Light Independent Activity

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 photosynthetic organisms. Photosynthesis occurs in two stages: light dependent reactions and light independent reactions/Calvin Cycle. This is a hands-on activity to demonstrate the steps in the light independent reactions/Calvin Cycle.

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

Science Standards

- 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

Math Integration

Literacy Integration

- 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:

- Identify the major events involved in the light independent reactions.
- Construct and modify models of carbon compounds involved in the light independent reactions of photosynthesis.
- Know the role of carbon dioxide in photosynthesis.
- Calculate the amount of energy (ATP) needed in the light independent reactions.
- Relate the energy sources for the light independent reactions to their formation.
- Understand that manufacturing glucose is a complex process.

Focus Question:

- How do cells obtain and use 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.
- The amounts listed in the materials section provide extra beads and checks so that students will have to keep track of what they use as the reaction proceeds. Have extra beads on hand in case any are lost. Determine the total numbers of beads and checks necessary according to the number of student groups in your class. The molecules constructed can be taken apart and used again in other classes, although you may need to replace chenille stems if they become misshapen.
- This lesson requires students to work with partners, follow directions, and work through the process in a collaborative effort.

Timeline: 1 class period

Preparation:	• 1st time 1 hour, materials will be reusable
Elicit/Engage:	
Explore:	• Model on overhead 10 min, Student construction of model 20 min
Explain:	• 10 min
Cleanup:	• 5 min

Teacher Preparation:

- Gather materials, photocopy templates and lab sheets, assemble bags of materials

Materials:

- 46 black "pony" beads, 26 yellow beads, 16 white beads, 24 ATP "checks", 16 NADPH "checks", 2 small zipper bags, 2 copies of the lab, text or descriptive information.

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

☐ Camera	☐ Computer(s)	☐ Digital Camera
☐ Projection System	☐ Television	☐ VCR
☐ Video Camera	☐ Internet Connection	☐ Other:

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

☐ Database/Spreadsheet	☐ Multimedia	☐ Other:
☐ Internet Web Browser	☐ Word Processing	

Internet Resources:

Procedures:	**Teacher's Notes:**
	
• appropriate classroom behavior required	

Elicit

Engage

Explore

- Prior to doing this assignment, they should already have completed a study of the structure of chloroplasts and the processes that produce energy carriers during the light dependent reactions.
- 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

Elaborate

Evaluate

Formative Assessment

- Students will construct a concept map to illustrate the Calvin Cycle as they conduct the bead activity.

Summative Assessment

Extend

Cross-Curricular

Notes: