

6th Grade
Water Quality Lesson

Water O₂ and You!

LEARNING OBJECTIVES

The student will begin to understand the relationship between photosynthesis, dissolved oxygen and the quality of water.

STUDENT PERFORMANCE OBJECTIVES

- * The student will be able to define photosynthesis.
- * The student will make observations about terrestrial and aquatic plants undergoing photosynthesis.
- * The student will determine that photosynthesis is one way oxygen gas dissolves in water.
- * The student will define dissolved oxygen and begin to understand its affect on the quality of water.
- * The student will use probes to determine the dissolved oxygen content of water.
- * The student will look up the dissolved oxygen levels of Lake Lewisville on the ECOPLEX web site.

BACKGROUND

Water quality refers to the condition of water in relation to the number of contaminants in the water. Many contaminants are man made; however, natural processes such as erosion can cause natural contaminants as well. Contaminants, such as nitrates found in fertilizers and soil, can cause plants such as algae to become abundant. As the algae die and begin to decompose they use up much of the oxygen in the water. Oxygen is the primary source of life for plants and animals, one way to determine the quality of water is to determine the amount of dissolved oxygen in the water.

Oxygen available to aquatic organisms is found in the form of dissolved oxygen. Oxygen gas is dissolved in a stream or lake through aeration, diffusion from the atmosphere and photosynthesis of aquatic plants and algae.

Plants and algae create oxygen through a process called photosynthesis. Plants combine sunlight with carbon dioxide and water to produce glucose and oxygen ($6\text{CO}_2 + 12 \text{H}_2\text{O} \xrightarrow{\text{light}} \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2 + 6\text{H}_2\text{O}$). Photosynthesis occurs in the chloroplasts of plants and algae cells and on the plasma membrane of some bacterial cells. It is the main energy source for all living things because it supplies carbohydrates for both plants and animals.

Photosynthesis, aeration and diffusion from the atmosphere supply oxygen in the water for consumption by organisms in the water. Dissolved oxygen in water is necessary for sustaining aquatic life. Plants and animals in the lakes or streams consume oxygen in order to produce energy through respiration. In a healthy stream or lake, oxygen is replenished faster than it is used by aquatic organisms.

Different organisms need different amounts of oxygen to survive. Organic pollutants can consume large amounts of dissolved oxygen. When aerobic bacteria decompose and oxygen is depleted faster than it can be replaced, the decrease in dissolved oxygen is known as the biochemical oxygen demand. This lowers the amount of oxygen in the water and may change the population dynamics of the organisms in the water.

Adequate dissolved oxygen is necessary for good water quality. Dissolved oxygen concentrations can range from 0 to 15 mg/L. The ecological quality of water depends largely on the amount of oxygen the water can hold. The higher the level of dissolved oxygen the better the quality of the water system. By testing for dissolved oxygen, scientist may determine the quality of the water and the healthiness of the ecosystem.

See other lessons on [water](#), [properties of water](#), [water changes](#), [non-point and point source pollution](#), [food chain](#), and [bioaccumulation of toxins](#).

<for more>

MATERIALS

- * Fast growing plant seeds (such as Wisconsin fast plants, grass seeds, radishes or peas)
- * Potting soil
- * Fertilizer (as needed for plant seeds)
- * 6 inch pots, styrofoam cups or potting trays (enough for each group of students to plant at least two plants)
- * Lighted area for growing plants (window sill or UV lamp)
- * Darkened area for growing plants (cabinet or cardboard box)
- * 2 glass jars
- * Elodea plants in an aquarium if you cannot get to a pond, lake or stream
- * Locate a pond, lake or stream (to demonstrate photosynthesis in the water and for the dissolved oxygen test)
- * Dissolved Oxygen Probe and instructions for use

OPENING

Discuss with the class:

PROCEDURE

All living things need oxygen.

Ask the class:

How do aquatic organisms get oxygen?

1. Define photosynthesis as the process by which plants combine sunlight with carbon dioxide and water to produce glucose and oxygen.
2. Discuss the importance of sunlight for photosynthesis to take place.
3. Divide the class into groups of 2-4.
4. Explain to the students that they will be conducting an experiment demonstrating the process of photosynthesis and the need for sunlight to complete photosynthesis.
5. Distribute planting materials for each group.
 - *Fast growing plant seeds (such as Wisconsin fast plants, grass seeds, radishes or peas)
 - *Potting soil
 - *Fertilizer (as needed for plant seeds)
 - *6 inch pots, styrofoam cups or potting trays (enough for each group of students to plant at least two plants)
6. Explain that each group will set up an experiment using two plants; one to place in the lighted area and one to place in the darkened area.
7. Have the students plant their seeds in their containers and label the containers with their group information (name, etc.).
8. Have the groups place one plant in the lighted area and one plant in the darkened area.
9. Have the students observe, draw and label their plants each day for one week or 10 days. Students will water their plants as needed during the observation time.
10. At the end of the observation time, have the students compare their drawings and make inferences as to the need for sunlight for plant growth and photosynthesis.

11. Have the students place the plant that was in the dark in the light for a few days. Students will observe, record and make inferences about the plant growth.
12. Have the students place a glass jar over the plant that was in the light and place it back into the light.
13. Discuss the condensation that occurs on the glass. Explain to the students that the condensation is water vapor given off by the plant during photosynthesis when it exchanges oxygen for carbon dioxide. This condensation is called transpiration.
14. Discuss the formula for photosynthesis ($6\text{CO}_2 + 12 \text{H}_2\text{O} \xrightarrow{\text{light}} \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2 + 6\text{H}_2\text{O}$) and explain that water is a product of photosynthesis along with glucose and oxygen.
15. Take another glass jar and completely submerge the jar in the water of an aquarium or pond so that there is no air in the jar. Then place the jar over the elodea in an aquarium or over a green plant in a pond, lake or stream. Make sure that the jar is completely filled with water over the plant.
16. Have the students observe, draw and label what their plants look like in the jar when the jar is first placed on the plant.
17. Have the students observe, draw and label their plants in the jar after a period of time (Students should check every 15 to 30 minutes for changes. The amount of time necessary for observations depends on the amount of light the plant receives.) They should see oxygen bubbles in the top and sides of the jar.
18. Explain to the students that the bubbles are oxygen, a product of photosynthesis. Explain that this is one way that oxygen gas dissolves in water.
19. Have the students test for dissolved oxygen by using a PROBE, following the instructions for their probe.
20. Discuss the importance of dissolved oxygen for the plant and animal life in the pond.
21. Have the students explain what would happen to the plants and animals if there was not enough oxygen in the water.
22. Have the students look up the [ECOPLEX](#) web site and determine the amount of dissolved oxygen in Lake Lewisville

and discuss the quality of the water based on the amount of dissolved oxygen.

- a) Go to [Ecoplex](#) web site.
- b) Click on [Clams](#) under Water Quality
- c) Click on [Water Quality Data](#)
- d) Click on [Water Quality Sonde 1](#)
- e) Scroll down to Dissolved Oxygen and record the current level of dissolved oxygen. (Teachers may want to have the students discuss the data and the graphs on this page)

**SO WHAT?
(LIFE APPLICATION)**

Discuss the importance of dissolved oxygen on water quality. Photosynthesis is important to life. Have the students complete a food chain to demonstrate the importance of the sun's energy for humans.

**CURRICULUM
EXTENSIONS**

Science:

Following the directions for the dissolved oxygen PROBE, determine the effect of temperature on dissolved oxygen.

TEKS:

6.1(A) (B), 6.2(B), 6.8 (B), 6.12 (B) (C)

RESOURCES

<http://ecoplex.unt.edu/main>

<http://www.trms.ga.net/habitat/lessons/photosynthesis.html>

http://www.brr.e.cr.usgs.gov/projects/SW_corrosion/diel-poster/abstract.html

<http://www.acnatsci.org/erd/ea/pollnb2.html>