

**Subject:** Science, Biology, Chemistry

**Topic:** Testing the water we drink!

**Time Frame:** Roughly 60 minutes

**Objectives:** To allow students to run tests on five different sources of water. Students are expected to collect three samples of water: Urban and Rural (includes aboriginal and non-aboriginal communities) treated waters, and a Raw Source Water. A Drinking Water Guideline sample will be provided with the OWD Kit. The guideline sample is for quality control purposes (was the test performed properly?). This will also be a reference to see what a sample would look like if it meets the Canadian Drinking Water Guideline, The only exception to this will be the Ammonium test where Canada does not have a guideline, and in this case the comparison will be to the European Union Limit. If it is impossible to collect water samples from your own community, SDWF will provide water samples at a charge of \$20 per kit, to cover shipping costs. **It is recommended that teachers assign a Class Captain student who will track student and teacher opinions of OWD and complete the required Evaluation form and submit it to SDWF along with the community analysis sheet and any pertinent suggestions.**

**Methodology:** 13 different tests will be conducted on water from the five different sources so that the students can compare the different drinking water qualities. The tests will include: precipitation, colourimetric, visual, bacteriological, and test strips. All procedures, instructions, and reference material are available online for easy reference and reporting. It is suggested you print out each test instruction sheet to give to respective students/groups to follow procedures carefully. It is also recommended that you print the materials list (In Landscape), to insure you have all materials.

**Materials:** Each Operation Water Drop Test Kit contains 13 test supply bags with all requirements for testing five different samples; one for your community water sample, Drinking Water Guideline sample and three for the other supplied source

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waters; Rural (includes aboriginal and non-aboriginal communities), Urban and Raw untreated source water. For each analyte tested all supplies required are packaged in one bag to be given directly to the responsible group. Below you will find a list of all materials sent in the OWD kit for High Schools; please cross-reference your list with material received to ensure you have all of the material required.

**Please check to make sure that you have received all of the material listed below.**  
All of the test materials will be packaged in separate bags for each determination (Test).

## Materials List For High School Operation Water Drop Kit

<u>Test</u>	<u>Vial size</u> (mL)	<u># In</u> <u>Kit</u>	<u>Test</u>	<u>Vial size</u> (mL)	<u># In</u> <u>Kit</u>
<b>Alkalinity</b>			<b>Ammonium</b>		
Alkalinity (Low Limit Sample)	50	1	Ammonium (AEUL)	5	1
0.02N H <sub>2</sub> SO <sub>4</sub>	15	5	Test Strip Packets		5
Methyl Purple Indicator	1.5	1	Colour Chart		1
Disposable Pipette	1.2	1	Cuvette	3	2
Drink glass		5			
			<b>Copper</b>		
<b>Colour</b>			Copper (CGLS)	10	1
Colour Standard (CGLS) (Tube)	50	1	Test Strip Packets		5
Plastic test tubes	29x115 mm	6	Disposable Beaker	10	5
<b>Heterotrophic Plate Count</b>			<b>Iron</b>		
Sterile Pipettes	1.7	5	Iron (CGLS)	10	1
Sterile Spreader	In package	5	Aluminum Pouches		5
Petri Dish	100x15	5	Disposable Beaker	10	5
Heterotrophic Sampling Tube	5	4			
			<b>Manganese</b>		
<b>pH</b>			Manganese (CGLS)	10	1
pH Buffer 7 (Tube)	5	1	Manganese #1 strip		5
pH Indicator Strip	10	5	Manganese #2 strip		5
pH Scale Card		1	Manganese #3 strip		5
Disposable Beaker	10	4	Colour Chart		1
			Free Standing Vial	10	4
<b>Sulphate</b>			<b>Nitrate</b>		
Sulphate (CGLS) (Tube)	2	1	Nitrate (CGLS)	10	1
Sulphate Reagent # 1 (Tube)	5	6	Test Strip Packets		5
Sulphate Reagent # 2 (Tube)	5	6	Disposable Beaker	10	4
Disposable Pipette	2	5			
Drink glass		6			
			<b>Total Chlorine</b>		
<b>Arsenic</b>			Test Strip Packets		5
Plastic Bottles <sup>(1 with Proposed CGLS)</sup>		2	Drink glass		5
Caps (Flip Top)		2			
Arsenic Reagent # 1 Packets		5	<b>Total Hardness</b>		
Arsenic Reagent # 2 Packets		5	Hardness(CGLS)	10	1
Arsenic Reagent # 3 Packets		5	Test Strip Packets		5

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Arsenic Indicator Strips	5	Disposable Beaker	10	5
Colour Chart	1			
<b>Total # of beakers and glasses</b>				
Drink glasses	16			
10 mL Disposable Beakers	23			

The drink glasses and beakers will be shipped together in 2 bags to help reduce breakage.

It will be the teachers responsibility to allocate the beakers to the groups.

### Additional materials:

Although the kit is complete, there are a few things that will be needed to ensure analyses are performed with ease and accuracy.

Each group should have:

- A permanent marker for test tube labeling
- Masking tape for labeling pipettes
- A 25 mL and a 50 mL measuring device ( preferably a graduated cylinder)
- A test tube rack
- Fume hood or well ventilated area for Arsenic test
- Protective gloves, goggles, and apron for Arsenic test

**Space Requirements:** Students should be in a room with sufficient bench or desk space to work comfortably in small groups to conduct their tests, the Arsenic, and Alkalinity test should be done in either a fume hood or in a well ventilated area.

### Directions:

The students will be testing water for the following parameters:

Approximate Time for each test to be completed (minutes)

- |                                    |                        |                       |
|------------------------------------|------------------------|-----------------------|
| 1. Alkalinity (20)                 | 2. Ammonium (20)       | 3. Arsenic (40)       |
| 4. Colour (10)                     | 5. Copper (10)         | 6. Total hardness (5) |
| 7. Iron (5)                        | 8. Manganese (5)       | 9. Nitrate (5)        |
| 10. pH (5)                         | 11. Total Chlorine (5) | 12. Sulphate (20)     |
| 13. Heterotrophic Plate Count (20) |                        |                       |

Classroom should be divided into 4 separate groups; each group will be running tests on all five water samples including a Canadian Guideline Limit Sample that is supplied for all analytes. The following distribution of the tests among the students will consume approximately 60 minutes:

Group 1: Will do Arsenic alone.

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Group 2: Will do Alkalinity, Copper, Manganese, and Total Hardness.

Group 3: Will do Heterotrophic Plate Count, Ammonium, and pH.

Group 4: Will do Sulphate, Colour, Nitrate, Total Chlorine, and Iron.

The Arsenic test is the biggest time consumer; these tests have been set up so that students can get exposure to doing laboratory work, testing their water, comparing different water qualities to the Canadian Drinking Water Guidelines. The optimum size for Group 1 would probably be 4, and the other groups could be as large as 6-8.

It can not be overstated how important it is to be clean and careful while doing all of these tests. Please remember that although the tests are designed to be safe for students to use, whenever working with any amount of chemicals lab safety precautions must be taken into consideration. For best safety practices, please ensure that your students wear lab coats, goggles and gloves when handling the kit materials and samples.

After the tests have all been completed, the teacher should lead a discussion on the results that were found.

#### **Possible Presentation Questions/Topics:**

- ▶ Does it concern you that Canada has no national regulations (just guidelines) for drinking water?
- ▶ Do you feel Rural (including aboriginal and non-aboriginal) people should be concerned about their drinking water?
- ▶ Is your water treatment plant modernized?
- ▶ Are your water treatment plant operators certified?
- ▶ Are you comfortable/satisfied that your community water is safe?
- ▶ For more questions and possible solutions please refer to the fact sheets that are attached to the methods.

#### **Results:**

After the tests have all been completed, the teacher should lead a discussion on the results that were found and enter in the water quality results online to "Put your school on the Map" at [www.safewater.org](http://www.safewater.org). The class and teacher are also encouraged to complete and submit the online Program Evaluation on the Safe Drinking Water Foundation website. The success of the Operation Water Drop program depends on this feedback, and reporting. The Safe Drinking Water

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Foundation thanks everybody in advance for their cooperation in the reporting of their results.

### Evaluation: Presentation Checklist

Requirements	Yes	No
Did the group prepare a summary sheet of information for the rest of the class?		
Did the group demonstrate their knowledge about their topic?		
Was the presentation approximately 3-5 minutes in length?		
Did the group come up with a creative way to present the information?		
Did the group complete a poster to demonstrate what they have learned?		

### Resources:

Visit the Safe Drinking Water Foundation Website [www.safewater.org](http://www.safewater.org) to learn more about issues affecting safe drinking water.

You will find links to many Educational Fact Sheets and various articles published pertaining to the different analysis which students conduct as part of Operation Water Drop.

For more information on health risks and possible contributors of all chemicals you can go to the following website: <http://www.lenntech.com/WHO-EU-water-standards.htm> you will also find the drinking water standards for the World Health Organization, and the European Union at this site.

Following student presentations on their test results, it is suggested that the class have a discussion and formulate a Community Action Plan.

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