

# Science Investigation Using Water Quality

by Sean Estill

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**Grade level** 8

**Time required**

Two 50-minute class periods

**Materials/Technology**

Dissolved oxygen test kit or dissolved oxygen sensor  
pH paper or pH sensor  
Funnel  
Filter paper  
Ring stand  
Iron ring  
500 mL beaker  
2 - 200 ml beakers  
Mass balance

**Summary**

The students will act as laboratory technicians, examining the physical and chemical characteristics of several water samples. They will test water samples to determine if they meet the standard for water classified as A-1 according to the water quality standards of the Confederated Salish and Kootenai Tribes.

**Objectives**

The students will

- 1) develop skill in performing safe and appropriate lab procedures.
- 2) develop their ability to record and communicate their laboratory findings.
- 3) gain awareness of water quality standards and the CSKT's role in managing water on the Flathead Reservation.

**Montana Science standards addressed**

- 1) Students design, conduct, evaluate, and communicate scientific investigations.
- 2) Students demonstrate knowledge of properties, forms, changes, and interactions of physical and chemical systems.

**Assessment**

Evaluate students using the following criteria.

- 1) Lab procedure and lab safety scoring record
- 2) Student records of laboratory work
- 3) Ability of students to communicate their laboratory findings in written form
- 4) Accuracy of water test results and the students' ability to justify their judgments about water quality

**Background Information**

Beginning with the Hellgate Treaty of 1855 and the creation of the Flathead Reservation, the Confederated Salish and Kootenai Tribes have been legally responsible for the management of the 1,243,000 acres that comprise this reservation. Present on this land are a variety of water resources, both above and below ground. From the expanses of Flathead Lake to the multitude of creeks and streams, the responsibility for the health and management of these resources falls to the Tribe. This plan is outlined by the Tribe in the report entitled "Confederated Salish and

Kootenai Tribes of the Flathead Reservation Surface Water Quality Standards and Antidegradation Policy”, on file with the Environmental Protection Agency. Please contact members of the CSKT Water Quality Department and invite them to work with your students either in your classroom or in the field.

### Teacher Tips

- 1) *Standard sample* - Many of the water sources used to supply drinking water to the towns here on the reservation are classified as A-1. The easiest source for your standard sample is the tap water in your classroom. This works well because the point of the lab is not the actual classification of the water, but the comparison of the samples to this standard. Be sure to let the water run for a long time to clear out water that has been sitting in the school pipes for an extended time period. Collect a large sample to provide all the students with a sample from the same source.
- 2) *Dissolved oxygen* - Tests to determine the dissolved oxygen content of a sample are available in a wide variety, from pre-filled ampules to interfaces that measure the dissolved oxygen content. Choose one that fits your budget and that you feel comfortable using. When the students are working with samples, remind them not to agitate them, since this will add atmospheric oxygen to the sample and falsify their results. To deplete the dissolved oxygen from a water sample, leave the water sample in a warm area for two days. Much of the oxygen will come out of solution with no other help.
- 3) *pH* - Determine the pH of the water sample using pH strips or a pH sensor. The pH sensor is recommended since it has a greater sensitivity than pH paper. These are available at a low cost from science supply companies. Vinegar may be used to lower the pH, or ammonia may be used to raise the pH. Students may have an easier time measuring differences if the pH change is exaggerated.
- 4) *Sediment Load* - This sample can be prepared by adding one to two grams of sand and clay for every 100-ml sample that the students will test. Have the students mass a piece of filter paper that has been lightly dampened with water. Place this piece of filter paper in the funnel to set up a basic filtration column. The students should filter one of the 100-mL samples through this setup. They might have to swirl or mix the sample to ensure that all of the sediment is emptied out of the beaker. After the sample has filtered, mass the filter paper. The difference between the saturated filter paper and the filter paper plus the sediment will give the sediment load in grams per 100 ml of water. If this number is multiplied by ten you will get your results in grams per liter.
- 5) *Allowable Tolerances* – Provide these guidelines to students as allowable tolerances for their water samples.
  - pH – The pH must not vary more than one (1) unit from the pH of the standard.
  - Dissolved oxygen – The dissolved oxygen of the sample must not vary more than 2 ppm.
  - Sediment Content – The sediment content may not vary from the standard sample.

**Note:** These tolerances are altered from the actual content of the water quality standards utilized by the CSKT. The important part of this activity is the work and investigation in the lab. If you are interested in actual values and more details, the complete text of the report “Confederated Salish and Kootenai Tribes of the Flathead Reservation Surface Water Quality

Standards and Antidegradation Policy” can be found at the following link  
[http://www.epa.gov/ost/standards/wqslibrary/tribes/salish\\_kootenai\\_8\\_wqs.pdf](http://www.epa.gov/ost/standards/wqslibrary/tribes/salish_kootenai_8_wqs.pdf).

- 6) *Clean Up* - If using a dissolved oxygen kit or pH strips, be sure to read and follow waste disposal instructions for these items. The rest of the water samples can be disposed of down the sink.

## **Procedure**

### *Pre-Lab*

- 1) Discuss with students the water resources found on the Flathead Reservation and the CSKT’s role in managing these resources.
- 2) Demonstrate the procedure for determining the amount of dissolved oxygen, pH, and sediment concentration for the water samples. Be sure to point out all appropriate safety concerns.

### *Lab - Day One*

- 3) Break the class into groups of two or three students. Provide each group with two 100-mL samples of the standard water sample. The students should determine the dissolved oxygen, pH, and sediment concentration for this sample. This will serve as the standard for the A-1 water classification.
- 4) After the students have determined the values for the standard provide them with two 100-mL samples of each of the three samples that are to be tested. Tell students that they will be responsible for recording all experimental data.

### *Lab - Day Two*

- 5) For each unknown water sample that the students test, ask them to write a letter documenting their results and explaining why the water sample did not meet the established standards.

## **Further Information**

For further information about this lesson, contact Sean Estill via electronic mail at [estillsci@hotmail.com](mailto:estillsci@hotmail.com).

For further information about the CSKT’s Water Quality management and policies, please contact the tribal Water Quality Department at (406) 675-2700.

For the complete text of the CSKT’s water quality standards report go to the following page.  
[http://www.epa.gov/ost/standards/wqslibrary/tribes/salish\\_kootenai\\_8\\_wqs.pdf](http://www.epa.gov/ost/standards/wqslibrary/tribes/salish_kootenai_8_wqs.pdf)