

Explore: 5th Grade Dissolved Oxygen

Summary

Students measure the dissolved oxygen levels and pH levels of distilled, stream, and pond water.

Materials

3 two liter clear plastic soda pop bottles with lids; Weak methylene blue solution (see background section); pH paper; thermometer; safety goggles; 1 liter of distilled water; lemon juice; bleach;

Background for Teachers

When water is polluted by organic material its levels of dissolved oxygen generally drop. The organic material serves as food for microorganisms. As the microorganisms multiply, oxygen is depleted causing fish and other aquatic life to die. In extreme cases of oxygen depression (less than 2 mg/l) a fish kill may occur. Methylene blue is a good indicator of oxygen. In the presence of oxygen, Methylene blue is blue and as the oxygen levels drop the Methylene blue becomes bleached and colorless. You can purchase Methylene blue from a chemical supply house or make it yourself as follows: Add 1.48 grams of Methylene blue dye to 100 ml of 95 ethyl alcohol (the solution should be quite dark). Dilute the stock solution just before you use it by adding 10 ml of the stock solution to 90 ml of distilled water. The pH of water - a measure of acidity and alkalinity - is another important factor. Stream waters usually range from pH 6.5 (slightly acid) to pH 8.5 (somewhat alkaline). Rainwater is naturally acidic (pH of 5.6), but its acidity has been greatly increased (to pH 4) in some regions by atmospheric pollutants. If the pond water reaches extremes of acidity (pH 3) or alkalinity (pH 10) it is less hospitable to aquatic life.

Intended Learning Outcomes

Students will use basic science process skills to measure and compare the dissolved oxygen levels in distilled, stream, and pond water. Students will draw inferences from these observations.

Instructional Procedures

Divide the class into two groups. Give each group leader a strip of pH paper. One group should put lemon juice on their strip. Have them note the color change. The second group should put bleach on their strip. Have them note the color change. Bring the entire class together and have them predict the color change that will occur when hand soap is placed on a third pH strip. Discuss the differences in color that result from the acidity of the object that interacts with the pH strip. Point out that acidity is an important factor in the amount of aquatic life that a pond can support. Following the introduction, ask the class members to brainstorm on other water quality factors that could affect the aquatic life in a pond. Watch for students to mention the oxygen content of the water. Since many 5th grade students will not think that oxygen is in water, watch for them to discuss the 'purity' of the water. Use the term 'purity' to discuss 'good' things that mix in the water (oxygen) and 'bad' things that mix in the water (poison). Explain that even fifth graders can determine the relative level of oxygen that is dissolved in the pond water. To carry out the experiment fill one clear plastic bottle with distilled water and label it 'CONTROL'. Explain that distilled water is water from which all the impurities have been removed. For this activity the distilled water is considered 'pure'. Fill the second bottle with water from the pond. Label this bottle POND WATER. Measure the temperature of the pond water and record it on the chart attached to this lesson. Be sure to put the lid on tight after measuring the temperature. Fill the third bottle with water from the stream feeding the pond. Label this bottle STREAM WATER. Record its temperature on the chart attached to this lesson. Put the cap on tight after taking the temperature of the stream water. In the classroom measure the temperature of the distilled water.

Record the temperature of the distilled water on the attached chart. Next dip a pH strip into the distilled water. Record the color (or if a scale is available on the back of the pH paper box write down the pH number that corresponds to the color of the wet strip). Put on your safety goggles. Place between 10 & 20 drops of Methylene blue solution into each of the bottles holding water samples. Make sure that equal amounts of Methylene blue are placed into each of the three samples. Record the coloration of the water in each sample as the Methylene blue reacts with the dissolved oxygen in the water. Repeat the process of checking for dissolved oxygen over a five day period. After five days sniff the sample for any odors. Compare the pH and dissolved oxygen results of the water samples. Compare your observations to the averages given in the Background and Introduction sections of this lesson. What indications are there that pollution is a problem for your pond? How could we replicate this experiment to verify that our results aren't created by sampling error?

Extensions

This might be a great time to study the pH of other liquids. If acid rain is considered a problem in your area, you may wish to test the pH of rain or snow at your site.

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