

Option 7: Tracking Marine Animals Lesson Plan

This additional lesson will accompany Lesson 8, “Photosynthesis in the Ocean,” in the ACES continuum.

Grade Level: 6th

Time Frame: 1, 90-minute Period

Objectives:

- Students will investigate the effects of sunlight on the rate of marine plant photosynthesis.
- Students will make the connection between the results of their investigation, and their understanding of the photic zone.
- Students will develop an understanding that the deeper the ocean ecosystem, the lower the light intensity, the fewer photosynthetic organisms there are.

NGSS Standards:

LS2.A: Interdependent Relationships in Ecosystems

- Organisms, and populations of organisms, are dependent on their environmental interactions both with other living things and with nonliving factors.

Constructing Explanations and Designing Solutions

- 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.

Description: Photosynthesis provides a major food source for marine ecosystems. The photosynthetic process requires light energy. In this investigation, students will experiment with how the distance (5cm, 10cm, and 15cm) the light source is from the elodea plant has an effect on the rate

of photosynthesis. The rate of photosynthesis will be measured by counting the number of oxygen bubbles produced by the Elodea plants in each 3-minute trial. Students will graph their results and draw the conclusion that the further the light is from the plant, the slower the rate of photosynthesis. Students will discuss how this takes place at a macro level in the varying depths of the ocean. During Part 3 of Lesson 8, "Where are the Phytoplankton," students should use their data to make inferences about the photic zone.

Engaging Context: Show the students this cartoon, and ask them to explain what it means.

Students should be able to identify that carbon dioxide and water are the reactants in the process of photosynthesis. Sunlight is also a necessary factor in photosynthesis because it supplies the energy needed to transform the atoms of the reactants into the products of glucose and oxygen.



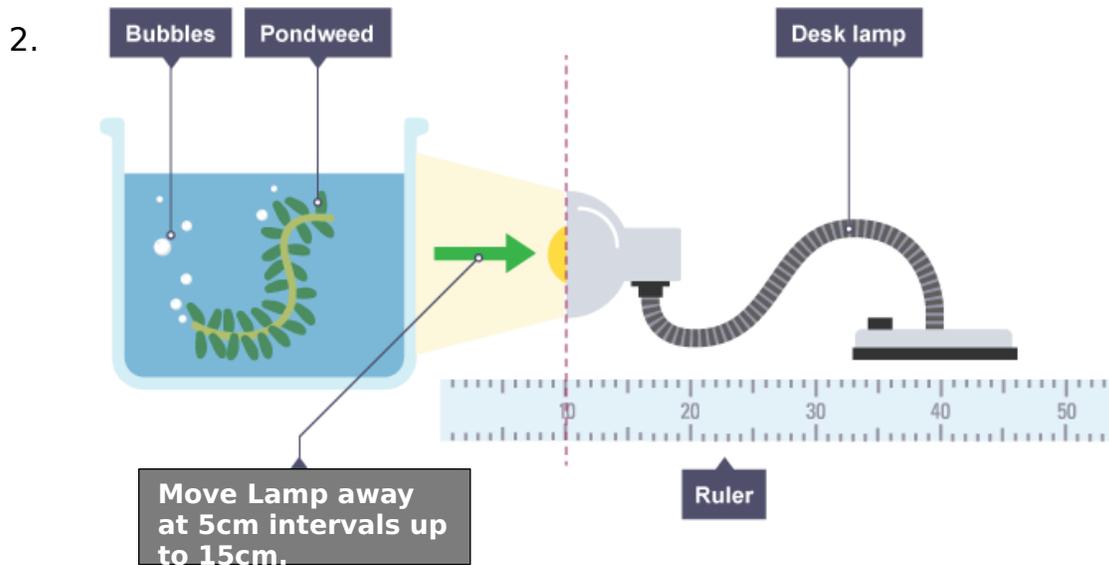
"Just the steak for me and my friend will have the carbon dioxide and the water with the sunlight."

Materials:

- Elodea plants (1 plant per class, or 1 fresh)
- 2 solutions of baking soda and water (one strong and one weak)
- Graduated cylinders (1 per group)
- 100 - 150 watt clip on light, or desk lamp (1 per group)
- Rulers
- Data sheets
- Dot stickers

Procedure:

1. Students should work in groups of 4. Each group will have one set of materials as listed above.



Students will peel off several leaves from the cut end of the elodea stem and crush the stem with their fingers (this will allow oxygen bubbles to escape from the stem more easily).

3. Students should then place the elodea sprig upside down into the graduated cylinder. The cylinder will be filled with normal tap water or spring water, and the stem of the elodea should be submerged 1-2 inches in the water. If the elodea is floating, a small paperclip can be placed on the bottom end of the elodea to help it stay submerged.
4. Students will then place their light source 5 cm. from the test tube containing the elodea sprig and will count the number of oxygen bubbles released from the stem over a 2-minute period. They will conduct 3, 2-minute trials. Data will be recorded on the data sheet AND each group's average data will be added to a class graph in the front of the classroom using the dot stickers.
5. At this point, the students should STOP work and the teacher should discuss the class graph with the students. Why were bubbles emerging from the elodea plant? (Photosynthesis was taking place and oxygen was begin released). How many bubbles occurred in the 2-minute trial? (Answers will vary). The teacher should have students notice any outliers or inconsistent data and discuss possible reasons for this (perhaps different elodea sprigs, different lights, different

people counting, etc). Next the teacher should ask the students, “Now, let’s change one variable in this experiment.” Elicit responses from students about what could be changed (water conditions, aspects of the elodea sprig, the length of the trial, the strength of the light source, the distance of the light from the elodea plant). “Let’s move the light source and position it 10 cm away from the elodea sprig. How might this effect the rate of photosynthesis and therefore the amount of bubbles we observe? What if move the light 15cm away from the plant?” Stop and write down a hypothesis. How will the rate of photosynthesis be affected by the distance the light source is from the plant?

6. Each group will set up the system with the light source 10cm away from the test tube, run the procedure again, collect data, and add their data to the class graph. Finally, each group will position the light source 15cm away from the test tube, run the procedure, collect data, and add the data to the class graph.
7. Discussion: As a class, students will reflect on their individual and class results and will discuss how the rate of photosynthesis was affected by moving the light source away from the elodea plant. (Fewer bubbles were produced. This may be a minor difference, but difference nonetheless. Further discussion questions are: How might this play out in the natural environment? (The further the light source/sun is from the plant, the lower the rate of photosynthesis). How might this effect photosynthetic marine organisms? (The deeper down in the ocean, the lower the rate of photosynthesis, the lower the rate of oxygen production by photosynthesis.) How might we investigate this hypothesis? (Find deep parts of the ocean and sample to see if there are photosynthetic organisms such as phytoplankton, or test for oxygen in the water.)
8. Have students complete the Data Analysis Sheet and share their ideas with the class.
- 9.

Data Sheet

Record your data for each test. Add your averages to the class graph.

Test #1:

Distance of Light Source from the Elodea Plant:	
Trial:	Number of O ₂ Bubbles Produced:
1	
2	
3	
Average:	

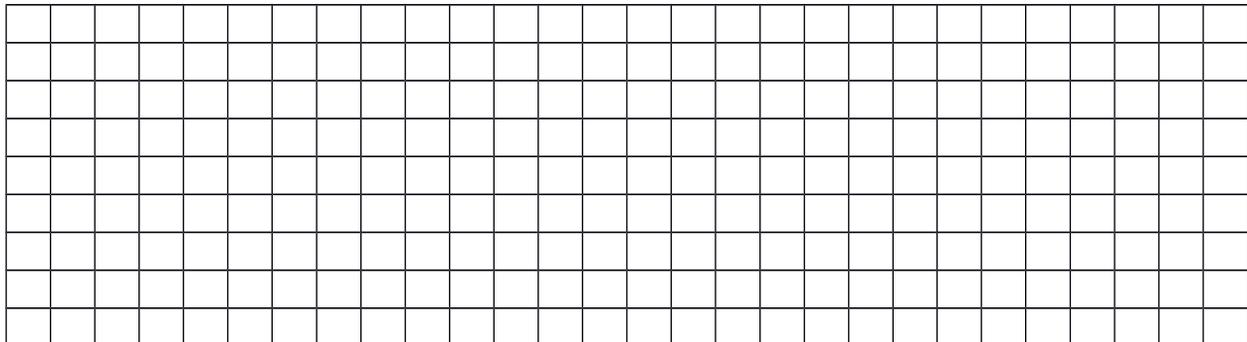
Test #2:

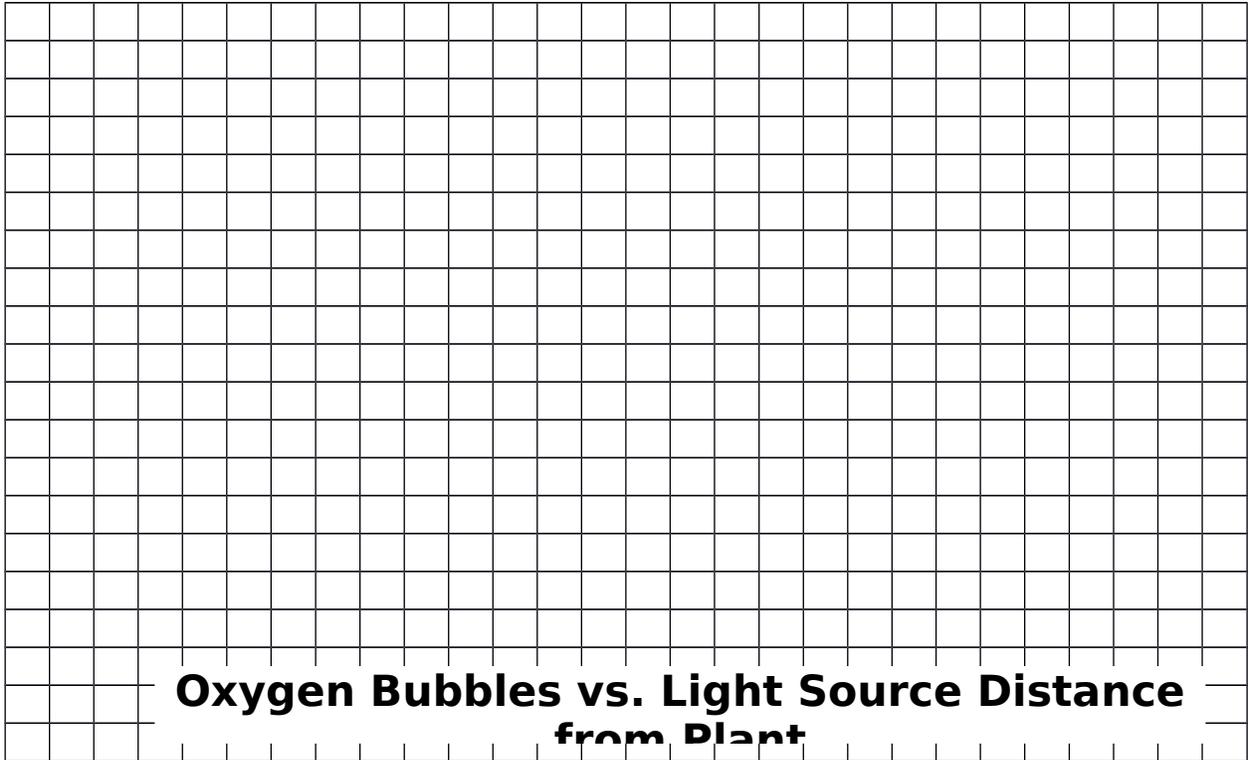
Distance of Light Source from the Elodea Plant:	
Trial:	Number of O ₂ Bubbles Produced:
1	
2	
3	
Average:	

Test #3:

Distance of Light Source from the Elodea Plant:	
Trial:	Number of O ₂ Bubbles Produced:
1	
2	
3	
Average:	

Use your average data to create a *Number of O₂ Bubbles vs. Distance of Light Source* graph.





Dependent Variable: Number of Oxygen Bubbles

**** Add your data to the class graph!**

Independent Variable: Light Source Distance
from Plant

