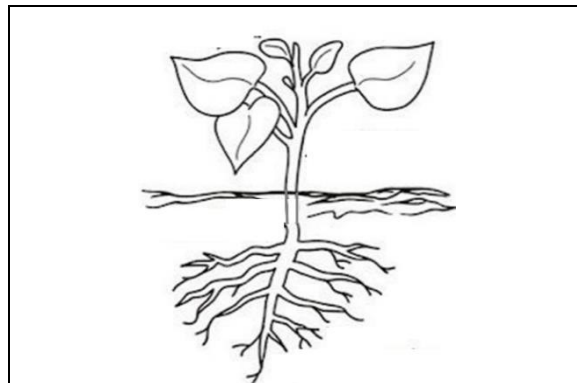


Using Models to Understand Photosynthesis¹

1a. Add to this drawing to show what you already know about:

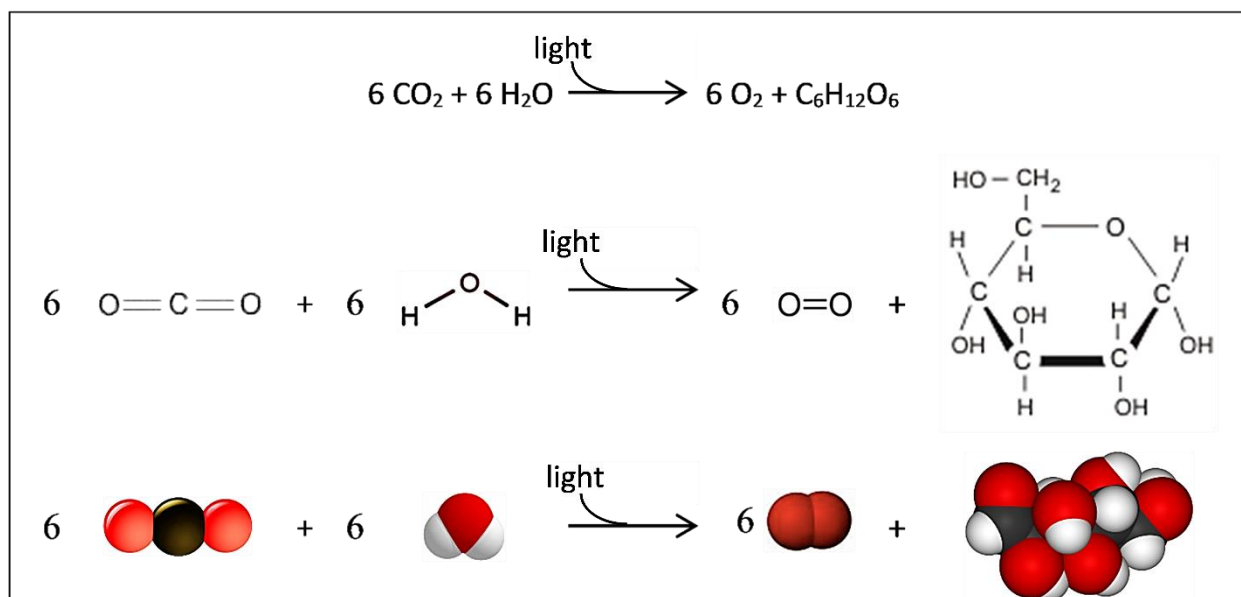
- the inputs needed for photosynthesis
- the outputs produced by photosynthesis.

1b. What do you already know about why plants need to carry out photosynthesis?



To learn more about photosynthesis, you will analyze three different scientific models of photosynthesis. A **scientific model** is a simplified representation of reality that highlights some key features of a process such as photosynthesis.

One model of photosynthesis is a chemical equation that summarizes the inputs and outputs of photosynthesis. This figure shows three different versions of the chemical equation that summarizes photosynthesis.



2a. Circle each of the three different representations of the sugar glucose.

2b. Why is photosynthesis a good name for this process?

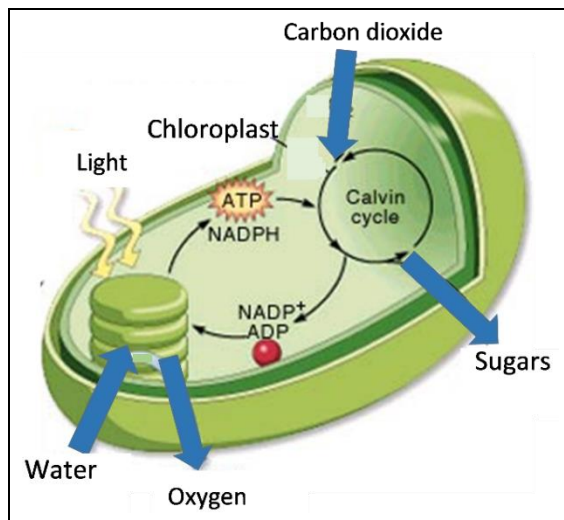
3. Plant cells use the sugar molecules produced by photosynthesis for two purposes. Some of the sugar molecules are used to synthesize other organic molecules like amino acids and cellulose so the plant can grow. Other sugar molecules and oxygen are used for _____ to make _____ which provides the energy for many biological processes.

¹ By Dr. Ingrid Waldron, Dept Biology, Univ Pennsylvania, © 2023. This Student Handout (can be copied for classroom use) and Teacher Notes (with background information and instructional suggestions) are available at <https://serendipstudio.org/exchange/bioactivities/modelphoto>.

Photosynthesis takes place in **chloroplasts** inside leaf cells. This simplified diagram of a chloroplast is another model of photosynthesis.

Photosynthesis includes many steps. The two main groups of steps in photosynthesis are:

- the **light-dependent reactions**, which convert light energy to chemical energy
- the **Calvin cycle**, which uses chemical energy, CO₂ molecules, and H atoms to synthesize sugar molecules.



7a. Inside the chloroplast, **chlorophyll** molecules absorb light and help to convert light energy to chemical energy. Put an * in the chloroplast diagram to show where chlorophyll molecules should be located to accomplish their function.

7b. Circle the molecules that carry chemical energy and hydrogen atoms from the light-dependent reactions to the Calvin cycle.

8. Suppose that a chloroplast lacked the enzymes needed for the chemical reactions in the Calvin cycle. Could this chloroplast produce sugars when it receives the inputs for photosynthesis (light, water and carbon dioxide)? yes ___ no ___ Explain why or why not.

9a. What are some basic features of photosynthesis that are shown in all three models presented in this activity – the chemical equation on page 1, the energy and matter flowchart on page 2, and the chloroplast diagram on this page?

9b. Different types of models have different advantages for understanding photosynthesis. In the table below, describe the advantages of each type of model. How does this type of model contribute to your understanding of photosynthesis?

Advantages of the chemical equation	
Advantages of the energy and matter flowchart	
Advantages of the chloroplast diagram	