



Photosynthesis Unit Guide

Unit Overview

Unit Title: Photosynthesis

Lesson Summary: The structure and function of cells determines the foundation for all living things

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

SLE – Student Learning Expectation Details



- MC.3.B.1 - Compare and contrast the structure and function of mitochondria and chloroplasts. (Only the chloroplast portion is addressed in this SLE.)
- MC.3.B.4 - Describe and model the conversion of light energy to chemical energy by photosynthetic organisms: light dependant reaction, light independent reaction.
- MC.3.B.5 - Compare and contrast cellular respiration and photosynthesis as energy conversion pathways. (Only the photosynthesis portion is addressed in this SLE.)



- Equations, symmetry, graphing



- Find real world application of photosynthesis in magazines, newspapers or other non-fiction text.
- RAFT Writing Prompts
- Solar Powered Sea Slug video:
<http://www.newscientist.com/article/dn16124-solarpowered-sea-slug-harnesses-stolen-plant-genes-.html>

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

National Standards Details:

- Standard C: Develop an understanding of the cell.
- Standard G: Historical perspectives.

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

- Objective:**
- Kinesthetic Walk-Through:
 1. Recognize the photosynthesis equation.
 2. Write the equations for photosynthesis with coefficients and subscripts.

- Leaf Models:
 1. Create/Examine a leaf model.
 2. Know the basic structure of a leaf.
 3. Relate the structure to the function of a leaf during photosynthesis.
- Chloroplast:
 1. Design and create a model of the internal structure of a chloroplast.
 2. Know the names of the parts of the chloroplast.
 3. Relate the internal structure of a chloroplast to its function.
 4. Write a fact-based account of a journey through a chloroplast from the viewpoint of a molecule or photon.
- Leaf Disk Lab:
 1. Describe the reactants and products of photosynthesis and the source of reactants from the environment.
 2. Explain the relationship of photosynthesis to the observations made during the experiment.
 3. Identify another variable that might affect photosynthesis and design an experiment that uses leaf disks to test ideas.
 4. Create hypotheses about the effects of environmental variables on the rate of photosynthesis.
- Light Dependent Role Play:
 1. Describe and model conversion of light energy to chemical energy.
 2. Model light dependent reactions.
- Light Independent Bead Activity:
 1. Construct and modify models of carbon compounds involved in the light independent reactions of photosynthesis.
 2. Know the role of carbon dioxide in photosynthesis.
 3. Calculate the amount of energy (ATP) needed in/provided by the light independent reactions.
 4. Relate the energy sources for the light independent reactions to their formation.
 5. Understand that manufacturing glucose is a complex process.

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

Prerequisites / Background Information:

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

Timeline: 1 -2 weeks depending on schedule

Preparation: See individual lessons.

Elicit/Engage:

Explore:

Explain:

Cleanup:

Teacher Preparation:

- Teacher prep, possible misconceptions, lab information can be found in the individual lesson documents.

Materials:

- Lab materials are included in individual lessons.

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

- | | | |
|---|---|---|
| <input type="checkbox"/> Camera | <input checked="" type="checkbox"/> Computer(s) | <input type="checkbox"/> Digital Camera |
| <input checked="" type="checkbox"/> Projection System | <input type="checkbox"/> Television | <input type="checkbox"/> VCR |
| <input type="checkbox"/> Video Camera | <input checked="" 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 checked="" type="checkbox"/> Internet Web Browser | <input type="checkbox"/> Word Processing | |

Internet Resources:

Procedures:

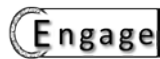
Teacher's Notes:



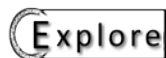
- No eating or drinking in the lab
- Follow written & oral instructions
- No horse play
- Wear appropriate safety gear (goggles, apron, gloves)



- General Elicit: Discuss the impact of clear cutting in the forest and explain the ramifications of losing the trees. Have students explain why the loss of trees can influence humans. Ask students to identify what part(s) of the tree we most rely upon.
- Kinesthetic Walk-through: Review equations and balancing from physical science by writing the equation for photosynthesis on the board and have students tell what they already know.
- Leaf Models: Have sample real leaves on student's desks. Have students quickly draw the leaf and label the parts.



- Suggested Engage: Elodea Video, Kinesthetic Walk-thru, Conduct light dependant activity, have students collect leaves from trees.
- Kinesthetic Walk-Thru: This activity can be done as whole group with students actively moving about to create the photosynthesis equation or it can be done as table groups.
- Leaf Models: Unfold the large leaf model and flip through the layers. Students will be excited to create their own smaller version.



- Leaf Models: The large leaf model is best be used as a teachers aid. The small leaf model is designed for each student to be able to make and take their own leaf model with them.

- Chloroplast Model: Students will design and construct a model of a plant chloroplast using textbooks or diagrams as reference. If studying respiration, the class may be divided, and half of the students assigned models of mitochondria. The models can also be retained and used for comparison to mitochondria in future chapters.
- Light Dependant Role Play: The activity is linear in design, although many of the events happen simultaneously. After the students become familiar with the overall process, have the students run the scenario with all the parts moving at the same time.
- Light Independent Bead Activity: In this activity, students will construct models of the basic compounds involved in the Calvin Cycle, focusing on the role of carbon and the amount of energy utilized during the process.

Explain

- Use of Photosynthesis PowerPoint.

- Vocabulary:
ATP, electron transport chain, glucose, carbon dioxide, oxygen, chloroplasts, light dependent, light dependent, photosynthesis

Elaborate



- Suggestions:
 1. Lab reports
 2. Written tests

Evaluate



- Suggested Evaluations: Photosynthesis Formative Assessment, student questions with lessons, light independent writing prompt, RAFT writing activity.

Formative Assessment:

- Photosynthesis Pre/Post Tests
- Photosynthesis Standards Based Formative Assessment
- Leaf Models: Students build a small leaf model and use it to identify the layers of a leaf.
- Chloroplast Model: Student models are evaluated for accuracy of parts and labels.
- Light Independent Bead Activity: Students will construct a concept map to illustrate the Calvin Cycle as they conduct the bead activity.

Summative Assessment:

- Water/Photosynthesis Unit Summative Assessment



- Extend Suggestions: With any of the lessons and labs in this unit, there are no limits to what a class can do. Explore models, repeat role play, etc.
- Kinesthetic Walk-through: This activity provides a good transition into the study of acids and bases, chemical bonding, study of nutrients, and the way that cells and the bodies of animals use energy.
- Leaf Models: The small leaf model is a great integration of the leaves of Arkansas. This offers students a chance to explore and model that content as well.
- Chloroplast Model: Write a fact-based account of a journey through a chloroplast from the viewpoint of a molecule or photon.
- Light Dependant Role Play: Using what you have learned, draw and label a diagram showing Photosystem I and Photosystem II and the processes that occur during the light dependent reactions.
- Light Independent Bead Activity: This lesson requires students to work with partners, follow directions, and work through the process in a collaborative effort.

Cross-Curricular



- See Cross Curriculum document
- Technology:
 1. Kinesthetic Walk-through: Glucose & humans: Conduct research or discussions to explore the physiology of diabetes. Students love to sing. Challenge students to include basic concepts about photosynthesis in a song, poem or rap.
 2. Leaf Models: Student conduct internet or library research of the native leaves of Arkansas and their structure.
 3. Chloroplast Model: students research various diagrams and pictures of chloroplast.

Vernier Lesson: Photosynthesis With Probes - included

Notes:

- Kinesthetic Walk-through: Modified from an activity by: Eva Carswell, Westside High School, Macon, GA and Ananda Weerasuriya, PhD, Mercer University School of Medicine.
- Large Leaf Model: Adapted from an article, Building Leaves and an Understanding of Photosynthesis, Patty Littlejohn, The Science Scope, p. 22-25, April/May, 2007.
- Chloroplast Model: Helpsavetheclimate.com/photosynthesisBiodidac.bio.uottawa.ca
- Light Dependant Role Play: Biology, Eighth Edition. Neil Campbell, et.al. San Francisco: Pearson 2008. Biology. Kenneth Miller, & Joseph Levine. Upper Saddle River: Pearson 2006.