Science Unit: ***The Earth Around Us: Air, Water & Soil***

Lesson 11: ***What happens to water before we use it?***

School Year:	2009/2010
Developed for:	L'École Bilingue, Vancouver School District
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Grade level:	Presented to grades 1 - 2; appropriate for grades 1 - 7 with age appropriate modifications.
Duration of lesson:	1 hour and 20 minutes

Objectives

1. Think about the different ways in which we use water.
2. Learn about ways in which water is treated before it is used (and, therefore, an introduction to how water can be re-used).
3. Consider what measures they could take in order to conserve water.

Background Information

The process of water purification involves removing unwanted chemicals, materials, and biological contaminants from raw water. The intent is to produce water fit for a specific purpose. Most water is purified for human consumption drinking water; however, water purification may also be designed for a variety of other purposes (e.g., medical, pharmacological, chemical, and industrial applications). Generally, the methods used include physical process such as filtration, and chemical processes such as chlorination, and even the exposure to electromagnetic radiation such as ultraviolet light.

Filtering water may reduce the concentration of particulate matter including: suspended particles; parasites; bacteria; algae; viruses; fungi; and a range of dissolved and particulate material coming from whatever the water might have come into contact with since falling as rain.

The standards for drinking water quality are typically set by governments, and will typically set minimum and maximum concentrations of contaminants for the use that is to be made of the water.

Most of us take our access to water for granted. We seem to have a limitless supply available to us whenever we desire it. This is not the case for many parts of the world. In fact, over 1 billion people lack access to an improved drinking water supply.

Vocabulary

Filtration: The separation of solids from fluids by interposing a medium (the filter).

Materials

- sand
- pebbles
- mesh cloth
- large bowl
- coffee filters
- clear plastic cups
- elastic bands
- large bottles
- water
- soil
- food colouring (three different colours)

In the Classroom

Introductory Discussion

1. Lead a discussion about the importance and usages of water. Emphasize that Canadians are lucky to have access to clean water.
    - Why is water important?
    - What might happen if we didn't have access to clean water?
2. Spend a few minutes asking questions about the pre-lesson discussion.
    - What are the different ways in which you use water?
    - What are some of the ways in which other people use water?
3. Define filtration to the students.
4. Briefly describe the filtration demonstration and the science activity to the students. The students will first watch a demonstration in which the scientist 'filters' the pebbles from a mixture of sand and pebbles. This will give the students a model to base their understanding upon how a water filter works. The students will then divide up into groups and filter three slightly different mixtures of 'dirty water'.
5. For the science experiment, the students will be asked to focus on a number of the steps that make up the scientific method. They will make predictions, take careful observations, record their results, and draw conclusions. As always, students will be asked to communicate their results and conclusions, and their hypotheses and results will be recorded in their science worksheets.

Science Activity

Activity Title: Filtration demonstration

Purpose of Activity: To show the students how filtration works at a scale they can actually observe.

Experimental Observations: That a mesh cloth (with suitable mesh size) can effectively 'filter' (i.e., separate) pebbles from and sand and pebble mixture.

Prediction or Hypothesis: Before students make their prediction (or hypothesis), it helps to start with a question. Suggest that they use their prior knowledge of nets and/or meshes and/or filters to predict what they think will happen when the sand and pebble mixture is poured on to the mesh cloth. Have them record their prediction based on the following question: What will happen to the sand and pebble mixture if it is poured onto the mesh cloth?

Methods and Instructions:
Set-up prior to experiment: Combine the sand with the pebbles to make a sand and pebble mixture.

The students will observe as the scientist performs the demonstration.

1. Have the students make a written prediction about what will happen to the sand and pebble mixture as it is poured in to the mesh cloth.
2. Lay the mesh cloth across the bowl.
3. Pour the sand and pebble mixture over the mesh cloth.
4. Ask the students what they observe (the sand falls through the mesh, while the pebbles stay in the mesh).

5. Have the students record their observations in their science worksheets.

Science Activity

Activity Title: Using water filters.

Purpose of Activity: To demonstrate that water (not just pebbles from sand) can be filtered.

Experimental Observations: Three different muddy solutions will be passed through filters to determine the colour of the water in the solution. Initially, the students won't know that the water is coloured, as it will appear black from mud..

Prediction or Hypothesis: Again, it helps to start with a question when formulating a prediction. Ask the students to use their prior knowledge of water and filters to predict what they think will happen when the dirty water is passed through the coffee filters. Be sure they record their prediction based on the following question: What will happen to the dirty water as it passes through the filter?

Methods and Instructions:
Set-up prior to experiment: Make three solutions of muddy water and food dye (e.g., green/blue/red water with soil added). Add enough soil and stir sufficiently so that the solutions appear black.

The students will be divided into four groups and will perform the experiment simultaneously. It may help to assign roles to each of the students (e.g., “filter maker”, “water pourer #2”, “muddy solution selector”).

1. Each group is provided with 6 plastic cups and three coffee filters.
2. Put a coffee filter into a cup and fold the edges over to hold it place. Do this three times, to make three filters. Use an elastic band on each to hold the filter in place.
3. The scientist/teacher will pour a little of each of the three muddy solutions into the remaining three empty cups of each group.
4. Have the students predict what will come through the filter and what will not. (The soil will get filtered out, and coloured water will get filtered through. The students will be surprised to see the coloured, not clear, water.)
5. Have the groups independently choose one solution to begin with. Then, get them to pour the selected muddy solutions into the coffee filter and observe the colour of the water that emerges. Have them record their observations. Do not go onto the next step until everyone has completed this step.
6. Get the students to share their observations out loud with the rest of the class. They will learn that there are two (and maybe even three) different colours of water making up the muddy solution.
7. Now have the groups select a second muddy solution to work with. Get them to make a prediction about the colour of the filtered water. Pour this second muddy solution into a second coffee filter and observe the colour of the water that emerges. Be sure the students record their observations. Do not go onto the next step until everyone has completed this step.
8. Again, interrupt to briefly poll the students about the colours they have observed. Following the discussion, have the students predict the colour of their final muddy solution. (They should be able to do this successfully, now that they know which colours the other groups observed.)
9. Pour the final muddy solution into a second coffee filter and observe the colour of the water that emerges. As always, observations are recorded.

Closure Discussion

1. How does a filter work?

2. Let students know that they will soon be learning about what happens to water after it has been used.
3. Inform students that the next Scientist in Residence lesson will be the field trip to Capilano Regional Park. On this field trip, the students will be asked to keep an eye out for all instances of air and water around them.

References

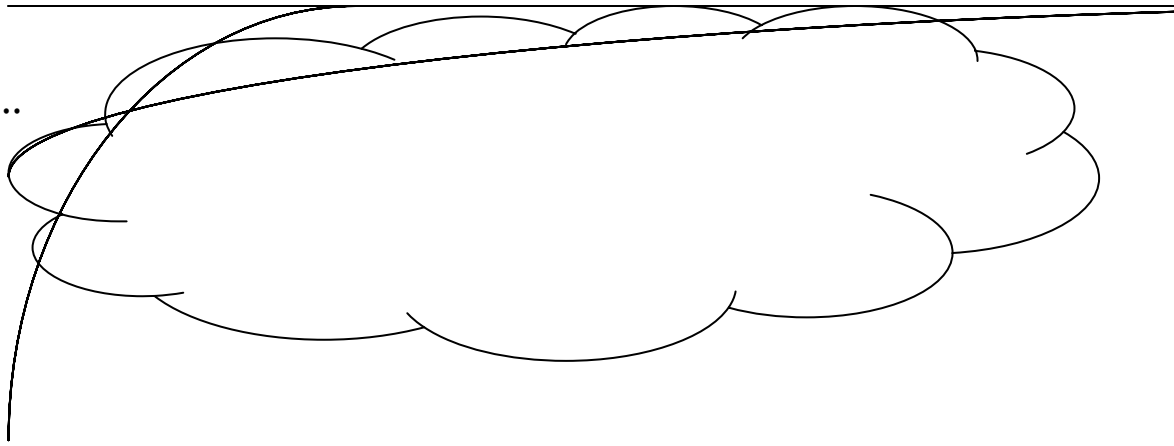
1. <http://www.un.org/works/Lesson_Plans/Water/Lesson_Plan_on_Water.doc> The UN Works for People and the Planet. [Educational resources related to the water crisis.] Accessed Feb. 24, 2010.
2. <http://en.wikipedia.org/wiki/Water_filtration> 'Water Filter' entry on Wikipedia [Definition of water filtration, with links and references therein].
3. Parker, Steve (translated by Claude Cossette). 2004. L'eau. Pp. 14-15. Broquet Inc.
4. Edited by Pan-Canadian Science Place © Scholastic Canada Ltd. (translated by Pierre Brault, Agnès, Lin Burman, and Karima Afchar). 2005. L'air et l'eau: Guide de l'enseignant. Pp. 89-91, 99-103. Les Éditions Duval, Inc. and Scholastic Canada Ltd.
5. <http://www.mcwa.com/kids.htm#dirty> MCWA – Kids Water Fun. [The Monroe County Water Authority lists numerous water-related activities for children. In particular, they include an activity titled 'You can clean dirty water!'] Accessed Feb.27, 2010.

Extension of Lesson Plan

1. Students can make their own paper and sand filters at home, by using the instructions given in reference 5.

Is it possible to filter water?

I think...



I observe...

Conclusion:

Est-il possible de filtrer l'eau ?

Je pense : 

J'observe : 👁 👁