

When pH changes

What happens?

TEACHER



Activity Overview

Most aquatic organisms have adapted to life in water with a specific pH; if the pH changes, they may die. Dramatic pH changes are often (but not always) caused by humans. A change in pH in a stream, for instance, may mean that pollution is affecting the water. Water with pH values between 4 and 10 has a minimal effect on human health. Water with pH values outside of this range may cause eye and skin irritation.

Students will test the water at the aquatic site to determine whether the water is acidic, basic, or neutral. First, students make field observations to determine if the aquatic site supports animal life and vegetation. Next, they collect a water sample from a local aquatic site. They use a pH Sensor connected to a TI CBL 2™ or Vernier LabPro, and a TI-73 Explorer™ to measure the pH of the sample. They take a second pH reading of their sample and find the average value. They record their data in a table.

Conclusion: If the pH of the aquatic site is below 7, the water is acidic. If it is above 7, the water is basic. Often the pH of an aquatic site is between 7 and 8. Values outside this range may affect the ecosystem.

This activity is part of a series of activities to help students determine the water quality of a local aquatic site.



Activity at a Glance

Grade: 4-9
Subject: Science
Category: Life Science, Earth Science, Physical Science
Topic: Living Things, Plants, Animals, Ecology, Water Quality, Chemical Properties

Time required

- One 45-minute period

Level of complexity

- Low

Materials*

- TI-73 Explorer™
- TI CBL 2™ or Vernier LabPro
- TI-73 DataMate
- pH Sensor
- 250 mL beaker
- pH 7 buffer solution (for calibration - optional)
- pH 10 buffer solution (for calibration - optional)
- Distilled water
- Paper tissue



pH Sensor

* This activity has been written for use with the TI-73 Explorer™, however it can be easily adapted for use with the TI-83 and the TI-83 Plus. Appendix A explains how to transfer DataMate on your device and how to use DataMate for data collection.



Adapted from "Experiment 2 - pH", *Water Quality with Calculators*, written by Johnson, Robyn L., Holman, Scott, and Holmquist, Dan D., published by **Vernier Software & Technology**, 2002.

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Concept Background

- Water pH values outside the range of 4 and 10 may cause eye and skin irritation to humans.
- Aquatic organisms have adapted to life in water with a specific pH. If the pH changes, the organisms may die.
- Watersheds are critical as habitats for plants and animals and the people who live within their boundaries. Humans alter watersheds all over the world allowing chemicals and nutrients to enter them, and by creating dams, channels, and buildings.
- Streams and lakes are often basic, with pH between 7 and 8. Sometimes the pH is as high as 8.5.



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– National Education Standards

Content Standard A: Science As Inquiry.

Students should learn about scientific inquiry and develop the abilities necessary to do it.

English Language Arts Standard 3

Students should apply strategies to comprehend, interpret, evaluate, and appreciate text.



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Classroom Management Tips

- This test can be conducted on site or in the lab.
- It is better to take the pH measurements at the site. If this is not possible, collect the water sample from the aquatic site and store in an ice chest. Allow the sample to return to room temperature before students measure the pH.
- A 100 mL water sample is required.
- Obtain the water sample from below the surface of the water and as far away from shore as is safe. If suitable areas of the stream appear to be unreachable, samplers consisting of a rod and container can be constructed for collection.
- This activity works well with students in groups or as a demonstration.
- Encourage students to answer the questions in Observations and Conclusions in a *Journal*.
- Create your own student questions for use on your student's TI graphing devices using the Texas Instruments StudyCard applications. For more information, go to <http://education.ti.com/us/product/apps/studycards/scresources.html>



Observations & Conclusions

A. What observations did you make at your aquatic site (weather, description and type of site, signs and condition of animal life, signs and condition of vegetation, signs of pollution)?

Answers will vary.

B. Is the pH of your aquatic site acidic, basic, or neutral?

If the pH of the aquatic site is below 7, the water is acidic. If it is above 7, the water is basic. If the pH is about 7, the water is neutral.

C. Compare your pH readings with your observations. Based on your observations and the information provided in the research article, identify the factors that influenced your pH readings.

pH may be influenced by factors like water temperature, water salinity, amount of light, amount of algae or plants in the water, air pollution, acid rain, runoff that contains chemicals, and more.

D. Find examples of watersheds (local or outside of your area) that are affected by pH. Describe efforts that are being done to maintain or change pH levels.

Answers will vary.

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Vocabulary

Acid A substance that produces positively charged hydrogen ions (H^+) when dissolved in water and reacts with bases to form salts.

Acidosis Condition characterized by abnormally high levels of acidity, which may affect aquatic life. Acidosis can also affect humans with abnormally high levels of acidity in their blood.

Alkalosis Condition characterized by abnormally low levels of acidity, which may affect aquatic life. Alkalosis can also affect humans with abnormally low levels of acidity in their blood.

Base A substance that produces negatively charged hydroxide ions (OH^-) when dissolved in water and reacts with acids to form salts.

Ecosystem A group of organisms together with its environment, seen as a unit.

Habitat The environment where a particular plant or animal is normally found.

pH A measure of acidity.

Salinity The amount of dissolved salt in water.

Watershed An area of land that delivers runoff water, sediment, and dissolved substances to surface water bodies, such as rivers or lakes. All watersheds consist of boundaries, a basin and collection areas.

