



mobile inquiry technology

Teacher Notes

Monitoring a Pond Introduction

In this activity, students investigate the process of photosynthesis in an aquatic ecosystem. Using the light, pH, and dissolved oxygen (DO) probes, the students compare and organize their information in simple tables or graphs.

Students investigate and observe the factors of an aquatic ecosystem while they are:

- realizing that the number of organisms an ecosystem can support depends on the resources available and abiotic factors, such as quantity of light and water, range of temperatures, and soil composition.
- understanding that for ecosystems, the major source of energy is sunlight. Energy entering ecosystems as sunlight is transferred by producers into chemical energy through photosynthesis.
- recognizing that substances often are placed in categories or groups if they react in similar ways, such as an acid or base.
- making explanations and predictions from evidence and drawing logical conclusions.
- identifying variables that can affect the outcome of an experiment. In addition they will learn to identify other variables in an experimental design that must be controlled in order to isolate the affect of one variable.
- gaining skills and confidence in using a scientific measurement tool, light, pH, and DO (optional) probes, as well as the spreadsheet and graphing capacity of a computer to represent and analyze data.
- learning to value accuracy and precision in scientific investigation.





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Discussion Guide

Initiate a discussion with students about changes they have noticed from day to day or during the day around their pond. The students will probably discuss changes in factors such as appearance, temperature, light, etc.

Direct the students to "Thinking About the Question." Ask the students to share with the class their concept maps. Draw a class concept map that includes the gas exchange between the plants and animals.

Introduce the idea that sometimes in order to understand a complex process, scientists try to isolate components in a controlled experiment. Point on the concept map to the interaction between plants and light. Make a list of the ideas students have about this relationship. Now, point to the gas exchange relationship between plants and animals. Make a list of the ideas students have about this relationship.

Based on the class concept map, ask the students to answer the following questions. What evidence have you observed that plants consume carbon dioxide? What evidence have you observed that animals use oxygen? What evidence have you observed that light affects how plants undergo photosynthesis? What does the pH of a solution indicate about the amount of dissolved carbon dioxide in the water? If the students have completed "Monitoring an Aquarium" activity, ask them to point out differences in the related concept maps.

Introduce the probes that the students will be using for their investigations. It is highly suggested that this activity is only done after the students have already completed the other activities especially relating to pH and DO probes. Review with the students that light is necessary for the photosynthesis. Students should already be familiar with the pH scale and the range of the DO probe. Healthy ranges for pH are between 6.5 and 8.0 and for DO between 5.5 and 8.5. Explain to the students that any extremes will produce an unhealthy pond.

Direct the students to "Investigating I".

Note: Before going to any body of water, several guidelines should be discussed with the students and field trip procedures should be followed. Explain to the students the importance that they not disturb or pollute the ecosystem at the site. Remind the students that because they will need to wade into the water to obtain many of the readings, proper dress and shoe covering should be worn. It is advised that the parents sign proper permission slips for the students and that they are filed with the school administration.

Note: You should scout out the pond in advance to identify possible student test sites. If the pond is in a public park or on private land, you should notify the officials or owners of the date(s) that your students will visit. Discuss with them any special rules that the students should adhere to while at the site. Check for any hazards including poison ivy, steep banks, etc.





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Additional Teacher Background

Photosynthesis adds O_2 to water. In photosynthesis, sunlight converts water (H_2O) and carbon dioxide (CO_2) into sugars such as $C_6H_{12}O_6$. The sugars contain less oxygen per hydrogen and carbon atom than the starting water and carbon dioxide. The excess oxygen is returned to the water as oxygen gas (O_2). The rate at which oxygen is added to water by photosynthesis depends on the amount of sunlight.

Oxygen is removed from water by respiration, decomposition and growing plants. Fish and other animals need oxygen to live. Aerobic bacteria eat up organic material and use up oxygen in the process. Plants also use the sugars they have stored up for energy to fuel their growth, using up oxygen in the process. *Remember*, the stronger an acid, the lower the value on the pH scale.



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Monitoring a Pond Suggested Timeline

The amount of time you spend on introductory discussions, data collection, and analysis, will determine your overall timeline. The following represents a possible timeline.

- One class period - Introductory Discussion
- One class period - Investigation I: Conducting a site assessment
- One class period - Investigation II: Testing samples Day one
- One class period - Investigation II: Testing samples Day two
- One class period - Analysis

Additional days can be used for further investigations.



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