# Water, Water Everywhere

Student Activity 10

## Introduction:

Although 75% of the Earth's surface is covered with water, only a very small fraction is available for human use. Of the water that is available to us, some becomes contaminated from human actions, such as toxic run-off from agriculture, factories or pollutants that we dump in the water supply from our sinks at home. Population growth over the past 30 years has caused demand for water to double in about half the countries in the world. Residents of states with rapidly growing populations, as well as citizens of other countries, often experience water shortages. In the following activity, students will gain an appreciation for the ways we use water and the need to conserve it.

## Procedure:

## Part 1:

## Set-up:

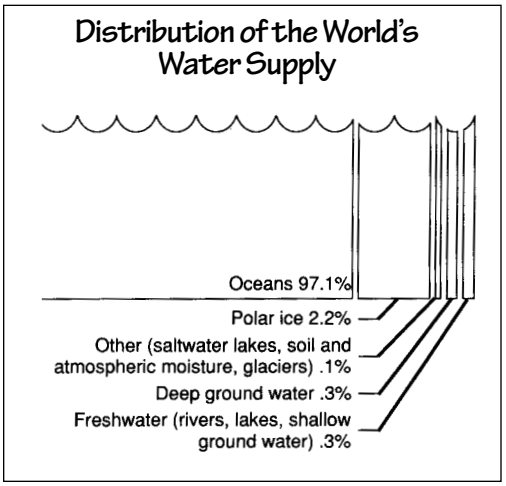
1. Gather all materials.
2. Fill one small container with sand.
3. Fill a one-liter container with water, add 4 drops of blue food coloring and stir.
4. Label the other 5 containers as follows: a one-liter container "oceans"; a small plastic container "polar ice"; a small container "deep groundwater"; a small container "fresh water."
5. Make a transparency of the adjacent diagram.
6. Measure and set aside 34 grams of salt.

## Facilitating the Activity:

Perform the following class demonstration to help students visualize the distribution of the Earth's water resources:

1. Display the seven containers prepared for this activity.
2. Display a transparency of the figure on the right. Use a graduated cylinder to distribute the one liter of water into the five empty containers according to the percentages indicated in the figure. (For example, 97.1 percent of the water on the Earth is found in the oceans. Because one liter contains 1000 milliliters, 97.1 percent of one liter is 971 milliliters. Therefore, pour 971 milliliters into the container marked "oceans.")
3. After you have filled the empty containers with the appropriate amounts of water, continue with the demonstration as follows:
   a) Add 34 grams of salt to "ocean" container; this will match the salinity of the water sample with the salinity of the earth's oceans (3.5 percent)
   b) Place the plastic "polar ice" container in the freezer.
   c) Set the "other" container aside. We do not have access to this water.
   d) Pour the "deep ground water" into the container of sand.
   e) Ask the students which of the containers represents fresh water that is readily available for human use. (They should easily see that only the jar marked "freshwater" has the readily available supply.) Initiate a discussion on the limits of fresh water supplies, the problems of population growth and distribution, and the contamination of existing supplies. Only a small part of this fresh water (.003 percent of the Earth's total water supply) is accessible. The rest is too remote (found in Amazon or Siberian rivers) to locate, too expensive to retrieve or too polluted to use. Hold a plate in front of the class and dramatically drop the usable portion of fresh water onto it. (Represent this portion as one drop of water from an eye dropper.)

*Adapted by permission from the National Science Foundation. The original activity appears in the* National Science and Technology Week Activity Guide, *1988, by the National Science Foundation, Washington, DC.*




**Concept:**
Although water covers three-quarters of the Earth's surface, only a small fraction is available for human consumption. As the population grows, water efficiency and conservation become more important.

**Objectives:**
Students will be able to:
- Understand aspects of a shared natural resource, such as availability and distribution.
- Estimate the amount of resources they use and compare that figure to actual use.
- Design a graph to show current resource use and use after conservation measures have been taken.

**Subjects:**
Biology, environmental science, math, family life

**Skills:**
Estimation, graphing, mathematic calculation, observation, research, writing

**Method:**
Students observe a brief demonstration on the distribution of the world's water and then calculate how much water they use on a daily basis, both directly and indirectly.

**Materials:**
7 clear containers (2 one-liter containers; 5 smaller containers, one of which is plastic.)
1 plate
Overhead projector
Masking tape
Marking pen
One liter of water
Salt (34 grams)
Sand (approximately 250 ml)
Blue food coloring
1000 ml graduated cylinder
One eye dropper
Graph paper
Calculators (optional)
Copies of Student Worksheet
Freezer

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## Part 2:

1. Have students record how many gallons of water they think they use individually in an average day. Later, they will compare this estimated daily water use with their calculated daily water use.
2. As a group, have them list all the ways members of their class use water on a day-to-day basis.
3. Using the data in the table, "Domestic Uses of Water," have them determine their individual water use per day for each activity that the class listed in step 2. They should include their share of general family uses such as dishwasher and clothes washer. Then they can determine their individual total water use per day.
4. Students should compare the individual water use calculated in step 3 with the water use estimated in step 1. Are their calculated figures higher or lower than their estimated figures? Ask students whether they consider themselves typical water users. Have them explain their answers.
5. Students should now draw a bar graph to illustrate how much water is used by their class for each activity. Which activities require the most water? Using the class average, students should also calculate the average use of their town and/or state.

## Suggested Answers to Student Worksheet Questions:

1. *Water is needed to grow the food and grasses the calf would consume.*
2. *Student answers will vary.*
3. *Student answers will vary.*
4. *Possible answers: purchasing and eating foods which require less water to cultivate (eating lower on the food chain); recycling items to prevent excessive use of water in manufacturing; driving less.*
5. *Possible answers: take showers instead of baths; don't let water run while brushing teeth or shaving; fix leaky faucets; install water-saving devices for toilet and shower; water lawn less frequently; run dishwasher and washing machine only when you have* full loads.
6. *Student answers will vary. For further information on water contamination, you may wish to contact the U.S. Environmental Protection Agency, Public Information Center, 401 M Street, SW, Washington, DC 20460; 202/829-3535; www.epa.gov.*

## Follow-up Activities:

1. Have students investigate new household products which conserve water (such as low-flush toilets, new shower heads, timed sprinklers, etc.) Each student or group of students could be responsible for writing up a brief synopsis of the costs and benefits of one or two of these products.
   *(Note: Free catalogs listing water conservation devices are available from: Eco Source, 610 Wendell Court, Atlanta, GA 30336, 800/864-2737; and Gaiam Inc., 1 Mill St., Suite A26, Burlington, VT 05401, 800/456-1177.)*
2. Have students read their home water meters daily for a week, at the same time each day, and report back to the class. They can then compare these readings to their estimates of daily water use. They can then read the meter for a second week, in which they implement many of the conservation measures suggested above.

*Adapted by permission from Biological Science Curriculum Study. The original activity appears in* Biological Science: An Ecological Approach *(Kendall/Hunt Publishing Company, 1987, 1992, 1998).*

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## Domestic Uses of Water

| Activity | Gallons Used |
|---|---|
| Brushing teeth | 2-10 |
| Washing hands | 2 |
| Shaving | 20 (2/min.) |
| Showering | 20-25 (5/min.) |
| Tub bathing | 25-35 |
| Flushing toilet | 3.5 - 8 |
| Getting a drink | 0.25 |
| Cooking a meal | 5-7 |
| Washing dishes | 30 (8-10/meal) |
| Automatic dishwasher | 15 |
| House cleaning | 7 |
| Washing machine | 24-50 |
| Watering lawn | 10/min. (102/1000 $m^2$) |
| Leaking faucet | 25-50/day |

(Faucet and toilet leaks in New York City = 757 million gallons/day)

## Indirect Uses of Water

### Agricultural

| Item | Gallons Used |
|---|---|
| 1 kg corn | 374 |
| 1 loaf of bread | 150 |
| 1 kg rice | 1,232 |
| 1 kg grain-fed beef | 1,760 |
| 1 kg cotton | 4,400 |

### Industrial

| Item | Gallons Used |
|---|---|
| 1 gallon gasoline | 10 |
| 1 kg steel | 25 |
| 1 kw electricity | 80 |
| 1 kg paper | 220 |
| 1 kg synthetic rubber | 660 |
| 1 kg aluminum | 2,200 |
| 1 car | 100,000 |

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Student Worksheet

1. There are many water uses that are not obvious to most people. Consider, for example, that 1.2 million gallons of water are needed to raise one calf until it is fully grown. Why do you think so much water is needed to raise a calf?

2. Make a list of the ways you use water indirectly, for example, in the production of food you eat or materials you use.

3. Compare your list with the table above, "Indirect Uses of Water." How many of these uses did you list?

4. How could you reduce your indirect use of water?

5. What could you do to reduce your direct use of water?

6. Is there any evidence that the water supply you use daily is decreasing in size or is being contaminated by pollutants? How could you go about obtaining this information?