

Earth's Water: A Drop in Your Cup

GRADE LEVEL	5 th Grade
SUBJECTS	Earth Sciences
DURATION	Preparation: 10-15 minutes Activity: 20 minutes
SETTING	Classroom

Objective

Students will:

1. Learn that the Earth has a finite amount of fresh water
2. Learn ways to conserve fresh water and brainstorm ideas to increase usage of untapped water resources in their local area.

Materials

- a vessel capable of measuring 1 liter of water (beaker, graduated container, etc.)
- graduated cylinders (in milliliter increments)
- eye-droppers
- Kool-Aid or Tang drink mix that is colored (optional)
- food coloring (optional)
- water
- salt

Scientific Terms for Students

- resource: a natural, economic, or political asset that can be drawn upon when needed
- desalination: a process that removes salt from seawater to produce drinkable water
- fresh water: water that contains minimal amounts of salt (as opposed to saltwater in the oceans)

Background for Educators

Water (H₂O) is a very important molecule. Because of water, Earth is able to support many different life forms. In humans, water makes up between 68% and 72% of the body volume (depending on gender and body composition), and it is so important that we cannot survive longer than 3 days on average without replenishment.

Because water is such a vital resource, it is important to understand how much is available, where water comes from, and how to make sure we will have enough drinkable water in the future.

If you look at a model globe, approximately 70% of the surface is covered by water. Of that total water, 97% is in the oceans and is undrinkable without desalination treatment (to remove salt). Of the remaining fresh water, less than one half of one percent is available in surface



sources like lakes, rivers, and swamps. Most fresh water exists as glacial ice or is trapped underground (see charts).

The Bay Area gets water from a variety of sources. The San Francisco Public Utilities Commission (SFPUC) manages reservoirs in 3 distinct watersheds. The majority of this water, supplying 85% of the Bay Area, comes from the Hetch Hetchy reservoir in Yosemite National Park. This reservoir collects water from the 1189 square kilometer (459 square mile) Tuolumne River watershed, which is fed by snowmelt from the Sierra Nevada mountains. Two smaller reservoirs, Lake Eleanor and Cherry Lake also collect moderate amounts of water from the Eleanor Creek and Cherry Creek watersheds, respectively.

Other watersheds include the Alameda watershed, which serves 2.4 million people in the Bay Area, the Peninsula Watershed, and the Lake Merced Watershed, which supplies an aquifer serving Daly City and South San Francisco.

Adapted from Activity 5.1 "A Drop in the Bucket" in the California Coastal Commission Science Activity Guide for Waves, Wetlands, and Watersheds. Can be done as a demonstration or, for older students, in groups.

Educator Preparation

Prepare one liter of colored liquid. You can use a colored drink, like Tang or Kool-Aid, or just put food coloring in plain water. The color will make it more easily visible for the demonstration. Set all materials on a table in front of the classroom where students can observe the demonstration.

Introduction

1. Brainstorm with your students about how people use water. We need to drink water in order to survive. We also use water in many other ways, such as bathing, swimming, watering the lawn, doing the laundry, etc.
2. Ask your students where we get the water we need. Have them brainstorm natural sources of water.
3. For this activity, we will be looking at how water is distributed across these sources:
 - oceans
 - groundwater
 - lakes
 - ice
 - swamps
 - rivers

List these sources on the board so they will be visible throughout the activity. Discuss them with your students, making sure they understand what each one means.



Procedure

1. Show the class one liter of colored liquid. Tell them that for this activity, the liter will represent all the water in the world.
2. Split the class into six groups. Tell students that the world's supply of water will be divided among all the groups. Each group will have one source of water that must provide for all their needs. For example, one group will get all the water found in rivers, one will get all the water that exists as ice, etc.
3. You can let the groups choose their preferred source of water, or you may assign each group a source. Before you distribute the water, have each group predict roughly how much they think they will receive.
4. Distribute the liquid to the groups one by one using the amounts listed below. Measure out the portions into clear cups (so that the amount of water is easily visible) and hand the cup to the group assigned to that source. As you hand the cup to the group, tell them how much water it is, and write the amount on the board.
 - ice: 20.6 mL
 - groundwater: 9.0 mL
 - lakes: 0.08 mL
 - swamps: 0.01 mL (roughly 5 drops)
 - rivers: 0.002 mL (roughly 1 drop)
5. The last group receives the remainder of the water.
 - ocean: 970 mL

Congratulate this group on choosing a source that contains so much water, BUT before you hand it to them, dump a generous amount of salt into the liquid. Explain that while the oceans contain most of the planet's water, that water is too salty for us to use. There are desalination processes that can remove the salt and make the water drinkable, but these processes are expensive and use a lot of energy.

(Note: these numbers are rounded off to make them feasible to measure, but represent the real proportions as closely as possible. As a result of rounding off, the amounts add up to 999.692 mL rather than exactly 1000 mL.)

6. Refer back to the numbers written on the board. Point out that while there is a large amount of water on the planet, only 3% of that is fresh water. 97% is found in the oceans. That limited amount of fresh water must support a growing population of humans in addition to plant and animal life and agriculture.
7. Tell the students they can drink the liquid if they want to, but must first decide how to divide it among the group members. (Remind the ocean group not to drink their salty water.) Have the groups discuss how they might share their portion of water, considering



that the water has to accommodate the needs of plants and animals as well as humans.

8. If desired, you can extend the discussion to consider how water might be distributed equitably. Some groups of students have more water than others. Is this fair? What could be done about it?

Alternative procedure:

If you want your students to practice their measuring skills, you can structure this activity so that each student gets a chance to measure. Put students in groups of six, and give each group a liter of water. Each student in the group will select (or be assigned) a source of water. Write the measurements on the board, and have each student measure out the appropriate amount into a cup.

Wrap Up

- Because fresh, drinkable water is such a limited resource, it is important to conserve water in our daily lives. Have the class brainstorm ways to conserve. For example:
 - Turn faucets off when washing dishes, brushing teeth, and when soaping up in the shower.
 - Buy low-flow showerheads.
 - Water lawns and gardens in the morning or at night to reduce evaporation, and make sure that the water does not run onto the street or sidewalk.
 - Make sure dishwashers and clothes-washing machines are fully loaded before running them.
- Discuss other ways of acquiring drinkable water (desalination plants, ground water wells, rain capture, etc.)

Resources

California Department of Water Resources: www.water.ca.gov

San Francisco Public Utilities Commission: www.sfwater.org



California State Content Standards

Grade Five

Earth Sciences

- 3a. Students know most of Earth's water is present as salt water in the oceans, which cover most of Earth's surface.
- 3d. Students know that the amount of fresh water located in rivers, lakes, underground sources, and glaciers is limited and that its availability can be extended by recycling and decreasing the use of water.
- 3e. Students know the origin of the water used by their local communities.

Next Generation Science Standards

Performance Expectations:

- **5-ESS2-2.** Describe and graph the amounts and percentages of water and fresh water in various reservoirs to provide evidence about the distribution of water on Earth.

DCIs

- **ESS2.C:** The Roles of Water in Earth's Surface Processes

