



Turning Over a New Leaf

Credits: Elizabeth Gall, University of Tennessee Extension

Skill Level

4th-5th grade

Learner Outcomes

Youth will be able to list one reason why plants need light energy.

Youth will be able to demonstrate a variable that affects photosynthesis.

Education Standard(s)

GLE 0407.3.1

GLE 0507.3.1

CCSS.ELA-Literacy.SL.4.1.C

CCSS.ELA-Literacy.SL.5.1.C

Success Indicator

Design an Experiment to observe photosynthesis.

Life Skill(s)

Teamwork

Tags

Photosynthesis, biology, sun, solar, science, STEM

Time Needed

30-40 minutes (45-60 mins. with optional activity)

Materials (per group)

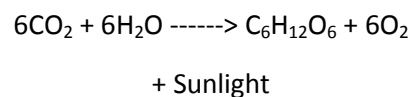
- ◆ Large clear plastic container
- ◆ 2 Test tubes
- ◆ Elodea plant (found at pet stores)
- ◆ Water
- ◆ Lamp
- ◆ Manipulations (other bulbs, salt, cardboard)

Background

Note: Background information is provided here; facilitators do not distribute to the learners. It can be discussed briefly after youth have completed the experience.

The biochemical process of photosynthesis is essential to maintaining life on Earth. Photosynthesis is the process by which plants take light energy and transform it into chemical energy, which they use as food. The process uses carbon dioxide and water, along with the sunlight, producing sugars (glucose) and oxygen.

Photosynthesis Equation



Carbon Dioxide and Water (Along with Sunlight) Forms Sugar and Oxygen

This process occurs in the chloroplasts in the leaves of the plant. Within the chloroplasts, there is a green pigment known as chlorophyll. This pigment appears green because it absorbs red and blue light but reflects the green light back to our eyes. The plant then uses the red and blue light energy to perform photosynthesis. The leaves of the plant are structured in such a way that they have stomata to allow carbon dioxide in and oxygen out. Leaves also contain veins (or vascular bundles) that help to move water and nutrients throughout the plant.

In addition, the process of photosynthesis allows plants to capture carbon dioxide (a greenhouse gas). These greenhouse gases get trapped by the atmosphere causing negative impacts on the environment.

Introduction and Opening Questions

Script: Today we will be observing how plants take light energy from the sun and transform it into food and oxygen. I have some questions that I want you to think about as we go through the activity today.

What would happen to a plant if it doesn't get sunlight? Have you ever had a plant that did not get enough sun and it died? What would happen to us if we didn't have trees and other plants?



Experience (use the Experiential Learning Model and encourage critical thinking and the use of science abilities and skills)

FACILITATOR INSTRUCTIONS:

Note: Youth will be observing how plants take light and transform it into food, also generating oxygen in the process.

- 1) (Optional if you have time): Give each student a part of the photosynthesis equation (including light energy from the sun). In order to perform photosynthesis, the chlorophyll within the chloroplasts takes in sunlight, then the sunlight is combined with carbon dioxide to produce sugar (glucose) and oxygen. Use large pieces of paper or other material that can adhere to a board or the wall (template can be found in the Appendix). Have the youth tack the pieces onto the surface in the correct order. *Note: Use the balanced version of the equation and have 6 Carbon Dioxides, 6 Waters, 6 Oxygen, 3-10 Sugars, and 3-10 Particles of Sunlight. (The number of Sugars and Sunlight will depend on the size of the class.)*
- 2) Play the video of the Photosynthesis song: <http://www.teachertube.com/viewVideo.php?videoid=49549>
- 3) Break the class up into groups of two-three (or a group size that is most appropriate based on the size of the class). Each group will set up the activity.
- 4) Set up and conduct the activity as described in the Procedure Instructions below.
- 5) Have the youth design a manipulation to the experiment to demonstrate a factor that may influence photosynthesis. This could be different types of light, absence of light, different types of water, etc. Allow youth to use critical thinking skills to design the experiment on their own.
- 6) Youth will need to re-set the experiment to remove the current oxygen bubbles.
- 7) Have youth observe what happens now.
- 8) Explain to youth that this process is very important because it takes carbon dioxide out of the air (which can have negative effects if we have too much of it) and produces oxygen.
- 9) Replay the video of the Photosynthesis song.
- 10) At the end of the activity, plants should be placed in the trash, **not outside**. This plant is invasive (non-native and grows without control) and should not allowed to propagate outside.



Experience (cont.)

PROCEDURE INSTRUCTIONS:

- 1) Instruct youth to fill the large container with water and turn the small, clear containers on their sides underwater to remove all the air bubbles.
- 2) Have them cut a branch off of the plant, place it under water in the large container, shake off any air and put it in the small, clear container- stem side up.
- 3) Youth should invert the small container, allowing no air to enter it. The small container (test tube) should be inverted into the plastic cup and leave cup and test tube in the larger container.
- 4) *Note: Facilitator can also already have the plants set up in containers that are enclosed and can stand upright on a table.*
- 5) Have youth repeat the experiment with your other small clear container, but don't add a plant. This is your control.
- 6) Youth should place the experiment in bright sunlight or near a strong lamp and observe what happens. *Script: You should see oxygen bubbles form on the plant as it performs this process (photosynthesis). In the test tube, you will eventually see some water displaced by oxygen. (Should begin within just a few minutes.)*
- 7) *Script: I have already demonstrated how oxygen is formed in this experiment with Elodea. I also have completed a control. Now I want you to take this experiment to the next level and add a variable to see how it affects the amount of oxygen.*



Step #6: Place the experiment in bright sunlight or under a strong lamp.



Step #3: The test tube should be inverted, placed in the plastic cup and left in the larger plastic container.



Talk It Over...

Share...

- 1) What did you observe happening to the plant during the activity?
- 2) Why were bubbles formed in the container?
- 3) How did it feel to have the opportunity to design the experiment?

Process...

- 1) If there weren't any bubbles formed, what does that mean?
- 2) How did you decide how to design the experiment? Did one person in your group take on a leader role and decide for the group or was there a discussion?

Generalize...

- 1) What does this process of photosynthesis (plants making food and oxygen) mean to you?
- 2) What might happen to us as humans if we did not have enough trees performing this process?
- 3) Have you designed an experiment before? How did it compare to this experience?

Apply...

- 1) How can you help to preserve the amount of trees that we have performing this important process?
- 2) In what other situations might you be able to design an experiment to answer a question?

Term and Concept Discovery

Photosynthesis- process of converting light energy to chemical energy and storing it in the bonds of sugar

Chlorophyll- the green pigments found in chloroplasts that allow plants to absorb sunlight

Chloroplasts- the organelles found in plant cells that conduct photosynthesis



Appendix

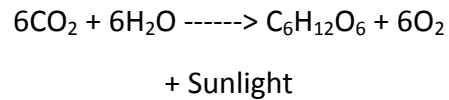
Components of Photosynthesis Equation

Carbon Dioxide	Carbon Dioxide	Carbon Dioxide
Carbon Dioxide	Carbon Dioxide	Carbon Dioxide
Water	Water	Water
Water	Water	Water
Oxygen	Oxygen	Oxygen
Oxygen	Oxygen	Oxygen
Sugar	Sugar	Sugar
Sunlight	Sunlight	Sunlight



Appendix

Photosynthesis Equation



Carbon Dioxide and Water (Along with Sunlight) Forms Sugar and Oxygen

Standards:

4th grade

GLE 0407.3.1- Demonstrate that plants require light energy to grow and survive.

CCSS.ELA-Literacy.SL.4.1.C- Pose and respond to specific questions to clarify or follow up on information, and make comments that contribute to the discussion and link to the remarks of others.

5th grade

GLE 0507.3.1- Demonstrate how all living things rely on the process of photosynthesis to obtain energy.

CCSS.ELA-Literacy.SL.5.1.C- Pose and respond to specific questions to clarify or follow up on information, and make comments that contribute to the discussion and elaborate on the remarks of others.

Resources:

Adapted from: Kitchen Pantry Scientist, Photosynthesis Activity

Photosynthesis Experiment. (2015). Retrieved from: <http://kitchenpantryscientist.com/?p=4114>

Photosynthesis. (2014). Retrieved from: <http://biology.clc.uc.edu/courses/bio104/photosyn.htm>

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