

## Photosynthesis and Respiration

**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 the relationship between plants and animals in an aquatic ecosystem and be able to predict the effects of low dissolved oxygen on the organisms.

### Lesson Outline:

1. Students create microcosms with plants, animals, or both
2. Students use observation skills to determine which microcosm was more successful (define this before starting)
3. Review photosynthesis and respiration
4. Students answer review questions
5. Students extend their knowledge using Hudson River data

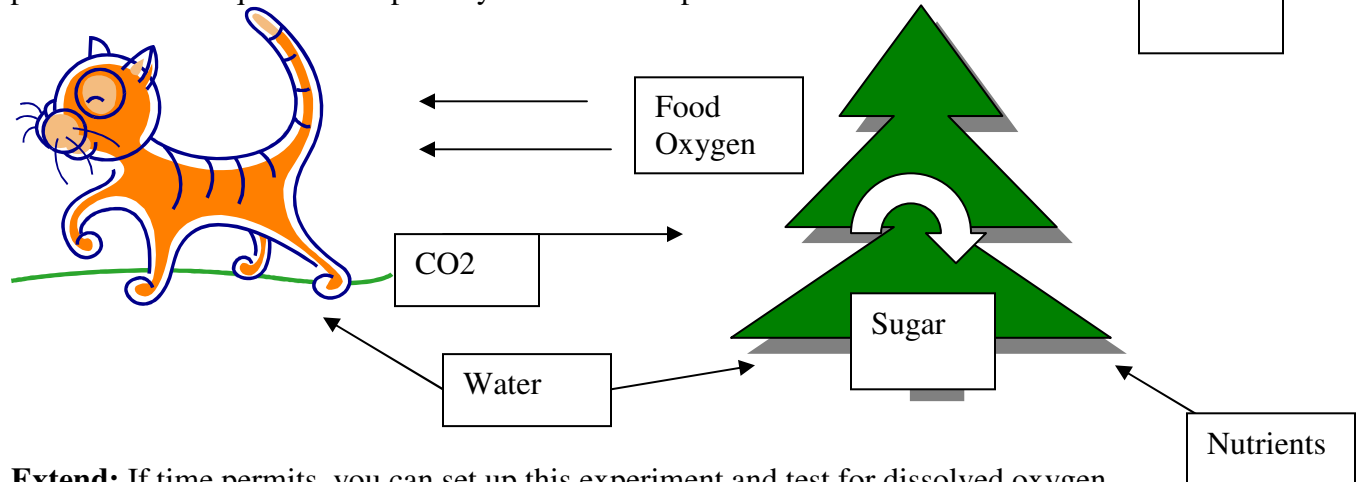
**Materials:** four one-quart jars with lids, aged tap water, several pieces of Elodea, 4 aquarium thermometers, several aquarium guppies and/or water snails, copies of 'Dissolved Oxygen Changes' worksheet

**Engage:** Ask students what happens to them when they hold their breath. This should create a decent amount of discussion. Connect this to the predicament a fish or other aquatic organism would face if they didn't have any dissolved oxygen in the water.

**Explore:** Set up the four jars for each group. Aged tap water should go in each jar, along with an aquarium thermometer. Allow students to decide what they would put in each of the three jars, based on the materials available; this can be done in pairs or in groups. One jar should be the control, one jar should have only plants, one should have only animals, and one should have both plants and animals. Students should write their predictions in their lab notebooks about what responses they think they will observe. The

jars should be closed tightly and left in a well-lit place (but not in the sun, as this will introduce temperature as an additional variable). Observations should be made daily; although the animals that are without plants may need to be taken out of the jar within the first day to avoid casualties.

**Explain:** Students should be familiar with the cycle of photosynthesis and respiration. Encourage students to create a diagram on the board for the relationship between the two processes. The equations for photosynthesis and respiration should be reviewed.



**Extend:** If time permits, you can set up this experiment and test for dissolved oxygen levels on a daily (or hourly, in the case of the aquatic animals) basis. You can also create an inquiry-based lab by adding other variables such as temperature or light, and allowing the students to create their own experiments.

**Evaluate:** Students should be able to answer the questions from 'Dissolved Oxygen Changes' worksheet.

**Comments:**