



Water/Photosynthesis Comprehensive Learning Guide

Unit Overview

Unit Title: Water/Photosynthesis Module

Unit Summary: Chemistry is essential to understanding the life process. 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.1.B.3 Investigate the properties and importance of water and its significance for life: surface tension, adhesion, cohesion, polarity, and pH.
- MC.3.B.1 - Compare and contrast the structure and function of mitochondria and chloroplasts. (We will only address the chloroplast in this SLE.)
- MC.3.B.4 - Describe and model the conversion of light energy to chemical energy by photosynthetic organisms: light dependent reaction, light independent reaction.
- MC.3.B.5 - Compare and contrast cellular respiration and photosynthesis as energy conversion pathways. (We will only address the photosynthesis portion of this SLE.)
- CDL.7.B.17 - Describe the structure and function of the major parts of a plant: roots, stems, leaves, flowers. (We will only address the leaf in this SLE.)



- Data collection and analysis.



- Integrate grade level/student level appropriate reading books about water, utilize library skills by having students research properties of water or utilize exploration skills on the internet.

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

National Standards Details: NES Content Standards for Grades 9-12:

- Standard B - Physical Science B1: Structure of Atoms; B2: Structure and Properties of Matter.
- 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:**
- Water:
 1. Sketch or construct a molecule of water demonstrating polarity and hydrogen bonding.
 2. Compare and contrast cohesion/adhesion.

3. Give examples of life processes related to the properties (adhesion, cohesion, surface tension) and importance of water.
- Photosynthesis:
 1. State/write the chemical equation of photosynthesis.
 2. Identify the major events involved in the light dependent and light independent reactions (Calvin Cycle)
 3. Identify the structure of a chloroplast.
 4. Identify the role of a chloroplast in photosynthesis.

Focus Question: How do the properties of water affect life?
How do cells obtain and utilize energy?

Prerequisites / Background Information:

- Lab safety
- Lab procedures

Timeline: Unit could take 1-2 weeks depending on class schedule.

Preparation:

Elicit/Engage:

Explore:

Explain:

Cleanup:

Teacher Preparation:

- Properties of Water Labs:
 1. Engage Activity-the science specialists chose the "Ballooney" activity as a demonstration. However, the teacher may choose any one of the lab activities to do as a demonstration.
 2. Explore Activity-students will rotate through the remainder of the activities.
- Other performance tasks:
 1. Sketch or construct a molecule of water demonstrating polarity and hydrogen bonding.
 2. Compare and contrast cohesion/adhesion.
 3. Give examples of life processes related to the properties (adhesion, cohesion, surface tension) and importance of water.
- Photosynthesis Labs and Activities:
 1. Kinesthetic Walkthrough
 2. Leaf/Chloroplast Model building
 3. Leaf Disc lab
 4. Lt Dependent Role Play
 5. Lt Independent Bead Activity

Materials:

- Materials for labs are included in each Teachers Guide

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

Internet Resources:

[Cytoplasm Elodea Streaming - YouTube](#)
[Cytoplasm Streaming in the Water Lily - YouTube](#)
[The Futures Channel - Fish Farming](#)
[The Futures Channel - Water Supply](#)
[The Futures Channel - Water Tanks](#)
[Slow Frozen People – Web Research](#)

Procedures:

Teacher's Notes:



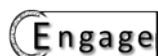
Safety

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



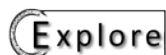
Elicit

- Water: In groups of two or three, have students discuss and write in science notebooks and illustrate what they know about the structure and properties of water. Share responses on the board or chart paper so that students can add to their own science notebook entries any ideas they did not already have.
- Photosynthesis: 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 and ask students to identify what part(s) of the tree we most rely upon.



Engage

- Properties of Water Lab- the science specialists chose the "Ballooney" activity as a demonstration. However, the teacher may choose any one of the lab activities to do as a demonstration.
- Photosynthesis: streaming video of Elodea, light dependent activity, students collect leaves from trees.



Explore

- Water: Properties of Water Lab -students will rotate through the remainder of the activities.
- Photosynthesis: Leaf disk lab, counting stomata, kinesthetic activity, light dependent role play, chloroplast/leaf model building, light independent bead activity.

- Vocabulary:
 1. Water:
Adhesion, cohesion, polarity, surface tension, pH, capillary action, acid, base, hydrogen bonding, solvent.
 2. Photosynthesis:
ATP, electron transport chain, glucose, carbon dioxide, oxygen, chloroplasts, light dependent, light independent, photosynthesis.

Explain

- Teacher should review the Properties of Water and Explanation of the Lab documents prior to the lesson.
- Teacher will review properties of water with students and discuss why these properties are important for living things (water's significance for life).
- Teacher will ask questions about lab, such as:
 1. Which properties of water are being demonstrated at this station?
 2. How is this property important for living things?
 3. What are some other properties of water not covered in the lab and how are they important for living things?
- Photosynthesis PPT can be used.

Misconceptions:

- Water:
 1. Adhesion is the same as cohesion.
 2. Water dissolves everything.
 3. Water atoms expand or change when ice melts.
 4. A film on the surface of water does nothing to the water.
 5. Liquids rise in a straw because of "suction".
- Photosynthesis:
 1. Photosynthesis is a simple reaction.
 2. Photosynthesis occurs only in plants.
 3. Photosynthesis occurs only on land.
 4. Leaves reflect all green light and do not use green light in photosynthesis.
 5. Plants photosynthesize during the day and conduct cellular respiration only at night.
 6. Photosynthetic carbon fixation (dark reactions) occurs at night.
 7. Bubble formation on leaves submerged in water is always caused by photosynthesis.

Elaborate



- Any of the chemistry lab activities not previously done, or students may design experiments to test the questions they generated during the lab.
- Each photosynthesis lab/activity can be expanded to further student knowledge.

Evaluate



- Ex: Make a "foldable" whereby students compare adhesion/ cohesion, list 5 properties of water and/or write an application for each of the properties of water to life.

Formative Assessment:

1. Water Formative Assessment
2. Questions from self-assessment
3. Notebook entries from beginning of lesson
4. Photosynthesis Pre/Post test
5. OR Questions

Summative Assessment:

- End of unit assessment provided.



Environment Movie - Water Supply Lesson - Web

Cross-Curricular



- Water:
 1. Water samples from various sources could be tested with pH probes.
 2. Water scavenger hunts via internet are another way for students to interact with the learning.
- Photosynthesis:
 1. Students can record on video the photosynthesis process correctly and post it for review.
 2. Students can record an incorrect version of the process and have students identify what was wrong and explain the correct process.
 3. Students can build an electronic presentation of the photosynthesis reaction.

Notes:

- Modifications:
 1. Place students in mixed ability groups or mixed learning style groups. Other modifications may be made as determined by an individual IEP.
- Interventions:
 1. Water: Address misconceptions by explaining the difference in adhesion and cohesion. Discuss the reason water is known as the "Universal Solvent" even though it does not dissolve everything.
 2. Photosynthesis: Address misconceptions by explaining the difference in light dependent and independent reactions. Discuss the importance of photosynthesis for both the plant and animals.
- Gifted and Talented:
 1. GT students can research and present other activities that demonstrate the properties of water or research ways these properties are associated with living things. GT students can research and present other activities that demonstrate the process of photosynthesis.
- Parental Involvement:
 1. Water and its importance to living things could be an excellent theme for a family science night. Stations with water activities and mini lessons could be set up. Invite guest speakers from universities or greenhouses, coordinate field trips for students to explore how businesses and universities need to understand photosynthesis.