



Classroom Teacher Preparation

Life Science 27: Investigating Photosynthesis

Please use the following to prepare for the next SfS lesson.

Description:

Students carry out an experimental lab investigation of photosynthesis using the floating leaf disk procedure to measure oxygen production. Groups will compare results of their experiment, carried out in the presence of carbon dioxide, with the instructor's experiment, run without carbon dioxide. Especially long classes may also investigate the effect of the color of light on the rate of photosynthesis. Due to the timing constraints of the experiment, this module requires a minimum 60-minute class. This lesson is geared towards older (7th-8th grade) students.

Lesson Objectives – SWBAT (“Students Will Be Able To...”):

7th-8th

- Conduct an experiment to indirectly measure the rate of photosynthesis
- Explain what parts of the photosynthesis reaction are observed by this experiment

Disciplinary Core Idea (DCI)

LS1 From Molecules to Organisms: Structures & Processes – LS1.C Organization for Matter & Energy Flow in Organisms

- (6th-8th) Plants use the energy from light to make sugars through photosynthesis. Within individual organisms, food is broken down through a series of chemical reactions that rearrange molecules and release energy

Science & Engineering Practice (SEP)

Constructing Explanations and Designing Solutions

- (6th-8th) Construct a scientific explanation based on valid and reliable evidence obtained from sources (including the students' own experiments) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future

Crosscutting Concept (CCC)

Energy and Matter: Flows, Cycles, and Conservation

- (6th-8th) Within a natural or designed system, the transfer of energy drives the motion and/or cycling of matter

Preparation:

A solid understanding of photosynthesis is critical to successfully completing this activity. **We suggest reviewing the following about photosynthesis and respiration:**

Photosynthesis is the process by which plants (and some other *autotrophs*) use energy from sunlight to turn water and carbon dioxide into the energy-rich sugar, glucose, and oxygen. However, photosynthesis does not take place in all plant cells; it only occurs inside leaf cells in chloroplasts, small green organelles. Chloroplasts contain a green pigment called chlorophyll, which captures light. During photosynthesis, leaves take in carbon dioxide gas from the atmosphere and use water drawn up from the roots. With the energy from sunlight (captured by the chlorophyll), the chloroplasts convert the carbon dioxide and water into glucose. Oxygen is also produced in this chemical reaction and exits the leaves into the surrounding air.



Photosynthesis Equation: carbon dioxide (CO₂) + water (H₂O) + sunlight --> sugar (C₆H₁₂O₆) + oxygen (O₂)

In addition to photosynthesis, plant cells also respire. Respiration is a set of chemical reactions taking place in the mitochondria (another organelle) of cells that converts sugar into energy. While the process of photosynthesis only occurs during daylight hours, respiration occurs during the day AND the night. Mitochondria convert glucose and oxygen into energy that the plant can use to grow. Carbon dioxide and water are also products of respiration.

Respiration Equation: sugar (C₆H₁₂O₆) + oxygen (O₂) --> carbon dioxide (CO₂) + water (H₂O) + energy

Room Set Up for Activities:

Students will work in small groups. There are enough materials for 6 separate groups. Students will need **flat table space** and access to an electrical outlet to plug in a desk lamp. **If your classroom does not have flat student desks to work on, please clear an area with a flat surface for students to set up their experiments. This will minimize bumps and spills.** Access to a sink is also requested.

Safety:

Caution students to observe proper care with liquids around electricity. Bumping tables during the activity will lead to spills. The needle-less syringes used in the procedure are filled primarily with water and are used to create a vacuum to remove air from spinach leaves. Make sure students do not spray themselves or classmates with water.

Related Modules:

This lesson may be taught as part of a sequence or group of related modules on the **Carbon Cycle**. Other modules in this sequence include:

Life Science 26: Carbon Cycling - a Virtual Lab – In this virtual activity, students observe the interaction of a snail and a water plant in a closed environment and use a chemical indicator to determine the presence of carbon dioxide in order to investigate the cyclic cellular respiration and photosynthesis processes.

For other module sequences and groups, look here: www.sciencefromscientists.org/sequences

Standards Covered:

Please click the following link to our website to review the standards covered by this lesson, listed by state:

www.sciencefromscientists.org/standards/

Lessons are matched to both national NGSS and local state standards.

After Our Visit:

Extend this lesson by conducting an experiment on transpiration and photosynthesis using local plants.

Access this Extension activity by visiting the Classroom Post found on our website at sciencefromscientists.org/cohorts. Use the name of your school/cohort and password to log in.

To help Evaluate, check out our Open Response questions online at sciencefromscientists.org/open-response-questions. They are freely available for all of our lessons for current teachers. Use the password supplied by your instructor to log in.

Additional Resources:

- Photosynthesis [advanced] - Crash Course Biology #8 (13:14): https://www.youtube.com/watch?v=sQK3Yr4Sc_k
- Plant Cells - Crash Course Biology #6 (10:27): <https://www.youtube.com/watch?v=9Uv1qAVCoqY>
- Glencoe Online Virtual Learning Center – Photosynthesis:
http://www.glencoe.com/sites/common_assets/science/virtual_labs/LS12/LS12.html
- The Biology Place: Online Photosynthesis Interactive:
http://www.phschool.com/science/biology_place/biocoach/photosynth/intro.html

