Lessons in a Backpack

United Nations Educational, Scientific and Cultural Organization

GEORGIAN BAY BIOSPHERE MNIDOO GAMII Spirit of the Water

Clean Water Challenge

Cleaning Water Using Filters

Post Water Festival or Independent Lesson

Description of Lesson

Students design their own water filtration system using a 2 litre plastic bottle. They test the filter by running dirty water through and examining the result. Food colouring will be added to the dirty water to represent chemical pollution. Students will become aware of how pollution moves through the soil and how it may be naturally filtered. Emphasis should be given to the fact that pollution is a threat to habitats, and that natural filtration is not enough to eliminate toxins.

Connect with the Georgian Bay Biosphere

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GEORGIAN BAY BIOSPHERE MNIDOO GAMII Spirit of the Water

At a Glance

Grade Level: 5

Learning Environment: Classroom

Prep Time: 15 minutes

Length of Lesson: 60 minutes

Key Vocabulary: water scarcity, renewable resource, evaporation, condensation, precipitation, run-off, percolation, coagulation, sedimentation, filtration, disinfection, watershed, wetland, contaminants, sediment, bacteria, pollution

Staffing: 1 educator

Materials: (per group)
1 empty (clean), pre-cut 2 Litre plastic pop bottle
*teacher will cut water bottles - ask students to bring one from home
gravel/rocks, coarse sand
fine sand, coffee filter, elastic bands, dirty water
5 different food colourings
Try and collect as many large gravel rocks as possible - to use next time!
Sand, cotton balls, and filters will need to be replaced.
**Inform parents and students to bring a change of clothes and to wear clothes that can get dirty.

Groupings: Pairs or groups

Teaching/Learning Strategies: Hands on experiment

Lesson Outline

TIME	ACTIVITY	LOCATION	MATERIALS
15 minutes	Water Filtration Introduction	Classroom	
45 minutes	Water Filtration Construction & Experiment	Classroom or outside	1 empty (clean), pre-cut 2 Litre plastic pop bottle, gravel/rocks, coarse sand, fine sand, coffee filter, elastic bands, dirty water, food colouring, worksheets

Curriculum Expectations
Gr. 5 Science and Technology

Understanding Life Systems: Human Organ Systems
Overall Expectations
1. Analyze the impact of human activities and technological innovations on human health.
Specific Expectations
1.1 Assess the effects of social and environmental factors on human health. Propose ways in which individuals can reduce the harmful effects of these factors and take advantage beneficial factors instead. Assess human impacts on biodiversity and identify ways of preserving biodiversity.

Understanding Structures and Mechanisms: Forces Acting on Structures and Mechanisms
Overall Expectations
1. Analyze social and environmental impacts of forces acting on structures and mechanisms
Specific Expectations
1.2 evaluate the impact of society and the environment on structures and mechanisms, taking different perspectives into account and suggest ways in which structures and mechanisms can be modified to best achieve social and environmental objectives

Understanding Matter and Energy: Properties of and Changes in Matter
Overall Expectations
1. Evaluate the social and environmental impacts of processes used to make everyday products
Specific Expectations
1.1 Evaluate the environmental impacts of processes that change one product into another product through physical or chemical changes
1.2 Assess the social and environmental impact of using processes that rely on chemical changes to produce consumer products, taking different perspectives into account and make a case for maintaining the current level of use of the product or for reducing it.

Understanding Earth and Space Systems: Conservation of Energy and Resources
Overall Expectations
1. Analyze the immediate and long-term effects of energy and resource use on society and the environment, and evaluate options for conserving energy and resources
Specific Expectations
1.1 Analyze the long-term impacts on society and the environment of human uses of energy and natural resources, and suggest ways to reduce these impacts
1.2 Evaluate the effects of various technologies on energy consumption and propose ways in which individuals can improve energy conservation

Background

Sources of Water Pollution

Water pollution occurs when waste is added to a water body that significantly changes its' chemical and biological composition. Sources can include oil, garbage, fertilizers, chemicals and sewage. Today, urban run-off is considered one of the leading sources of pollution within a city. Litter is another large contributor, with about 10% of all plastic produced per year eventually ending up in the ocean. Personal and household cleaning products, as well as industrial and agricultural chemicals are also dangerous as these are often synthetic. Unfortunately, we often do not fully understand the degree of damage man-made chemicals may have on the natural environment.

Water Pollution and Land

The amount and type of landcover within a watershed greatly determines the health of surrounding rivers, lakes and wetlands. As more undisturbed forested areas become subject to human development and other destructive activities, the overall impact on water quality becomes higher. Forests help maintain water quality by filtering water. Forests protect water by slowing run-off (catching water in leaves, stems, soil, and roots), keeping soils stable by means of large and intertwined root structures and filtering pollution. Wetlands improve water quality by trapping and storing valuable organic and nutrient-rich sediments. Developed lands such as urban and agricultural areas increase surface water and soil run-off therefore impairing the natural processes of filtration by wetlands and forests. Developed lands 'load' hundreds of different chemicals into our waterways. Sources include fertilizers, pet waste, road salt, detergents, manure etc. Removing vegetation removes the natural buffer offered along rivers and wetlands putting these habitats at great risk. Without buffers, soil erosion and pollutant loading both increases, further impairing the natural processes. A lack of vegetation also means less shade and a lack of strong root systems to keep soil in place.

Teaching and Learning

Part A. Water Filtration Introduction

Option to take the construction activity outside once introduction sheets are completed. Inform children to bring a change of clothes and wear clothes that can get dirty.

Have water filter materials (i.e. sand, gravel) away from students at this point so they can focus on handout activity first.

Begin the lesson by discussing with your class the importance of water in our daily lives.

Have your students brainstorm how many times this week they have used water, write the answers on the board. (Examples: drinking, flushing the toilet, a bath or shower, brushing teeth, watering yard or garden, washing dishes, filling a pet's water dish or fish tank, laundry, swimming, fishing).

Now brainstorm a list of types of pollution. This can be based on concepts from previous lessons about water, or can be an introduction to types of pollution. (Examples: chemicals from factories, homes or businesses, garbage, sewage, fertilizers, cigarette butts, medicines).

Ensure students understand there is a limited amount of water on earth, and we must protect it. Explain that each group will work together to design a water filter.

Part B. Water Filtration Construction & Experiment

Divide class into pairs or groups and provide each student a worksheet. Each group will have a pre-cut 2L plastic pop water bottle and equal amounts of the following materials: gravel/rocks, coarse sand, fine sand (about 4 cups each), coffee filters, elastic band, dirty water in a beaker.

Demonstrate how a water filter is built to the class. Remove cap, secure 1-3 coffee filters (students can choose) outside bottom of bottle with an elastic band.

Place top of water bottle into other half as shown.

Students will place materials in their filter in order from smallest to largest, or they can experiment (i.e. from top: rocks, coarse sand, fine sand, coffee filter; OR from top: fine sand, coarse sand, gravel, coffee filter).

Students can pour dirty water (1 large beaker) into filter and examine results. Have students assemble filter again This time, students pour dirty water (1 large beaker) that has a significant amount of food colouring added to it.

https://science.lovetoknow.com/science-fair-projects/homemade-water-filter-science-project

Wrap Up: Water Filter Discussion

1) Which water in the container was cleanest and clearest? Have students examine other water bottle filters and results from around the class
2) How might this experiment compare to the actual process as it happens in nature? Are there still pollutants that get through?
3) Have students imagine that they have no running water and no water treatment facilities, they must collect water from sources near their homes. What might this water look like, taste like, smell like, etc. Would they like to use this water for drinking, cleaning, cooking, etc.?
4) Based on this activity, how would they design a filter to clean the water they would be using?
    a. What pollutants would they need to filter out?
    b. What materials would they use to filter each kind of pollutant?
    c. Are there any pollutants that they were not able to filter out with their hand-made filters?
    d. Even if the water looked clean, is it possible that the water was still undrinkable?
5) Think about microscopic organisms that are too tiny to see and possibly too small to filter. Also, think about contaminants that are dissolved in the water and thus would be difficult to filter. How do water treatment plants solve this problem? (Ex. they use chemical cleaners to treat the water.)
6) How can water pollution be prevented? Have students discuss what they can do in their everyday lives to prevent pollution.

Build Your Own Water Filter

Make Your Water Filter

1. Remove the cap and secure at least one coffee filter to the small opening using an elastic. Place the top half of the pop bottle upside-down (like a funnel) inside the bottom half. The top will be the filter and the bottom will hold the filtered water.

2. Layer the filter materials inside the top half of the bottle.

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Make Your Pollution

3. Make a concoction of polluted water. Use any of the "pollution" materials provided to you (dirty water, food colouring, can you think of others?) .

4. Predict what type of "pollution" might be removed by each layer of the filter materials. Write down your predictions on your worksheet.

Filter Your Water and Make Observations

5. Slowly and carefully pour the polluted water through the filter.

6. Observe what the filtered water looks like.

7. Take apart your filter and look at each of the different layers. Can you tell what each material filtered from the water?

8. Write down the results on your worksheet.

Try it Again

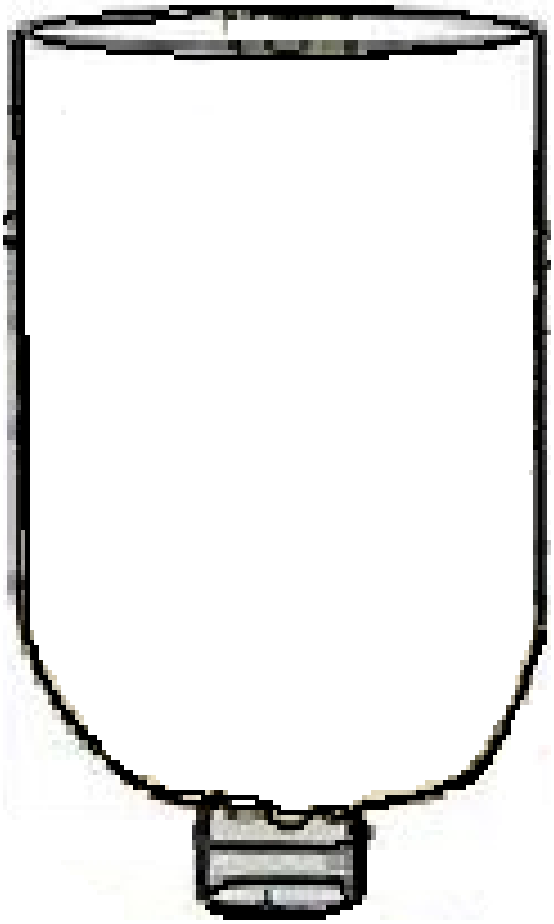
8. Empty the bottle, throw out the filter materials, and wipeout the bottle.

9. Try it again!

See if you can make the filtered water even cleaner! Try putting materials in different layers or try using different amounts of each material.

Build Your Own Water Filter Worksheet

Name: _____
Date: _____



Make Your Water Filter
1. Draw and label the layers in your filter on the image:

Make Your Pollution
2. Write your predictions of what type of "pollution" might be removed by each layer of the filter materials:

Filter Layer 1:
Filter material_____
Pollution filtered out _____

Filter Layer 2:
Filter material _____
Pollution filtered out _____

Filter Layer 3:
Filter material _____
Pollution filtered out _____

Filter Layer 4:
Filter material _____
Pollution filtered out _____

Filter Your Water and Make Observations:
3. Write your observations of the filtered water here:
It looks: _____
Color: _____
Transparency: _____
Smell: _____
Does this water seem like it could be drinkable: _____

4. Were your predictions about the filter layers correct? If no, why not? Explain below:
Filter Layer 1:_____

Filter Layer 2:_____

Filter Layer 3:_____

Filter Layer 4:_____