



Photosynthesis

Week 1 – Day 2

Lesson Overview

The purpose of this lesson is to teach students about photosynthesis and explore more deeply the components that plants need for growth introduced in the previous lesson.

Lesson Vocabulary

plants, photosynthesis, carbon dioxide, oxygen, glucose, chloroplast, and chlorophyll

Standards and Learning Targets for Lesson

Learning Targets

- I can explain the process of photosynthesis.

Next Generation Science Standards

- 5-LS1-1 – Molecules to Organisms
 - Support an argument that plants get the materials they need for growth chiefly from air and water.

Idaho Science Standards

- 5.S.3.2.1 – Goal 3.2 Biology
 - Communicate how plants convert energy from the sun through photosynthesis.

Common Core ELA Standards

- RI.5.1 – Reading Informational Text
 - Quote accurately from a text when explaining what the text says explicitly and when drawing inferences from the text.

Materials

- Four jars labeled: (1) soil (add soil), (2) water (add water), (3) sunlight (leave empty), and (4) air (leave empty)
- Photosynthesis cards: one set per group of students
- Text “Photosynthesis: The Amazing Talent of Plants”: one copy per student
- Graphic organizer “Photosynthesis Vocabulary”: one copy per student
- Exit ticket: one copy per student
- Photosynthesis demonstration setup: clear cups or jars, leaves, and water
- Xylem demonstration setup: small cups or jars, celery, food coloring, and water
(Note: demonstrations can be set up as one for the class or one per student group.)

Lesson Duration

Approximately 2 hours



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Lesson Description

Engage (20 minutes)

- Start by asking students to remember the basic components that plants use for growth.
- Place jars labeled “sunlight,” “air,” “soil,” and “water” on a table in the classroom. Ask students to consider that if these are the components that plants need for growth, then ask—can people grow with these same components? Ask for a volunteer who thinks they can make food with these components, and ask them to do it.
- Have students discuss in groups how they think plants use these materials to grow.
- Have groups share their thinking with the class. Reiterate that plants are amazing! They use sunlight and air to make food (sugars) that they use to grow.
- Ask if anyone knows what this process (photosynthesis) is called. Define photosynthesis on the board and unpack the word origin (Greek: *photo* means light and *synthesis* means putting together, so *photosynthesis* means putting things together using light).
- Unpack the learning target: *I can explain the process of photosynthesis*. Write the learning target on the board or on chart paper. Discuss the meaning of key words. Discuss the purpose of the lesson in terms of what students will be able to do by the end of the lesson.
- Explain that we will now set up two demonstrations. One we will observe at the end of the lesson today, and the other we will observe tomorrow.
- Set up two demonstrations (see the next two bullet points for instructions). You can decide whether to set up either one station for the whole class to observe or have student groups each set up their own demonstrations. Both demonstrations are simple, should not take much time to set up, and will be used in the Evaluate section of this lesson.
- **Photosynthesis demonstration setup** (this demonstration helps students see how the photosynthetic process creates oxygen):
 - Materials needed: clear cups or jars, leaves, water (Note: small clear cups work best so students can observe the top, bottom, and sides of the cups and leaves very easily.)
 - This demonstration can be set up as one for the class or one per student group.
 - Students (or groups) should remove two leaves from a plant and place each leaf in a clear cup of water—one in direct sunlight and one in a dark spot not receiving much light. After 1 to 2 hours, students can observe the leaves and will notice small bubbles, which is the oxygen released from the leaves through photosynthesis. They should see a difference in the amount of oxygen produced with and without direct sunlight. See the Resources list below for two websites that explain this classroom demonstration.
 - Have students record in their science notebooks the time the leaves were placed in the water and three initial observations (for both the leaves placed in the light and the leaves placed in the dark). Tell them we will come back to these later in the lesson today.
 - Have students draw the demonstration setup in their science notebooks and make a prediction about what they will be observing in 1.5 hours.
- **Xylem demonstration setup**: This demonstration helps students see how the plant roots take up water (and nutrients) from the soil and transport them through the stalk to the leaves. (Note: this demonstration will be left overnight and observed during tomorrow’s lesson on the water cycle.)



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- Materials needed: small cups or jars, celery stalks (preferably with leaves on the top), food coloring, and water
- This demonstration can be set up as one for the class or one per student group.
- Each student group should fill their cups about halfway with water and add about three drops of food coloring to each cup—one cup with red and one cup with blue.
- The instructor can provide one stalk of celery to each group. To prepare the celery, cut about ½ inch off the non-leaf end of the celery, then slice the stalk into two strips to about halfway up the stalk so the top half of the stalk remains connected.
- Students will place the cups next to each other and place one root end in the blue jar and the other in the red jar, making sure that the celery remains upright and balanced on the edge of the jars.
- Have students draw the demonstration setup in their science notebooks and make a prediction about what they will be observing tomorrow.

Explore (15 minutes)

- Distribute one set of photosynthesis cards to each group. Groups can be any size that works for your classroom.
- Have students work in groups to sort the cards to form the equation for photosynthesis—how plants use light to put things together and make food for growth.
- Instruct students to write down at least two questions they have in the process of organizing the cards.
- Once students have the cards organized into what they think is the equation for photosynthesis, instruct them to explain their thinking by completing this sentence: *We think this is the equation for photosynthesis because _____.*
- Ask a few student volunteers to share their thinking to transition into the explanation of photosynthesis.

Explain (45 minutes)

- Distribute the photosynthesis text and graphic organizer to each student.
- Have students independently read the text. Have them underline key concepts and circle unknown vocabulary words while they read.
- Instruct students to fill out the graphic organizer table, listing unknown vocabulary words and completing the “what I think it means” section of the table.
- Have students use the graphic organizer to answer the question: *What is the equation for photosynthesis?* Ask them draw a picture of a plant and the process of photosynthesis.
- Give a 10-minute mini-lesson on photosynthesis. Facilitate a class discussion to write the equation on the board. Explain the process and clarify vocabulary. Have students write the definitions of any words they did not know in their graphic organizer.
- For fun practice, have students find partners and stand with one partner facing the board where the equation for photosynthesis is written and the other partner looking in the opposite direction. Have them practice reciting the equation for photosynthesis from memory several times, with feedback from the partner looking at the board. Switch off as many times as desired.



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Elaborate (20 minutes)

- Instruct students to use their graphic organizers and mini-lesson notes to reevaluate their thinking from the card sort. Have them look at the equation for photosynthesis they wrote in their groups and at what they wrote about why they thought that was the equation. Have them critique their thinking by asking, *What were you right about?* and *What were you wrong about?* Have them write a few sentences.
- Use a think-pair-share protocol. Have students work independently first, then share their thinking with their groups, then with the whole class.
- Have students go look at the photosynthesis demonstration they set up at the beginning of class. Have students observe the leaves, record the time (to calculate how much time has passed during the experiment), record two or three observations, and include a proposed explanation for each observation.
- Have students share their new observations and proposed explanations. Focus on the air bubbles.
- Instruct students to use their knowledge of photosynthesis to explain the bubbles. They can use a format like this: *I observe _____ . Based on what I know about photosynthesis, I think this is because _____ .*
- Clarify that the bubbles are oxygen produced in photosynthesis. Reiterate that plants make the oxygen that animals need to breathe, including us! We cannot survive without plants!

Evaluate (20 minutes)

- Have the class circle up. Allow them a minute of silence to reflect on this phrase and how they would complete it: *I used to think _____ , but now I know _____ .*
- Have students share their phrases.
- Celebrate what they have learned and how their thinking has changed throughout the lesson.
- Use the exit ticket: have students go back to their seats and independently draw a diagram or model from memory showing the process of photosynthesis. Use this as a formative assessment.

Resources Used in Lesson Development

NSTA Science 101. How Does Photosynthesis Work? Found at http://science.nsta.org/enewsletter/2007-05/sc0704_60.pdf

Photosynthesis demonstration found at:

<http://education.seattlepi.com/photosynthesis-experiments-kids-6302.html>

<http://www.kids-fun-science.com/plant-experiments.html>



Photosynthesis Cards

Carbon Dioxide	CO₂
Water	H₂O
Glucose	C₆H₁₂O₆
Oxygen	O₂
Stomata	Photon (light)
Chloroplast	=
+	+
+	+



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Photosynthesis: The Amazing Talent of Plants

What does photosynthesis mean? Since we know *photo* means *light* and *synthesis* means *putting together*, we can start to understand that photosynthesis is a process of putting things together using light. Photosynthesis is the process by which plants (and other organisms like algae and bacteria) use the energy of sunlight to make food.

In photosynthesis, plants use carbon dioxide (CO₂) and water to make sugar and oxygen (O₂). Photosynthesis takes place in plant structures called chloroplasts. Chloroplasts have a pigment called chlorophyll that makes plants look green. When chlorophyll absorbs particles of light called photons, the photosynthesis reaction begins.

Here's how it works. Plants take in carbon dioxide from the air by opening tiny holes on the underside of their leaves called stomata. Plants take in water from the soil through their roots. When sunlight stimulates the chlorophyll, a chemical reaction occurs. Carbon dioxide and water are converted into a sugar called glucose and oxygen. The oxygen is released through the stomata into the air we breathe. The plant then uses the glucose as food. Plants use sugar as a source of energy for growth and living just like you and me!

So you see, photosynthesis is pretty cool! Plants use sunlight to make the food they need to grow. In the process they make the oxygen we breathe every minute of every day. Plus, we rely on plants as food for the energy we need to grow and live. Without photosynthesis, we could not survive! So be sure to share your thanks every day for all the hard work plants do for you and all of the creatures on our planet!



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Exit Ticket

Name: _____

What is the equation for photosynthesis?

Based on the text and your equation above, draw a picture of a plant and the process of photosynthesis.