



Testing Water Quality Teacher Guide

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1. Minds On Answer Key

Possible answers for “What substances are found floating or dissolved in water?” are shown in this table.

Helpful Substances	Neutral Substances - perhaps good to have in small amounts - too much or too little is harmful	Harmful Substances
<ul style="list-style-type: none"> - <i>oxygen</i> - <i>chlorine (in tap water to kill bacteria and viruses that make us sick)</i> - <i>fluoride to prevent tooth decay</i> - <i>aquatic plants like algae</i> - <i>aquatic animals like leeches, dragonfly nymphs, mosquito larvae</i> - <i>some bacteria that are decomposers</i> 	<ul style="list-style-type: none"> - <i>nitrogen (nitrates) for plants to grow</i> - <i>phosphorus (phosphates) for plants to grow</i> - <i>pH (not too acidic or basic)</i> - <i>salts like sodium chloride</i> - <i>carbon dioxide</i> 	<ul style="list-style-type: none"> - <i>pesticides</i> - <i>herbicides</i> - <i>litter</i> - <i>floating dirt from erosion</i> - <i>bacteria that cause disease</i> - <i>fish and animal feces</i> - <i>viruses</i> - <i>chlorine (in surface water kills plant and animals)</i>

2. Water Testing Kits – Ordering Information

Two of the main science supply companies have water test kits. It is important to order a kit that has teacher and student instructions. Be sure to order a kit with extra water test tablets so you can practice and also have some extra tablets available so that students unable to participate in the field trip can test tap water.

Boreal Science Supply at www.boreal.com

a) LaMotte Green Water Monitoring kit

(Order # WW46438M00) \$44.50

This kit is **recommended** and it is best to order 2 kits the first time so you have extra test tubes so there is less waiting for materials being shared. It is recommended that you laminate the colour charts before taking them near water. This kit tests for pH, turbidity(clarity), dissolved oxygen, nitrate, and bacteria.

b) Earth Force Elementary Education Watershed Field Trip Kit

(order # WW01810M63)\$81.50

Designed for grades 1-5 so the included instructions and worksheets are very simplistic for grade 8 students. Includes enough test materials for a class of 30 to share and tests for pH, nitrates, phosphates, dissolved oxygen, temperature and turbidity.

c) Water Quality Test Kit with 50 test strips

(order # WW46915M00) \$31.79

This kit is cheap because all the test results show up on one test strip and there is only one colour chart on the outside of the test strip bottle. This is not recommended as it is extremely difficult for kids to share and the experience of handling various scientific materials is lost. The kit tests for total and free chloride, total hardness, alkalinity and pH.

Sargent Welch at www.sargentwelch.ca

a) Urban Water Quality Test Kit

(Order # WL9788) \$57.09

The kit has materials for 10 tests of chlorine, nitrate, iron, copper, phosphates, hardness, pH and temperature and 5 bacteria test tablets.

3. Field Trip Preparation Checklist

Taking students outside is a crucial component of environmental education. Richard Louv in his 2005 book, "Last Child in the Woods: Saving our Children from Nature Deficit Disorder" stresses the importance of taking children outside to explore, learn and play. While the water quality lab could be done indoors, the essential environmental component would be lacking. As all Ontario teachers are responsible for integrating environmental education expectations into their curriculum delivery, this field trip is a perfect opportunity to do so. That said, there are many discouraging factors to overcome when organizing any outdoor field trip. This field trip preparation checklist can assist you if you lack experience and wish to avoid problems.

- ☐ Order the water quality testing kit and disposable gloves from a science supply company. Cheaper versions of water testing can also be performed with materials bought for testing aquarium water or pool water.
- ☐ Try to recruit a colleague to join you and bring their class on the field trip.
- ☐ Choose a site within walking distance if possible.
- ☐ Book transportation if walking is not possible.
- ☐ Visit the stream, river or lake ahead of time and assess the site for safety. Water samples can be scooped out with a bucket on a rope or beer cups duct taped to a meter stick. This keeps students back from the edge and protects the riparian zone.
- ☐ Perform all the tests yourself onsite. Often it is best to carry the water sample away from the edge of the water to do the tests. Remember students will need a clipboard for recording data. This will also keep papers from blowing away.
- ☐ Complete the required field trip forms. Some school boards have a special form for "high risk" field trips and being near water is a risk factor.
- ☐ Remember, there are often students who cannot afford a field trip, so ensure you have a way to cover their field trip costs without embarrassment.
- ☐ Recruit parents or other responsible adults like a pre-service teacher. Try to have them join you when visiting the site.
- ☐ Arrange coverage, if required, for your other classes. Notify other teachers that may be affected by your departure from the school.
- ☐ Be sure to include the following items on the parent permission form: hat, gloves, raingear, camera, mitts, long warm pants, coat, sunscreen, bug repellent, pencil
- ☐ Ensure that students with allergies bring an Epipen or Benadryl
- ☐ Bring a first aid kit with band-aids, antiseptic cream, sunscreen and bug spray just in case.
- ☐ Plan for safety. Carry a cell phone for emergencies. All students must wear gloves so you need to bring a garbage bag. A bottle of hand sanitizer is recommended as well as strict orders to kids when arriving back at school to **wash their hands**.
- ☐ Plan for waste disposal. Have a large plastic bottle for collecting the tested water. Do not put this back into the environment. Check with your Board for chemical waste disposal procedures.
- ☐ Bring good humour!! This trip should be fun for everyone. More important than any water testing results is a sense of enjoyment from being outside.

4. More Resources

Some resources to understand water quality testing factors can be found in the list below. These resources could be used if your water quality testing kit has a test which is not included in **BLM 3 – Test Results Interpretation Cards** and you want to write an additional test results interpretation handout.

Project Wet “Water Quality Indicators: Biological, Chemical and Physical Parameters” website

http://www.worldwatermonitoringday.org/uploadedFiles/Content/Resources/Water_Quality_Indicators_Update%20web.pdf - use for benthic macroinvertebrates – do not use for pH as the explanation is wrong in some parts.

Safe Drinking Water Foundation “Water Quality Fact Sheets” technical resource for teachers website

http://www.safewater.org/PDFS/resourceswaterqualityinfo/Resource_Water_Qual_Facts.pdf

“Monitoring Surface Water Quality: A guide for Citizens, Students and Teachers in Atlantic Canada” website http://www.ec.gc.ca/Publications/98126669-2E4D-4E2E-9273-DC23FD59F452%5Cwaterquality_e.pdf

Project WET “World Water Monitoring Challenge” website

http://www.worldwatermonitoringday.org/Guides_Lesson_Plans.aspx

Hach Company” Important Water Quality Factors” website

<http://www.h2ou.com/h2wtrqual.htm#References>

5. Sample Answers to BLM 5 –Analysis

- 1-3 Answers will depend on the data gathered.
4. Circle any outliers on the Class Data and Mean Table. In science there is often a discussion about the scientific honesty of removing outliers from the mean calculation. Do you think the outliers should be included in the mean or not? Explain.
- I think outliers should be included in the mean because all the results need to be included to be scientifically honest. OR*
I think the outliers should be removed from the mean because sometimes we make mistakes in measuring or observing. Mistakes should not be included in the mean.
5. Use the mean results and the **Test Results Interpretation Cards** to determine if the water quality for each quantitative test. Decide and record your results in the Results Table.
- The teacher can calculate all means based on class data collected. You might want to discuss why the results are more reliable if the class mean is used than each team measurement.*
6. Now, using the results of all eight water tests, what do you think is the overall quality of the water you tested? Write three sentences to support your conclusion. Be sure to use the observations and results in your concluding sentences.
- If the majority of the test results indicate good water quality then the students should conclude the water quality was good. Student answers should total the number of good, poor and bad test results. Poor results are a challenge and students can choose to class them with good or bad results and thus have different conclusions.*

Human Actions that Impact Water Quality

7. Name the water quality tests that can be influenced by fertilizer runoff from lawns, golf courses or farms.
- Nitrates, phosphates and dissolved oxygen levels.*
8. What human activity can cause a change in pH?
- Factory smokestacks that give off sulphates or other emissions.*
9. Why is it good to have higher levels of free chlorine in tap water compared to lake and river water?
- High levels of free chlorine in tap water indicate it is safe to drink and microorganisms have been killed by water treatment. High levels of free chlorine in surface water kill microorganisms. Note: free chlorine degrades rapidly but there is a lot of discussion currently about converting our water treatment systems to ultraviolet light (UV). UV light kills more organisms than chlorine treatment. Also, recent research shows that free chlorine can form compounds that are implicated in causing certain cancers. Keep in mind however, that safe drinking water has been one of the wildest success stories in human history.*

Reducing Water Pollution

10. What human action has reduced phosphate levels?
Laws banning phosphates from laundry detergents significantly reduced phosphate levels.
11. What are two ways that planting trees near the shore of rivers and lakes improve water quality?
Planting trees near shorelines (the riparian zone) prevents erosion which will decrease turbidity as well as decreases water temperature which will increase levels of dissolved oxygen available for aquatic organisms.
12. A law made in the 1980's required industries to install filters on their smokestacks. How did that law improve water quality?
That law reduced acid rain significantly. Over the past 2 decades the pH of many Ontario lakes that had all their organisms killed by acid rain, has improved and the lakes are recovering.
13. What is one way this lab could be improved for next year?
Any reasonable answer.