Dissolved Oxygen and Photosynthesis: 2

Time: 2 class period

National Benchmarks: Benchmarks 5A: Diversity of Life; 5D Interdependence of Life; 5E: Flow of Matter and Energy; 9B:Symbolic Relationships; 9D:Uncertainty; 12B:Computation and Estimation; 12D:Communication Skills; 12E:Critical-Response Skills.

National Science Content Standards: *Science as Inquiry: A*; *Life Science: C*: Biological Evolution; The Interdependence of Organisms; Matter, Energy, and Organization in Living Systems; *Science and Technology: E:* Abilities of Technological Design; Understandings about Science and Technology; *Science in Personal and Social Perspectives: F:* Population Growth; Natural Resources: Environmental Quality; Natural and Human-induced Hazards; Science and Technology in Local, National, and Global Challenges

New York State Standards: 1, 2, 4, 5, 6, 7

Objective: Students will know that plants produce oxygen underwater and be able to design an experiment to test this question.

Lesson Outline:

1. Students discuss the relationship between photosynthesis and respiration and dissolved oxygen
2. Teacher performs a demonstration using BTB
3. Students design an experiment to test the presence of oxygen using elodea in test tubes and BTB as an indicator
4. Students record and report their results

Materials: large-mouthed mason jars, bromthymol blue indicator, elodea plants (or other submerged aquatic plants), straws, glassware that can be sealed(large test tubes with stoppers, small glass bottles with tops), grow-lights or other light source (that does not produce heat)

Preparation: This lab only requires that you obtain the materials prior to class. This lab only tests the presence or absence of oxygen, not the actual amount or the response to different light. If your students would like a more in-depth experiment, try Dissolved Oxygen and Photosynthesis: 1.

Engage: Ask: How do we get the air to breathe? Most students will have heard that plants give off oxygen-but-can they prove it? Ask for ideas on how to prove that plants are giving off oxygen.

Show the students a tube filled with bromthymol blue, and ask what they think will happen if someone exhales into the tube. Ask for a volunteer, and allow the students to guess why the solution turned yellow. You can also combine baking soda and vinegar and siphon off the resulting gas to show another reaction that produces carbon dioxide. Note: In the presence of carbon dioxide, BTB turns yellow, and when carbon dioxide is removed, it turns blue again.

Explore: Students will be given the materials and asked to design an experiment in their groups to test the presence or absence of oxygen in water with aquatic plants.

The basic experiment will involve students turning the BTB yellow, adding the elodea plant to the solution, and then allowing it to sit overnight to see the response (the solution will turn blue again). If students want to test the difference between leaving the experiments in the light and in the dark, they can do so. Experiments left in the dark will not change to blue. Remind students of the importance of including a control.
Explain: Plants take in carbon dioxide and give off oxygen, but they also use it during respiration (which takes place all the time, even at night). Animals take in oxygen and give off carbon dioxide.
Extend: Students can vary the temperature of the experiment, or the amount of time that they wait for results.
Evaluate: Students should be able to draw a diagram showing the interaction between plants and animals.

Comments:

Modified with permission from: "A light snack" 1997. Living in Water, National Aquarium in Baltimore, Kendall Hunt Publishing, Iowa.