
  - b) They reflect all of the energy in sunlight into the atmosphere.
  - c) They release water into the atmosphere.
  - d) They take oxygen out of the atmosphere.
11. During photosynthesis, plants use chloroplasts to convert energy in sunlight into a food source that organisms can use. The food source that is produced during photosynthesis is
  - a) glucose
  - b) protein
  - c) stroma
  - d) oxygen.
12. Which of the following *best* describes the function of photosynthesis?
  - a) to release energy from sugar into the atmosphere
  - b) to convert energy from sunlight into the stored chemical energy of sugar
  - c) to produce water for plants to use in photosynthesis
  - d) to dispose of carbon dioxide that builds up by digesting food