



## WATER QUALITY INDOOR LAB TEACHER'S GUIDE

**Learning Goal:** Understand the importance of water quality and human impact, including personal behaviors, on our water resources.

### **Objectives:**

- Conduct various water quality tests and record data on a water sample.
- Determine water quality based on chemical and physical factors.
- Relate water quality parameters to the health of the lake, including the impact on organisms.
- Discuss how personal behaviors and choices impact water quality in local water systems.

### **Pre-lab supply check:**

- Make sure your pH strips are viable. If the strips have been stored in extreme temperatures, they may not be reliable.
- Inventory the Chemetts kits to make sure there are enough tubes for all student groups.
- Check temperature meters before in-class lab for functionality. Test at multiple temperatures (room water temperature and cold/ice water).

1. Introduce the guests in the room.
2. Introduce the importance of water quality. Ask students to share their ideas on why water quality is important for lake ecosystems.
  - Draw out discussion on conditions that are favorable for the functioning and balance of the lake ecosystems. Refer to the table in the lab for various effects on the lake.
  - Make the connection between the increase in severe storms in recent history to water quality. How do storms impact lakes? The runoff after storms brings in sediments, nutrients, and pollutants from urban and rural systems. Manmade structures, such as boat landings on private property, paths, roads, driveways, alter the course that water takes and increases nutrient runoff. The watershed is all connected.
  - Aesthetics are also a key variable as humans live on and recreate within the lakes. How can we balance our impact on the systems with the stability of land for future generations? Describe more broadly how the health of the lake affects our local economy and recreation.
3. Hand out lab packets and have students refer to the Water Quality Resource Table as you explain the lab. Demonstrate and explain the importance of each test that the students will be conducting on chemical and physical indicators of water quality.

- Make sure you note that the students will use these same concepts and tests when they are on the LEEP field trips.
- Note that students and instructors should wear safety goggles throughout the entirety of the testing. Also point out where the paper towels are in case they spill some water.

**Tips:**

**Temperature**

Procedure tips:

- It is best to take early in the lab, as it is easier to use the thermometer in the jar.

Connect to water resources and lake ecosystem health:

- Temperature is important as it relates to the thermal tolerances of organisms and determines the concentration of dissolved oxygen in the water.
- Some coldwater species, like trout, are unable to live in warmer temperatures.
- In addition, with increased temperatures, more algae will grow and the capacity for water to hold oxygen decreases.

**Turbidity**

Procedure tips:

- Make sure you mention that the bucket should be on the floor so the students don't spill on the tables.
- Although the students will be using the turbidity tube for the lab, make sure you introduce the larger Secchi disk that is used to determine lake turbidity levels.

Connect to water resources and lake ecosystem health:

- As turbidity increases, temperatures can also increase because the increased particles in the water absorb heat from the sun.
- Sediment in the water can clog gills of aquatic invertebrates and fish and can make spawning more difficult.

**Dissolved oxygen**

Procedure tips:

- The Chemette testing for dissolved oxygen involves the use of glass vials, including intentionally breaking the tip. Make sure you demonstrate the force and angle needed to break the tip.
- Point out where students should dispose of the glass when they are done with test. Note that the tip that they break off will be in the container provided and the students should drain the water without dumping the tip out. For safety, the tips should be disposed of in a separate container.

Connect to water resources and lake ecosystem health:

- Dissolved oxygen is important for organisms to respire. Some organisms have a low tolerance for decreased oxygen levels, whereas some are able to thrive in low oxygen conditions.
- However, increased species diversity leads to a greater balance in the ecosystem, making it more stable and resilient to change. Therefore, we do not want to lose the species that are sensitive to low oxygen levels as they play a vital role in the ecosystem.

## pH

Procedure tips:

- Demonstrate how you should take the strip out of the bottle with safe handling. Only touch the top of the strip so that you do not contaminate the testing and affect the results of the test.
- Make sure students are aware of where they can find the color coding to determine the results of the pH test. This can be found on the container that the strips are stored in.

Connect to water resources and lake ecosystem health:

- The pH level is a way to measure the acidity/alkalinity of the water.

## Phosphates and Nitrates

Note that the table also includes phosphates and nitrates and how they affect water quality. While we do not test these two nutrients in this lab, it is important for students to understand where these nutrients come from and the impact they can have on lakes. Phosphorus and nitrate that enters the system through runoff will accumulate over time and cannot be removed. This affects algae blooms and the growth of other aquatic plants.

4. Distribute the water sample jars to the lab groups. Have them go to the data table where they will be recording their results in the lab packets. Have students record their sample number right away. Each jar should be labeled with the sample number on top.
  - Describe how they should fill in the results of their tests in the “Your Findings” column for each test.
  - Then, they will need to use the Water Quality Resource Table to determine whether their sample was in the acceptable range for each test. Show them where they can find each of these tables in their lab books to avoid any confusion.
  - Make sure you also point out the column that describes the effects of each water quality factor on the lake. Students will need to understand the importance of what they are testing in the classroom to the impacts on local lakes and list these consequences under the critical thinking questions in the lab manual.
5. As the students are working, draw a table on the board where students will record their groups’ findings. See the table in the lab manual for a reference.

6. Demonstrate how to tabulate the data and transfer the information from their worksheet to the table on the board. Point out that the columns match their sample numbers and they should list their answers vertically.
7. When groups are wrapping up, make sure they know to record every group's sample data in their lab manual as well as the summary questions.
8. Give students time to wrap up their summary questions before you have a class discussion about what their various findings indicate about the water quality of their samples and the potential impacts each factor would have on lake ecosystems, recreation, and local economy.
  - Connect to broader context, linking the importance of water quality to lake ecosystems and how we use water quality information to determine and manage the health of our lakes. You can discuss topics such as factors that determine good critical habitat, the presence of aquatic plants (increased oxygen and habitat availability), absorbing pollutants (phosphorus, nitrogen, etc.), sediment retention through shoreline restoration (clearer water).
  - Ask students to consider how their personal behaviors and actions can ultimately affect the water quality of local water resources.