STUDENT GUIDE

Photosynthesis

Background

The word photosynthesis can be broken down to its Greek origin: **synthesis** “put together to form something new” and **photo** “light.” So the Greek origin of the word photosynthesis means “put together to form something new from light.” This amazing process of forming something new from light, photosynthesis, is what sustains life on Earth.

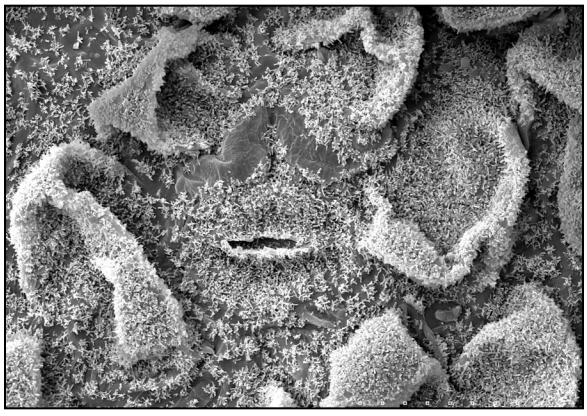
The most important aspect of photosynthesis is that radiant energy (from the Sun) transforms to chemical energy. The chemical energy is stored in the plant as sugar and is available as food. The leaves of plants contain everything needed to absorb the rays of the Sun and start photosynthesis. This interaction between radiant energy from the Sun and matter (carbon dioxide and water) causes a chemical reaction with the result of the formation of different matter (sugar and oxygen). The radiant energy absorbed by the plant is transformed during the process of photosynthesis and is stored within the newly formed sugar as chemical energy in the plant. Fortunately for us, oxygen is also released to the atmosphere during this process.

How a plant actually accomplishes this transformation is still a mystery as scientists are not able to recreate the natural process of photosynthesis using man made materials. However, what happens to the beginning substances (the reactants) and resulting substances (the products) during photosynthesis is understood, can be measured, and can be easily represented using models.

In this activity, you model the process of photosynthesis to see what happens to elements and compounds of the reactants and products as radiant energy is transformed to chemical energy. Answer the background questions in your *Student Journal* and then begin Part I.

Part I: The Reactants

The reactants must be present and available to the plant for photosynthesis to occur. Carbon dioxide is in the atmosphere and enters the plant through structures in the leaf called stomata. Water is absorbed by the plant’s roots.



A leaf magnified 800 times in a electron microscope the breathing structures of the leaf (stoma) are in the center of the picture.

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Part I: The Reactants, continued

1. Obtain 12 plastic chips labeled H, six plastic chips labeled C, and 18 plastic chips labeled O and the reactants page of photosynthesis.
2. The plastic chips represent atoms of hydrogen, carbon, and oxygen.
3. Use these atom models to build and represent water and carbon dioxide on the Reactant of Photosynthesis page. Place a stack of atom chips on each circle to represent the substance.
4. Answer the questions for Part I in your *Student Journal.*

Part II: Energy Transformations

Leaves absorb radiant energy from the Sun and can be thought of as a solar energy collectors. A leaf contains a pigment called chlorophyll. Chlorophyll gives a plant its green color and takes part in the action of transforming radiant energy to chemical energy. During photosynthesis, chlorophyll absorbs radiant energy and transforms it to chemical energy when water and carbon dioxide react. The reaction produces combinations of atoms with usable chemical energy stored within these newly formed substances of sugar and oxygen.

1. Place your Energy Transformation through Photosynthesis page directly to the right of the Reactants page.
2. Sweep all of the atoms of the reactants into one big messy pile on the energy transformation arrow.
3. Answer questions for Part II in your *Student Journal*.

Part III: The Products

The sugar formed as a result of photosynthesis is called glucose. The product glucose is a larger molecule than either of the reactants, water and carbon dioxide. Glucose is used by the plant as its own generated food source. Glucose can also remain in the plant and may serve as an energy source for a consumer. A by-product of the photosynthesis reaction is oxygen gas, and is released from the plant through the stomata.

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Part III: The Products, continued

1. Place your Products of Photosynthesis page directly to the right of the Energy Transformation through Photosynthesis page.

2. Obtain a paper model of glucose from your teacher.

3. Count the number of carbon atoms in the paper model of glucose. Take that number of carbon atoms from the pile of atoms on the energy transformation arrow and set them aside in a stack.

4. Count the number of hydrogen atoms in the paper model of glucose. Take that number of hydrogen atoms from the pile of atoms on the energy transformation arrow and add them to the stack of carbon atoms.

5. Count the number of oxygen atoms in the paper model of glucose. Take that number of oxygen atoms from the pile of atoms on the energy transformation arrow and add them to the stack of carbon and hydrogen atoms.

6. Set your stack of carbon, hydrogen and oxygen atoms on the Products of Photosynthesis page in the space labeled: glucose.

7. Take the remaining atoms from the pile of atoms on the energy transformation arrow and distribute them equally on the spaces provided on the Products of Photosynthesis page.

8. Answer the questions for Part III in your *Student Journal*.

9. Wrap up by completing the Reflection and Conclusions questions in your *Student Journal*.

Complete Part III and the Reflections and Conclusions questions in your *Student Journal*.

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