



## Photosynthesis in Leaf Disks

### Lesson Overview

**Unit Title:** Photosynthesis

**Lesson Summary:** Photosynthesis is a complex process that converts light energy into chemical energy in the form of carbohydrates and/or other compounds in plants and other photosynthetic organisms. This is a quick, easy, cheap and safe lab to demonstrate photosynthesis.

**Subject Area(s) and Grade Levels:** Click box(s) of the subject(s) and grade(s) that your Unit targets.

Life Science     Physical Science     Earth Science     5th     7th     Biology

**Arkansas Framework:** [http://arkansased.org/education/word/biology\\_9-12\\_06.doc](http://arkansased.org/education/word/biology_9-12_06.doc)

### SLE – Student Learning Expectation Details



- MC.3.B.4 Describe and model the conversion of light energy to chemical energy by photosynthetic organisms:
  1. light dependent reactions
  2. light independent reactions



- Graphing



- Constructed Responses

**National Standards:** <http://www.education-world.com/standards/national/index.shtml>

### National Standards Details:

- Standard C: Develop an understanding of the cell.

### Student Objectives and Procedures: (All 7-E's may not be present in a single lesson)

#### Objective:

- Demonstrate laboratory techniques necessary to perform the experiment.
- Identify another variable that might affect photosynthesis and design an experiment that uses leaf disks to test the ideas.
- Design an inquiry to examine an appropriate variable in the experiment.
- Describe the reactants and products of photosynthesis and the source of reactants from the environment.
- Explain the relationship of photosynthesis to the observations made during the experiment.
- Create hypotheses about the effects of environmental variables on the rate of photosynthesis.

**Focus Question:** • How do cells obtain and utilize energy?

**Prerequisites / Background Information:**

- Photosynthesis is a complex process that converts light energy into chemical energy in the form of carbohydrates and/or other compounds in photosynthetic organisms.
- Photosynthesis occurs in two stages: light dependent reactions and light independent reactions/Calvin cycle.
- In this experiment, the students will use a syringe to vacuum the air from the spaces in the spongy mesophyll of leaf disks (do not use thick leaves such as holly). The spaces will then be infiltrated with a sodium bicarbonate (NaHCO<sub>3</sub>) solution, which contains a tiny amount of detergent to break down the waxy leaf coating (cuticle).
- The leaf disks are then exposed to light and observations are made as the cells undergo photosynthesis.

**Timeline:** 1 class period

- Preparation:** • 30 min
- Elicit/Engage:**
- Explore:** • 25-30 min
- Explain:** • 10 min
- Cleanup:** • 5 min

**Teacher Preparation:**

- Gather leaves and other materials.

**Materials:**

- Baking soda, large cup or beaker (500 mL), 2 large cups or beakers (250 mL), hole punch, fresh leaves, light source (60 watt or higher), liquid detergent, plastic spoon or straw, eyedropper, timer, large plastic syringes (1 per group).

**Technology – Hardware: (Click boxes of all equipment needed)**

- |  |  |   |
|--|--|---|
| <input type="checkbox"/> Camera            | <input type="checkbox"/> Computer(s)         | <input type="checkbox"/> Digital Camera |
| <input type="checkbox"/> Projection System | <input type="checkbox"/> Television          | <input type="checkbox"/> VCR            |
| <input type="checkbox"/> Video Camera      | <input type="checkbox"/> Internet Connection | <input type="checkbox"/> Other:         |

**Technology – Software: (Click boxes of all software needed.)**

- |   |  |                                 |
|---|--|---------------------------------|
| <input type="checkbox"/> Database/Spreadsheet | <input type="checkbox"/> Multimedia      | <input type="checkbox"/> Other: |
| <input type="checkbox"/> Internet Web Browser | <input type="checkbox"/> Word Processing |                                 |

**Internet Resources:**

**Procedures:**

**Teacher’s Notes:**



- Goggles must be worn. The chemicals used are safe to use without gloves and the liquid may be disposed of down the sink. The leaf disks should be placed in a trash container as they may stop up a sink.

- Caution the students to grasp the syringe firmly and keep one finger over the tip to prevent water from spraying out the opening.

**Elicit**

**Engage**

**Explore**

- This lab gives students an authentic "Lab" experience and addresses several NS skills.
- Students will follow directions, conduct the written lab, and they will get to design their own experiment.

**Explain**

**Elaborate**  

- As an extension you may propose that the floating disks be placed in the dark to determine if the disks will sink after photosynthesis ceases.

**Evaluate**  

**Formative Assessment**

- Observations of students as they conduct the lab

**Summative Assessment**

- Constructed responses to student handout
- Design of inquiry experiment

**Extend**  

**Cross-Curricular**



Notes: