Testing Water Quality

Lesson Overview (3 periods)

This lesson is a hands-on inquiry activity examining physical and chemical water quality indicators. In the first period, students will focus on substances found in water and design a table to record water quality test data. The second period will be a field trip to a local stream or pond to do the physical and chemical water quality testing on water in their watershed. This lesson covers quantitative testing for temperature, pH, dissolved oxygen, free chlorine, phosphates and nitrates. As well, qualitative testing for clarity/turbidity and odour is covered. The actual tests conducted will depend on the water testing kit purchased. The last period will have students calculate the means of their results. Students will then examine their data, draw conclusions and determine some of the human and natural processes that could have contaminated the water.

Connections to Environmental Education

Students will use a range of resources, communication skills and technologies in addressing environmental questions. Students will learn about water as a resource and the impact of different human actions and technologies on the quality of water.

GRADE 8, SCIENCE AND TECHNOLOGY, MATHEMATICS

Curriculum Expectations

Science and Technology (2007) – Understanding Earth and Space Systems: Water Systems

2. Students will investigate factors that affect local water quality.

2.1 Students will follow established safety procedures for the use of apparatus and chemicals.

2.3 Students will test water samples for a variety of chemical characteristics.

Mathematics (2005) – Data Management and Probability

- Students will collect data by conducting a survey or an experiment to do with themselves, their environment, issues in their school or community, or content from another subject, and record observations or measurements.
- Students will collect and organize categorical, discrete, or continuous primary data and secondary data, and display the data in charts, tables, and graphs that have appropriate

titles, labels, and scales that suit the range and distribution of the data, using a variety of tools.
- Students will read, interpret, and draw conclusions from primary data and from secondary data, presented in charts, tables and graphs.
- Students will make inferences and convincing arguments that are based on the analysis of charts, tables and graphs.

Learning Goals
- At the end of this lesson, students will be able to conduct physical and chemical water quality tests safely.
- Students will be able to interpret and draw conclusions from the results of the water quality testing.
- Students will be able to design a data table for primary data, identify outliers in the class data, calculate means, and interpret the results.

INSTRUCTIONAL COMPONENTS AND READINESS

Readiness
- Understand nitrogen nutrient cycle and pH, acid and basic.
- Understand that all aquatic plants and animals require the same nutrients and gases as terrestrial life.
- Understand that human actions change water quality.
- Understand how to design a primary data table and calculate a mean.

Terminology
Acid rain, analyse, assess, ecosystem, environmental impact, environmental stewardship, evaluate, pollution, renewable resource, runoff, continuous data, distribution, inference, mean, outlier, primary data table.

Materials
Teacher Guide
Group Data Table and Checklist
Class Data and Mean Table
Test Results Interpretation Cards
Analysis
Water testing kit – for ordering information see the Teacher Guide
8 thermometers in a safe carrying case
40 pairs disposable gloves for students (use vinyl not latex) for protection from bacteria in water
Garbage bag
Large (1L) plastic bottle with a tight fitting lid for liquid waste and a waste label
First aid kit
Contact list with emergency numbers for all students
Hand sanitizer
Extra pencils and handouts
8 water sampling devices – recommend duct taping plastic beer cups to the bottom of a meter stick

Clipboards – 1 per student or 1 per team

MINDS ON

Students work as a whole class, then in groups of 4.

The class brainstorms, “What substances can be found floating or dissolved in water?”. All answers are written on chart paper. The substances are categorized by circling them in: green for substances that are good for aquatic plants, animals and humans; red for substances that are harmful to aquatic plants, animals and humans; and perhaps blue for substances that are good in medium amounts. The big idea “How do we test water quality?” is introduced. The students and teacher choose one substance on their list which is part of the water testing kit, and together read the water testing instructions while the teacher demonstrates.

Students then work in groups of 4 to design their data table for recording the results of the water quality testing. This is challenging as odour and clarity/turbidity are qualitative, not quantitative so the results should be recorded separately. As well, students should be challenged to make a list of what they should wear and bring for the field trip on the back of the data table page.

Minds On: Assessment

Assessment for Learning

The teacher projects **Group Data Table and Checklist**. The group confirms that they have a place to record the test results and the units are included. Then the list of items to bring on the field trip is projected and the group checks off each item they have. A score can be given to add an element of competition to the process.

Minds On: Differentiated Instruction

Students can be given **Group Data Table and Checklist** if they have difficulty.

ACTION!

Students work as a whole class, then in groups of 4.

Guidelines for conducting an outdoor field trip are in **Teacher Guide.** The instructions for the water testing will be with the kit purchased. You may have to modify the BLMs to reflect the actual tests included in the test kit ordered. This lesson is designed so that each student is responsible for two of the eight water tests.

Action: Assessment

Assessment of Learning

At the end of the field trip students submit **Water Quality Group Data Table and Checklist.** The teacher assesses the observations, ensuring they are complete and that units are included. The teacher should also transfer each team’s data to **Class Data and Mean Table** to prepare for the consolidation activity.

CONSOLIDATION

Students work individually.

Each student receives a copy of **Class Data and Mean Table** and a copy of **Test Results Interpretation Cards**. Students will use this information to complete **Water Quality Testing Analysis**. The teacher should review concepts including outliers and means.

Consolidation: Assessment

Assessment of Learning

Teachers can use the answer key in **Teacher Guide** to assess student learning.