Science Unit: ***Water***

Lesson 2: ***Surface Water and Groundwater***

School year:	2004/2005
Developed for:	Queen Alexandra Elementary School, Vancouver School District
Developed by:	Paige Axelrood (scientist), Trevor Wright and Jenny Lau (teachers)
Grade level:	Presented to grades 4 - 5; appropriate for grades 2 – 6 with age appropriate modifications.
Duration of lesson:	1 hour and 20 minutes
Notes:	Extension activities during the week

Objectives

1. Learn about the distribution of water on Earth and where water is stored on the surface and in the ground.
2. Introduce how to do a science experiment.
3. Learn about minerals and dissolved minerals in natural sources of water on Earth.

Background Information

A water molecule contains two atoms of hydrogen and one atom of oxygen (H_20). The hydrogen atoms have a positive charge and the oxygen atom has a negative charge. These charges cause water molecules to be attracted to each other (via hydrogen bonds), thereby creating strong surface tension. Water exists in three states on Earth: solid, liquid and gas. Water is stored on the surface of Earth in places such as glaciers, ice caps, oceans, lakes, ponds, rivers, and streams. Some water infiltrates into the ground and is stored in soil, porous rock, and aquifers. Water covers approximately 70% of the Earth's surface but approximately 97% of the Earth's water contains too much salt to drink or use for other purposes. Most of the fresh water on the Earth's surface is frozen in glaciers and icecaps; usable surface water and groundwater represent less than 0.5% of all water present on Earth.

The water on Earth contains different types and amounts of dissolved minerals from the weathering of rocks. These minerals dissolve from rainwater passing through soil, porous rock, and over mountains and from water flow in rivers and streams. Dissolved minerals (salts) enter the ocean from rivers and this salt remains in the oceans and has accumulated over a very long period of time. Salts in oceans also come from hydrothermal vents and underwater volcanoes.

Vocabulary

Water:	A colorless, odorless liquid with no taste or smell and of neutral pH; water can exist as a solid, liquid and gas.
Groundwater:	Water that infiltrates into the Earth and is stored in usable amounts in soil and rock below the Earth's surface.
Surface water:	Water on the surface of Earth that is stored in oceans, lakes, rivers, streams, creeks, ditches, wetlands, ponds, reservoirs, etc.; surface water is precipitation that does not soak into the ground or return to the atmosphere.
Mineral:	Nonliving substances found naturally in the Earth; rocks are made of minerals; there are many different types of minerals and they each have their own shape, color and

chemical composition.

Dissolve: To mix a type of matter into a liquid to form a solution.

Solution: A uniform mixture formed by mixing one or more types of matter; for liquids, a solution is made of uniformly dissolved tiny particles of matter evenly distributed in a liquid.

Materials for Experiment

- salt water from English Bay
- bottled mineral water (Gerolsteiner works well)
- tap water
- beakers
- aluminum pans
- labels for pans
- trays
- clear plastic cups
- permanent markers

Materials for Demonstration

- 1-L plastic bottle
- 30-mL container
- eye dropper
- blue food coloring
- 5-mL pipet
- salt
- warm water
- glass jar

In the Classroom

Introductory Discussion

1. Where do we find water on Earth? Highlight surface water and groundwater sources.
2. Why is fresh water important? Where does our fresh water come from?
3. Review the percent distribution of water on Earth using a transparent plastic bottle containing 1 L of water colored blue with food coloring; this represents Earth's entire supply of water. Pour out 30 mL into a small cup to represent the total fresh water on Earth. The remaining 970 mL in the bottle represents ocean water (salt water). Remove 2 drops from the 30 mL to represent all surface water, remove 1 drop to represent the water in air and soil, and remove 4 mL to represent groundwater. The remaining 23 mL represents ice caps and glaciers.
4. Why is there salt in ocean water? What is salt? (a mineral) What is a mineral?
5. Living organisms need minerals to stay alive. What mineral do we get from milk?
6. Demonstrate dissolving salt in warm water with student helpers. What happens?
7. Review experiment.
8. Review how to do a science experiment.
    - Ask a question: What will happen to the minerals in water when we evaporate the water?
    - Use your knowledge about water, evaporation and minerals to think about what will happen. Write down what you think will happen (your prediction). This is your hypothesis.
    - Set up the water evaporation experiment and treat everything the same except for one thing, what you want to test (the type of water). The type of water is a test treatment. The empty pan is a control treatment. Discuss why you only change one thing, the type of water (the variable).
    - Discuss replication.

- Make observations.
- Collect data, record and examine results (think about why things happened the way they did).
- Make conclusions and explain results (compare results to predictions to help you think deeper).
- Communicate results and conclusions.

Science Activity/Experiment

Experiment Title: Minerals in Water.

Purpose of Experiment: The purpose of this experiment is to investigate and observe minerals in tap water, bottled mineral water, and salt water from English Bay.

Experimental Treatments: There will be 5 groups of students. Each group will set up one pan per treatment, using the treatments below. In total, the experiment will represent 5 replications, 1 replication per group.

Control treatment	Empty aluminum pan
Test treatment 1	150 mL of tap water in aluminum pan
Test treatment 2	150 mL of mineral water in aluminum pan
Test treatment 3	150 mL of English Bay salt water in aluminum pan

Use your prior knowledge of water and evaporation to help you predict what you think will happen when the pans of water are left in the classroom until all of the water evaporates.

- What will happen to the minerals in the water after all of the water has evaporated from the pans?
- Do you think the pans will look the same or different for the four treatments in the experiment after the water has evaporated? If you think they will look different, describe your prediction of the differences.

Methods:

1. Pour each type of water into a transparent plastic cup and place the 3 cups at each student group workstation. Each workstation should also have a tray with 4 aluminum pans, a beaker, a permanent marker, and labels for pans.
2. Label each pan with the treatment number and description, and the student group name or initials.
   - empty (control treatment)
   - tap water
   - mineral water
   - salt water
3. Observe and record the appearance of the three types of water in the plastic cups, including whether the water appears clear.
4. Measure 150 mL of tap water in the beaker labeled for tap water and pour the tap water into pan 2 without getting the label wet.
5. Measure 150 mL of mineral water in the beaker labeled for mineral water and pour the mineral water into pan 3 without getting the label wet.

6. Measure 150 mL of salt water in the beaker labeled for salt water and pour the salt water into pan 4 without getting the label wet.
7. Leave pan 1 empty. This is the control treatment (no water).
8. Place the four pans on a tray near a warm location in the classroom and allow all the water to evaporate from the pans.
9. Observe and record the appearance of the inside surfaces of the 4 pans during the evaporation process and after all of the water has evaporated.
10. Record conclusions.
11. After observations and conclusions have been recorded, arrange all of the pans from the 5 student groups into 4 rows with 1 row representing each treatment (there will be 5 pans per row). The 5 pans for each treatment represent 5 replications per treatment. Determine if the 5 pans (5 replications) look the same for each treatment or if there is variability in the appearance of the 5 replications for each treatment.

Closure Discussion

1. Discuss hypotheses for the minerals in water experiment.
2. How do minerals dissolve in water?
3. What minerals did you eat for breakfast this morning?
4. What minerals are in your body?

References

1. Challoner, Jack. 1998. Rocks and Minerals. Lorenz Books, New York, [Young Scientist Concepts & Projects].
2. Parker, Steve. 1993. Rocks and Minerals. DK Publishing, Inc., [Eyewitness Explorers].
3. e.encyclopedia Science, Google. 2004. Pp. 40-41, 216-217. DK Publishing Inc.
4. http://www.epa/gov/safewater/kids/wsb The Water Sourcebook, A Series of Classroom Activities for Grades 3-5. 1994. The Water Sourcebook was produced for Legacy, Inc. Partners in Environmental Education, in cooperation with US Environmental Protection Agency and prepared by Tennessee Valley Authority, Environmental Education Section.
5. http://ga.water.usgs.gov/edu/ US Geological Service, Water Science for Schools, [Information about water].
6. http://www.gvrd.bc.ca/education/curriculum-resources.htm Greater Vancouver Regional District [Curriculum resources].
7. http://www.utdallas.edu/~pujana/oceans/why.html The University of Texas at Dallas, [A description about why the sea is salty].

Extension of Lesson Plan

1. Experiment with dissolving table salt and Epsom salts in warm and cold water.
2. Salt water can be distilled in the classroom. See A Salt Water-Y World page 3-6 http://www.epa.gov/safewater/kids/wsb/pdfs/353.pdf for the experimental method.

Name of Scientist: _____

Minerals in Water Experiment

Purpose:

1. To observe minerals in tap water, bottled mineral water, and English Bay water.

Materials:

tap water	aluminum pans
mineral water	labels for pans
salt water from English Bay	permanent markers
beakers to measure 150 ml (3 beakers / group)	clear plastic cups
trays	paper towels

Treatments: There will be 5 groups of students. Each group will set up one pan per treatment.

1	Control treatment	empty aluminum pan
2	Test treatment	150 ml of tap water in aluminum pan
3	Test treatment	150 ml of mineral water in aluminum pan
4	Test treatment	150 ml of English Bay salt water in aluminum pan

Hypotheses:

Use your prior knowledge of water and evaporation to help you predict what you think will happen when the pans of water are left in the classroom until all of the water evaporates. What will happen to the minerals in the water after all of the water has evaporated from the pans?

1. What will happen to the minerals as the water evaporates?

2. Do you think the pans will look the same or different for the four treatments in the experiment after the water has evaporated? If you think they will look different, describe your prediction of the differences.

Circle the word that describes how the pans will look.	Same	Different
Empty pan:		
Tap water:		
Mineral water:		
English Bay salt water:		

Methods:

1. Label each pan with the treatment number and description and the student group name or initials.
   1 empty
   2 tap
   3 mineral
   4 salt

2. Record observations of the appearance of the three types of water in the plastic cups and include observations about whether the water appears clear.
3. Measure 150 ml of tap water in the beaker labeled for tap water and pour the tap water into pan 2 without getting the label wet.
4. Measure 150 ml of mineral water in the beaker labeled for mineral water and pour the mineral water into pan 3 without getting the label wet.
5. Measure 150 ml of salt water in the beaker labeled for salt water and pour the salt water into pan 4 without getting the label wet.
6. Leave pan 1 empty, this is the control treatment (no water).
7. Place the four pans on a tray near a warm location in the classroom and allow all of the water to evaporate from the pans.
8. Record observations of the appearance of the inside surfaces of the 4 pans during the evaporation process and after all of the water has evaporated.
9. Record observations of the appearance of the water as it evaporates for treatments 2, 3, and 4.

Observations:

Conclusions:

After observations and conclusions have been recorded, arrange all of the pans from the 5 groups of students into 4 rows with 1 row representing each treatment (there will be 5 pans per row). The 5 pans for each treatment represent 5 replications per treatment. Determine if the 5 pans (5 replications) look the same for each treatment or if there is variability in the appearance of the 5 replication for each treatment.