

Reading the River  
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A Unit for Grade 8 Science  
An Adventure in Water

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## **Create a Model Filtration System to Purify Water for Drinking**

**Grade Level: 8**

### **Objectives**

In this lesson students will:

1. demonstrate the procedures that municipal plants use to purify drinking water
2. taste test the differences between groundwater and surface water
3. highlight some of the common contaminants in natural water
4. encourage student thoughts on the sources of drinking water

### **Program of Studies**

#### **Scientific Inquiry**

- S-8 SI-1 identify and refine questions that can be answered through scientific investigations combined with scientific information
- S-8 SI-5 communicate designs, procedures, and results of scientific investigations
- S-8 SI-6 review and analyze scientific investigations and explanations of other students

#### **Conceptual Understandings**

- S-8 ESS-1 investigate the structure of the Earth's systems (e.g. water cycle)

#### **Applications and Connections**

- S-8 AC-3 recognize how science is used to understand changes in populations, issues related to resources, and changes in environments
- S-8 AC-8 recognize that science is a process that generates conceptual understandings and solves problems

### **Core Content**

- SC-H-3.5.3 Organisms both cooperate and compete in ecosystems. Often changes in one component of an ecosystem will have effects on the entire system that are difficult to predict. The interrelationships and interdependencies of these organisms may generate ecosystems that are stable for hundreds or thousands of years.
- SC-H-3.5.5 Human beings live within the world's ecosystem. Human activities can deliberately or inadvertently alter the dynamics of ecosystems. These activities can threaten current and future global stability, and if not addressed, ecosystems can be irreversibly affected.

### **Essential Question**

Where does your drinking water come from?

## **Materials**

### **Activity 1**

1. 5 liters of “swamp water”(or add 2 ½ cups of dirt to 5 liters of water)
2. 1 two-liter plastic soft drink bottle with its cap (or a cork that fits tightly in to the neck)
3. 2 two-liter plastic soft drink bottles– 1 with the cap removed, 1 with the bottom removed.
4. 1 one-and one half-liter (or larger) beaker (or another soft drink bottle)
5. 20 grams of alum (potassium aluminum sulfate-approximately 2 tablespoons)
6. (Hint: should be available in spice aisle in grocery store or at a pharmacy)
7. Fine sand (about 800 ml in volume)
7. Course sand (about 800 ml in volume)
8. Small pebbles (about 400 ml in volume)
9. (Hint: washed natural color aquarium rocks will work)
10. 1 large (500 ml or larger) beaker or jar
11. 1 coffee filter
12. 1 rubber band
13. 1 tablespoon
14. 1 clock with a second hand (or a stopwatch)
15. **Activity 2**
14. 1 gallon of distilled water
15. gallon of tap water (identify the source)
16. gallon of mineral water (or private well water, if available)
17. gallon of filtered tap water
16. cups for the class

## **Resources**

“The Magic School Bus at the Waterworks” by Joanna Cole & Bruce Degen

<http://www.education.ky.gov/KDE/Instructional+Resources/Curriculum+Documents+and+Resources/Core+Content+for+Assessment/default.htm>

<http://www.education.ky.gov/KDE/Instructional+Resources/Curriculum+Documents+and+Resources/Program+of+Studies/default.htm>

<http://www.epa.gov/OGWDW/kids/cycle.html>

[Water in the World](#)

[Where Does Your Water Come From?](#)

[Teach Kids About the Water Treatment Process](#)

<http://ga.water.usgs.gov/edu/wwvisit.html>

A visit to a wastewater-treatment plant: Primary treatment of wastewater

“Adventures in Water!” A Curriculum Developed by Louisville Water Company

Section 6: From River to Faucet Activity

[www.louisvillewater.com](http://www.louisvillewater.com)

[www.tappersfunzone.com](http://www.tappersfunzone.com)

## **Activity Procedure**

### **Activity 1**

1. Pour about 1.5 liters of the swamp water into a 2-Liter bottle. Students will describe the appearance and smell of the water by recording their observations in their science journals.
2. **Aeration** addition of air to water. It allows gases trapped in the water to escape and adds oxygen to the water. Place the cap on the bottle and shake the water vigorously for 30 seconds. Continue the aeration process by pouring the water into either one of the cut-off bottles, and then pour the water back and forth between the cut-off bottles 10 times. Students will describe any changes that occur in their journals. Pour the aerated water into a bottle with its top cut off.
3. **Coagulation** is the process by which dirt and other suspended solid particles are chemically “stuck together” in floc (clumps of alum and sediment) so that they can be removed from water. With a tablespoon, add 20 grams of alum crystals to the swamp water. Slowly stir the mixture for 5 minutes.
4. **Sedimentation** is the process that occurs when gravity pulls the particles of floc the bottom of the cylinder. Allow the water to stand undisturbed in the cylinder. Ask students to observe the water in 5 minutes intervals for a total of 20 minutes and record their observations with respect to changes in the water’s appearance.
5. Construct a filter from the bottle with its bottom cut off as follows:
  1. Attach the coffee filter to the outside of the bottle with a rubber band.
  2. Turn the bottle upside down and pour a pebbles into the bottle-the filter will prevent the pebbles from falling out the neck.
  3. Pour the coarse sand on top of the pebbles.
  4. Pour the fine sand on top of the coarse sand.
  5. Clean the filter by slowly and carefully pouring through 5 liters (or more) of clean tap water (Try not to disturb the top layer of sand as you pour the water).
  6. Filtration through a sand and pebble filter removes most of the impurities remaining in the water after coagulation and sedimentation has taken place.
  7. After a large amount of sediment has settled on the bottom of the bottle of the swamp water, carefully-without disturbing the sediment-pour the top two-thirds of the swamp water through the filter.
  8. Collect the filtered water in the beaker.
  9. Pour the remaining (one-third bottle)swamp water back into the collection container.
  10. Compare the treated and untreated water.
  11. Ask student whether treatment had changed the appearance and smell of the water.

**Word of Caution :** The final step at the treatment plant is to add disinfectants to the water to purify it and kill organisms that may harmful.

Because the disinfectants are caustic and must be handled carefully, it is not presented in the activity. The water that was just filtered is unfit to drink and can cause adverse effects. **It's not safe to drink!**

### Activity 2

1. Have the students work together in groups to try to identify different tastes, smells, and appearances in the water. Have each group write down their observations on each water sample, and identify which cup has which type of water.
2. After everyone has completed their observations, have the students mark their guesses on the board. Ask the students what types of impurities they would expect to find in the different types of water, and if their senses confirmed their intuitions. Record these observations on the board.
3. Reveal to the students which samples contained which type of water. 5. Discuss with the students their observations and what other impurities might be found in these waters.
4. Discuss the source of water for the community.
5. If anyone in the class lives in a location supplied by a private well, ask him/her to describe the water at their home. And how it compares to other water he/she drinks in the community.

### Lesson Context

- Day 1 Students will be introduced to an adventure through water by watching the video "The Magic School Bus At the Waterworks" by Joanna Cole. Students will record a journal entry in their science notebooks on the topic of the water cycle and the water purification system.
- Day 2 Students will complete Steps 1-4 in Activity one. They will record their observations with respect to changes in the water's appearance.
- Day 3 Students will complete Step 5 of Activity 1. They will write a one-page reflection on the activity in their science notebooks.
- Day 4 Student will complete Activity 2. Students will make a journal entry on their observations and what other impurities might be found in the water.
- Day 5 Students will be assessed by their activity results and a written examination. The written examination will contain three worksheets over this unit on water filtration to evaluate if the students understood the activities and if they can apply the results of the activities to real life situations.

### Assessment

1. Participation in the activities demonstrated by presenting to the rest of the class, a reflection on the activity, or a poster that demonstrates the procedure that municipal plants use to purify drinking water. A rubric will be used to evaluate the poster.
2. Students will complete three worksheets over this unit. They may use multiple resources. (friends, library resources, Internet resources, and textbook)

### **Definition/Explanation of Concept or Skill**

Water is a very important substance that determines your quality of life and ability to survive. It regulates body temperature, circulates nutrients through your body, and keeps your skin smooth. Your family will use 6, 000 gallons of water every month at home. Water helps produce the food you eat, the car you drive, the house you live in, and even the clothes you wear.

The world's water is used over and over again in a process called the water cycle. Water in lakes, rivers, and swamps often contains impurities that make it unsafe for people to drink. This means that water that comes from these sources must be cleaned before people can consume it. Water utility plants provide such treatment before water is sent through pipes to homes in a community. Most treatments techniques aim to produce a product that is safe for human consumption, good tasting to the consumer, and that meets certain State and Federal regulations at the lowest possible cost. In the United States almost all cities treat their water using some type of treatment process. The type of treatment depends on the quality of the raw water.

Name \_\_\_\_\_ Score \_\_\_\_\_

Date \_\_\_\_\_

Where Does Your Water Come From?

Follow-up Questions:

1. What are some possible sources of water in your community? (5 points)

2. Which type of water tasted best? \_\_\_\_\_ Why?  
(5 points)

3. Which type of water would you consider safer to drink, groundwater from a spring, or surface water from a stream? \_\_\_\_\_

Explain your answer. (10 points)

Name \_\_\_\_\_

Score \_\_\_\_\_

Date \_\_\_\_\_

You use water every day! Try to guess the answers to these water trivia questions. Use may use the intern

1. How many glasses of tap water do Americans drink every day?
2. How much water does it take to make a gallon of paint?
3. How much water does it take to manufacture a car?
4. How much of your body is water?
5. How much water does it take to grow enough cotton for one pair of blue jeans?
6. How much of a tomato is water?
7. How much water is in a cloud that's the size of a classroom?
8. How much water does a family of four use in one month?
9. How much water does a fire hydrant release in one minute?
10. How much water does it take to make one can of soda?

## Put It to Good Use Answers

1. Americans drink 50 billion glasses of tap water every day.
2. It takes 13 gallons of water to make a gallon of paint
3. It takes 32,000 gallons of water to manufacture a car.
4. 70% of your body is water
5. It takes 1,800 gallons of water to grow enough cotton for a pair of blue jeans.
6. 95% of a tomato is water.
7. A cloud that's the size of a classroom can hold one ounce of water.
8. On average, a family of four will use 6,000 gallons of water in a month.
9. In Jefferson County, a fire hydrant can release 750 gallons of water in one minute.
10. It takes 10 gallons of water to make one can of soda.

Name \_\_\_\_\_

Score \_\_\_\_\_

Date \_\_\_\_\_

## Water Wows



\_\_\_ gallons of water, if you leave the water running, to brush your teeth.



Your body is \_\_\_ % water.



You need \_\_\_ quarts of water everyday to stay healthy.



It takes \_\_\_ gallons of water to make a car.



For \$1.30 you can fill your Pure Tap bottle more than \_\_\_ times.



\_\_\_ % of the earth's surface is water.



\_\_\_ % of an elephant is water.



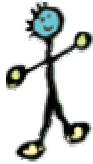
The three forms of water are \_\_\_\_\_, \_\_\_\_\_ and \_\_\_\_\_.

# Water Wows Answers

How did you do?



2 gallons of water, if you leave the water running, to brush your teeth.



Your body is 66 % water.



You need 2 quarts of water everyday to stay healthy.



It takes 39,000 gallons of water to make a car.



For \$1.30 you can fill your Pure Tap bottle more than 7,500 times.



80 % of the earth's surface is water.



70 % of an elephant is water.



The three forms of water are solid, liquid, and gas