



Conserve Water

Imagine you have one glass of water and six friends who want some. How are you going to divide it up?

Age Level:
Ages 8 and older

Subject Areas:
Earth Science,
Environmental Science,
Geography, Health, Life
Science, Mathematics

Duration:
Warm Up: 10 minutes
Activity: 30 minutes
Wrap Up: 10 minutes

Skills:
Gathering information
(calculating, recording);
Organizing information
(estimating, charting,
manipulating materials);
Interpreting information
(summarizing, relating,
identifying cause and effect)

Vocabulary:
conservation, potable water,
surface water, water use

Standards:
Common Core State Standards:

CCSS.ELA-Literacy.RST.6-8.3;
CCSS.ELA-Literacy.RST.6-8.4;
CCSS.ELA-Literacy.RST.6-8.7;
CCSS.ELA-Literacy.WHST.6-8.1e;
ELA-Literacy.WHST.6-8.2a;
CCSS.ELA-Literacy.WHST.6-8.2d;
CCSS.ELA-Literacy.WHST.6-8.2f;
CCSS.ELA-Literacy.WHST.6-8.4;
CCSS.ELA-Literacy.WHST.6-8.6;
CCSS.ELA-Literacy.WHST.6-8.10

NGSS: 3-LS4-4; 5-ESS2-1; 5-ESS2-2;
5-ESS2-5; MS-LS2-1; MS-LS2-4;
MS-LS2-5; MS-ESS3-1; MS-ESS3-3
For additional grade-level
and state-specific standards
visit www.projectwet.org/cleanandconserve.

Summary

By allocating a limited water supply, students learn how their water use affects others in their community.

Objectives

Students will:

- assess which daily activities require water.
- allocate a limited water supply with their peers.
- calculate gallons of water used in daily activities.
- identify ways to conserve water in their daily actions.
- recognize that individual conservation actions add up to significant collective water savings.

Materials

Warm Up

- Water
- Globe or world map
- 1,000-ml beaker
- Salt
- 100-ml graduated cylinder or beaker
- 10-ml cylinder or small cup
- Eyedropper or glass stirring rod
- Small metal bucket or cup

Activity

- Paper or plastic cups (1 per student plus extras)

- Markers
- Water jugs—one per group
- Copies of *Household Water Use Cards—Student Copy Page* (1 card per student)
- Copies of *Group Daily Water Use Worksheet—Student Copy Page* (1 per group)
- 2 identical containers, labeled “Round One” and “Round Two,” large enough to hold the total of one cup of water per group

Making Connections

Everyone uses water every day for drinking, cleaning and cooking. However, the amount of fresh water available is limited. By reflecting on their own water use and working together to allocate this limited but renewable resource, students can create a culture of water conservation that benefits the entire community.

Background

Ironically, on a planet extensively (71 percent) covered with water, water is one of the main limiting factors for life on Earth. The reason for this is that the majority of water is contained in oceans or frozen in glaciers and ice caps and is not available for human consumption. The Water Availability Table on page 25 summarizes the major factors affecting the amount of available water on Earth.

On a global scale, only a small percentage of water is available for human consumption, but this percentage actually represents a large amount per individual. If all the clean, fresh water were distributed equally among people, there would be about 1.6 million gallons (six million liters) per person. This is less than one percent (only about .003 percent) of the total water on Earth. The good news is that this tiny percentage of water is constantly being refreshed through the water cycle and this amount of fresh water is always available.

The paradox is that water is plentiful for some people and places, but scarce for others. There are approximately seven billion people and counting living on planet Earth. Each one of these people needs water daily for drinking, cooking and cleaning. Moreover, water issues are local. While one part of the world is flooding, another part may be in drought. Rainforests are places of plentiful water, but deserts have little water. People have learned to live and thrive with the available fresh water. To ensure there is enough water for everyone to meet basic needs, people must carefully manage, protect and learn to use water in a manner that allows all members of a community to have enough water.

Procedure

Warm Up

Note: For simplicity, metric measurements have been used.

1. Show the class a liter (1,000 ml) of water and tell them it represents all the water (100 percent) on Earth.

2. Ask students where they believe most of the water on Earth is located. Refer to a globe or map. Discuss the important difference between salt water and fresh water (the presence of salt, or salinity, makes salt water unfit for human consumption).
3. Ask students to estimate how many milliliters of water they think would represent all of the fresh water on Earth.
4. Pour 30 ml of the water into a 100-ml graduated cylinder or beaker. This represents Earth's fresh water, about three percent of the total. Put salt into the remaining 970 ml to simulate salt water found in oceans.
5. Ask students what is at Earth's north and south poles (ice!). Have students estimate what percentage of Earth's fresh water is stored in its frozen state. Almost 80 percent of Earth's fresh water is frozen in ice caps and glaciers. Remind students that the North Pole is frozen sea ice while the South Pole is Antarctica (a continent) covered in an ice sheet. Pour 6 ml of fresh water into a small cup or cylinder. The water in this cylinder (around 0.6 percent of the total) represents non-frozen fresh water. Only about 1.5 ml of this water is surface water; the rest is underground.
6. Use an eyedropper or a glass stirring rod to remove a single drop of water (0.03 ml). Release this one drop into a small metal bucket

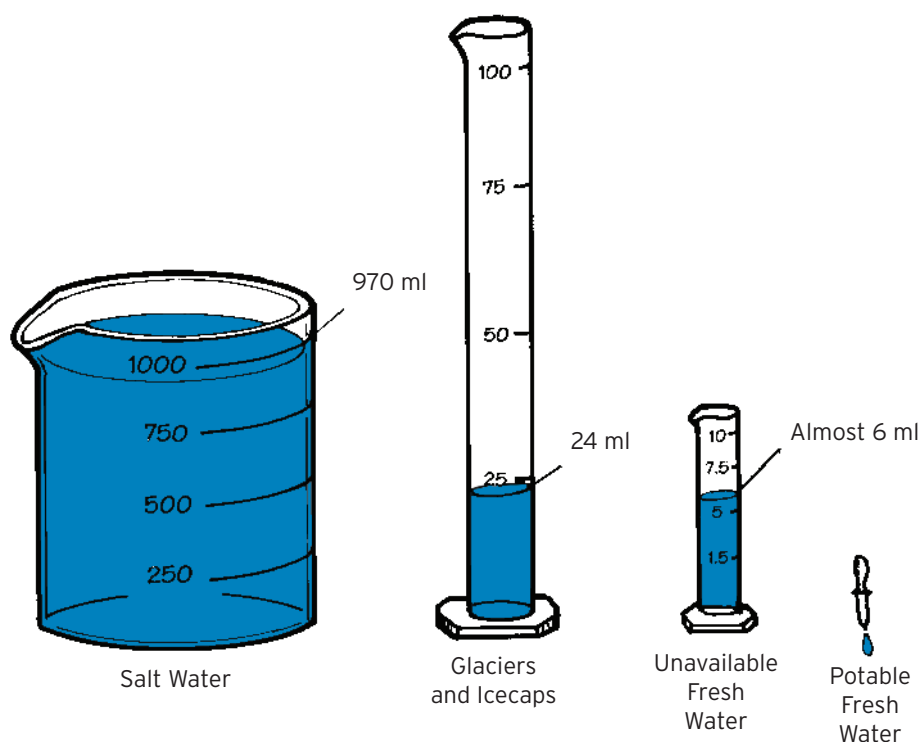
Conservation Actions

- Turn off the faucet after use.
- Turn off the faucet while brushing your teeth—only turn it on while rinsing.
- Fix any leaky water tanks or faucets.
- Use rain water for cleaning or watering gardens instead of tap water.
- Install low-flow toilets in new bathrooms.
- Use a receptacle or fill the sink to wash dishes instead of letting the water run.
- Take shorter showers.
- Run the dishwasher and washing machine only when they are full.
- Water the lawn in the morning or evening to minimize evaporation.
- When you are washing your hands, turn off the water while you lather.

Flow Rates for Household Appliances and Fixtures*

| | |
|-----------------|---|
| Kitchen Faucet | 2.5 gallons per minute |
| Bathroom Faucet | 1-2 gallons per minute (depending on efficiency) |
| Shower | 2.5 gallons per minute |
| Toilet | 1.6 gallons per flush (older models are 3 g/flush) |
| Washing Machine | 25 gallons per load on large setting (water efficient uses 15 g/load) |
| Dishwasher | 12 gallons per load (water efficient uses 4 g/load) |
| Garden Hose | 2 gallons per minute |

Sources: U.S. Geological Survey, <http://water.usgs.gov/edu/qa-home-percapita.html> and Southwest Florida Water Management District <http://www.swfwmd.state.fl.us/conservation/thepowerof10/>.



or cup. Make sure the students are very quiet so they can hear the sound of the drop hitting the bottom of the bucket or cup. This represents clean, fresh water that is not polluted or otherwise unavailable for use, about .003 percent of the total. This precious drop must be managed properly. Discuss the results of the demonstration. At this point many students will conclude

that a very small amount of water is available to humans. However, this single drop is actually a large volume of water on a global scale.

Activity Part 1

Before the Activity, fill jugs with water. Make sure there is NOT enough water in the jugs to fill all of the cups in the class (some students will be left without water).

1. Have students sit in a circle, and give each student a cup. Tell students they may not drink until everyone has water.
2. Ask students to reflect on how they use water. Students should name daily actions that require clean water.
3. Have the first student pour out as much water as he or she wants from a water jug and pass the jug to the next student in line. The first student may be decided by closest birthday or at random. (For young students, the teacher may need to pour the water into cups and ask students to say when to stop.)
4. Because of the limited amount of water in the jug, there might not be enough to go around. Ask students (those who received water and those who did not) how they feel. Tell them that sometimes there is not enough water available to meet everyone's needs.
5. Ask students what they could do to make sure everyone gets water. Have them think of what they would do differently the next time.
6. Pour the water back into the jug. Have them repeat the activity and put their ideas into action.

Part 2

Before the Activity, make copies of the Household Water Use Cards—Student Copy Page so

Water Availability Table

| | | |
|---|---|-----------------------------|
| Total water (100%) on Earth divided among all people (based on a world population of 6.9 billion people) | = | 202.9 billion liters/person |
| Minus the 97% of each share (196.813 billion liters) that contains salt (oceans, seas, some lakes and rivers) 202.9 billion liters minus 196.813 billion liters | = | 6.087 billion liters/person |
| Minus the 80% of this 6.087 billion liters that is frozen at the poles (4.869 billion liters) 6.087 billion liters minus 4.869 billion liters | = | 1.218 billion liters/person |
| Minus the 99.5% of the 1.218 billion that is unavailable (too far underground, polluted, trapped in soil, etc.) (1.212 billion) 1.218 billion liters minus 1.212 billion liters | = | 6.0 million liters/person |

Most recent estimates indicate that there are approximately 370 quintillion gallons (3.7×10^{20}) of water on Earth.

that there is at least one card per student.

1. **Divide students into groups of six people.** Tell students to keep their empty cups. Give each group one “group cup” in addition to their individual cups and the *Group Daily Water Use Worksheet–Student Copy Page*.

2. **Give each person in the group one action card from the Household Water Use Cards–Student Copy Page.** If a group has fewer than six people, students can have two actions. Actions are:

- a. Brushing teeth
- b. Washing hands
- c. Washing dishes
- d. Showering
- e. Flushing the toilet
- f. Washing clothes

3. **Students should look at their Household Water Use Card and note how many gallons of water the average person in the U.S. uses for their activity.**

Have student share with the other members of their group their assigned water use and gallons from their card. Let students think about how their daily use compares with the average use of a person on the card.

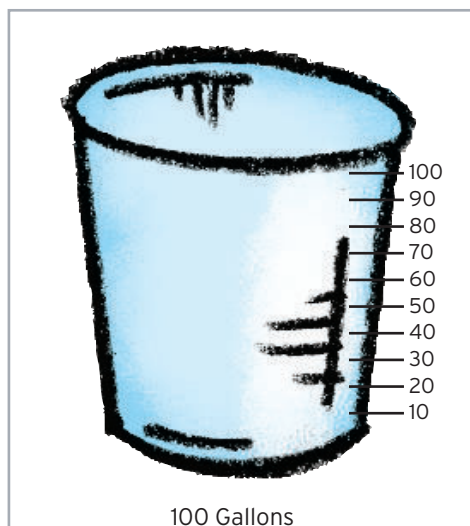
4. **Tell students to look at their cup. Explain that each cup represents 100 gallons. Instruct students to divide their cups into 10 sections and mark off 10 even marks with a marker.** Explain that each mark represents 10 gallons. Have student label each marker as illustrated in the diagram.

5. **With a marker, have students draw a line on their cups representing the number of gallons the average American uses for their action from the number on their card.** Each student in the group should also record the number of gallons used from their card on the *Group Daily Water Use Worksheet–Student Copy Page*.

6. **Give each group a jug of water. Each student should pour water to the line they drew on their cup (designating the amount of water for the activity they have been assigned).**

7. **Have each group pour their water into one communal group cup.** As a group, everyone’s action represents a single person’s water use for specific activities in a day. Have someone in the group draw a line on the group cup at the combined water line.

8. **Tell students that on average, a person in the U.S. uses 88 gallons**



of water per day. Have students note where on the cup 88 gallons is. Did the group use 88 gallons? If not what water uses might be missing (drinking water, watering the lawn, etc.)?

9. **Dump the water from the group cup into the bucket labeled “Round One.”** After all groups have dumped their water, note the water line on the bucket. Set this bucket aside until the end of the activity (or cover it so that students can no longer dump water into this bucket).

Part 3

1. **Have groups brainstorm ways they can conserve water with their respective actions.** How much water could they conserve using their conservation actions?

2. **Ask students to draw a new line on their cup representing less water use if they thought of ways to conserve water with their assigned action.** Be sure to emphasize that some actions (such as drinking water) may not have a conservation action for health reasons.

3. **Repeat step 6 from Part 1 using conservation actions.** Did the group use less water during this round using conservation actions? How much water did they save individually? Have each person calculate his or her individual savings and fill it in on the *Group Water Use Worksheet–Student Copy Page*.



4. **Ask students to pour the water from their cups into the group cup with the line on it from Part 1.** How much water did the group save? Have the group estimate the amount of water saved as a group by calculating the totals on the *Group Water Use Worksheet*. If appropriate have each group calculate the percentage of water they saved using conservation methods.
5. **Dump the water from the group cup into the "Round Two" bucket at the front of the room.** Ask each group to report their gallons saved and record the numbers on the board.
6. **After all groups have dumped their water, note the water line on the bucket. Compare this to the "Round One" bucket.** How much water did the class save? Add up the gallons the entire class saved. How does this compare to the gallons saved by each person? By each group?
7. **Have the class estimate the percentage of water saved by looking at the amount before and after.** You can

also calculate percentages using all of the groups' data.

8. **Ask each group to report their results and conservation actions.** Record the conservation actions of each group on the board. Use the *Water Conservation Actions—Teacher Resource Page* table as a reference and bring up any actions students didn't list.

Wrap Up

Have students summarize the importance of sharing water and other resources. Ask each student to list one conservation action they will take that week to reduce water consumption.

ActionEducation™

Have students perform a water audit at home by estimating gallons of water used over 24 hours. Students should record actions that required water and the amount of time/uses of water. Next, students can implement conservation actions and record their actions again. Ask them to compare their water use on days they conserved water versus days they were not mindful about it. (Use the table "Flow Rates for Household Appliances and Fixtures" on page 24 as a guideline or measure the amount of water flow per minute from your school or home faucets using a bucket or other vessel.)



WATERSTAR students and educators to contribute to a positive water future by learning about water and taking appropriate local action.

The WaterStar recognition program encourages

Report what you've learned and done at www.projectwet.org/waterstar.

Assessment

Have students:

- determine the proportion of Earth's available fresh water. (*Warm Up*)
- list the ways they use water in their daily lives. (*Part 1 and Part 2*)
- allocate a limited water supply so that everyone has water. (*Part 1*)
- recognize ways to conserve water in their daily actions. (*Part 1 and Part 3*)

Presenter Tips

For walk-up festivals: Perform the *Warm Up* of the activity. It can also be set up ahead of time with labels/sign explaining each amount.

For younger children: Do not have younger children estimate percentages.

Resources

Websites

The United States Geological Service. Water Use in the United States. A resource about water uses in the U.S. <http://water.usgs.gov/edu/wateruse.html>. (Accessed January 27, 2015.)

The United States Geological Service. How much is your daily indoor water use? A tool to calculate indoor water use. <http://water.usgs.gov/edu/sq3.html>. (Accessed January 27, 2015.)

Environmental Protection Agency. Water. Information on water including drinking water in the world. <http://water.epa.gov/>. (Accessed January 29, 2015.)

Household Water Use Cards—Student Copy Page

Washing Your Hands

10 gallons/day

Running a faucet for 30 seconds while you soap and lather your hands uses approximately 1 gallon of water. A person who washes his or her hands 10 times per day uses 10 gallons of water!

How can you reduce the amount of water used without reducing hand washing?



Brushing Your Teeth

8 gallons/day

Running the faucet for two minutes while you brush your teeth uses 4 gallons of water. If you brush your teeth twice per day, this is 8 gallons of water used!

How can you reduce the amount of water you use to brush your teeth while still keeping a healthy dental routine?



Doing Laundry

25 gallons/day

One load of laundry uses 25 gallons of water. If someone does not fill the machine full before doing laundry the result is more loads of laundry. A person who does one load of laundry in a day uses 25 gallons of water.

How can you reduce the amount of water you use for laundry? How can you reduce the number of loads of laundry in your house? How much water does a water-saving washing machine use?



Showering

25 gallons/day

A 10-minute shower uses 25 gallons of water.

How long is your shower? Do you have water-efficient shower heads or a shower timer?



Flushing the Toilet

16 gallons/day

Everyone needs to use the toilet! Each time you flush a standard toilet, it uses 1.6 gallons of water. If you flush 10 times a day, you will use 16 gallons of water. How many times a day do you flush?

Do you know any methods to reduce the amount of water that your toilet uses?



Washing Dishes

12 gallons/day

People wash dishes by hand in the sink with a faucet and by using a dishwasher. One load in the dishwasher uses approximately 12 gallons of water. If a family does not fill the dish washer full before running it, this results in more loads and more water use.

How can you reduce the number of dishwasher cycles in your house? How much water does a water-saving dishwasher use?



Group Daily Water Use Worksheet–Student Copy Page

| Action | Round 1: Average Water Use (from card) | Conservation Action | Round 2: Your Water Use (conservation actions) | Gallons Conserved (Difference = Round 1 - Round 2) |
|--|---|---------------------|---|--|
| Brushed Teeth | | | | |
| Took a Shower | | | | |
| Washed Hands | | | | |
| Flushed Toilet | | | | |
| Washed Laundry | | | | |
| Washed Dishes | | | | |
| Total Water Use (add the numbers from each column) | | | | |

| | |
|---------------------------------------|--|
| Total Water Use Part 1 | |
| Total Water Use Part 2 | |
| Water Savings (Round 1 minus Round 2) | |

Water Conservation Actions–Teacher Resource Page

| Action | Conservation Actions |
|----------------|---|
| Brushed Teeth | <ul style="list-style-type: none">• Turn off faucet while brushing teeth• Use a cup to catch water while wetting brush and use this water for rinsing |
| Took a Shower | <ul style="list-style-type: none">• Time showers to make them shorter• Install water-efficient showerheads• Turn off the water while lathering with soap and shampoo, then rinse |
| Washed Hands | <ul style="list-style-type: none">• Turn off faucet while lathering |
| Flushed Toilet | <ul style="list-style-type: none">• Fill a liter bottle with rocks or sand and put it in the toilet tank so that the toilet uses less water• Install water-efficient toilets |
| Washed Laundry | <ul style="list-style-type: none">• Only run washer with full loads• Use water-efficient washing machines |
| Washed Dishes | <ul style="list-style-type: none">• Only run washer with full loads• Use water-efficient dishwashers• Use a receptacle or fill the sink to wash dishes (instead of letting the water run) |