A SALT WATER-Y WORLD

OBJECTIVES

The student will do the following:

1. Observe a model of the distribution of the earth's water.
2. Compare the relative volumes and percentages of types of water on earth.
3. Demonstrate solar distillation.

SUBJECTS:
Science, Social Studies, Math

TIME:
50 minutes

MATERIALS:
two 1,000-mL graduated cylinders (or 1-L clear containers)
four 100-mL graduated cylinders (or small jars)
medicine dropper
food coloring
teacher sheet (included)
acetate sheet
overhead projector
large bowl or pan (1 per group)
small drinking glass (1 per group)
small rocks
plastic wrap
2-gallon bucket
water
soil
student sheet (included)

BACKGROUND INFORMATION

Humans must have fresh water to live, but about 97 percent of the earth's water is too salty to use. The remaining 3 percent is fresh water, but most of it is in polar icecaps, remote glaciers, and icebergs and is not easily accessible. Accessible fresh water, therefore, comes from surface water and groundwater sources. These sources represent less than one-half of one percent of all water on the earth.

Terms

groundwater: water that infiltrates into the earth and is stored in usable amounts in the soil and rock below the earth's surface; water within the zone of saturation.

surface water: precipitation that does not soak into the ground or return to the atmosphere by evaporation or transpiration, and is stored in streams, lakes, wetlands, reservoirs, and oceans.

ADVANCE PREPARATION

A. If you do not have two 1,000-mL graduated cylinders, use other clear liter containers. If you have access to laboratory glassware, fifteen 100-mL graduated cylinders will work. If you use the small cylinders, ten of them will hold 972 mL of salt water, while the remaining five will hold fresh water. A clear plastic jug (soft drink container) holding one liter of colored water can be used. Other clear glasses or jars can hold the smaller divisions. The following table shows the distribution of water for this demonstration.

Earth's Total Water Supply		Earth's Total Fresh Water Supply	
972 mL	Ocean (salt water)	23 mL	Icecaps and glaciers
28 mL	Fresh water	4 mL	Groundwater
1,000 mL	Total Water on Earth	2* drops	Surface water
		1* drop	Water in air and soil
		28 mL	Total Fresh Water on Earth

1 liter = 1,000 mL
*3 drops = 1 mL

B. Make a transparency from the teacher sheet "Water Distribution on Earth." (NOTE: You can make a chart rather than using a transparency and overhead projector.)

C. Duplicate copies of the student sheet.

D. Get a liter of water in the cylinder or bottle. Put food coloring in it so the students can see it.

E. Gather the materials to have 5-6 groups each build a distillation apparatus. Make muddy water by filling a 2-gallon bucket with water and mixing in about 2 cups of soil.

PROCEDURE

I. Setting the stage

A. Share with the students the background information.

B. Display the transparency or chart, "Water Distribution on Earth." Discuss this briefly with the students. Tell them you are going to show them what these proportions look like.

II. Activity

A. Place all the materials on a table in front of the class.

1. Fill one graduated cylinder with colored water to the 1,000 mL line. Tell the students that this represents the earth's entire supply of water. Pour 28 mL of this water into a second 1,000-mL graduated cylinder. The 28 mL of water represents the earth's total fresh water supply. The remaining 972 mL of water is salt water that occurs primarily in oceans.

2. Divide the 28 mL of fresh water by pouring portions of it into smaller containers: 23 mL for icecaps and glaciers, 4 mL for groundwater, 2 drops for surface water, and 1 drop for the water in the atmosphere and soil.

3. Refer the students again to the table on surface water distribution.

B. As the students examine and compare the different volumes of water in the graduated cylinders, ask the following questions:

1. Which of the four fresh water graduated cylinders represents the most fresh water on earth? (23 mL, representing icecaps and glaciers)

2. Is this a source of fresh water commonly used by humans for drinking, watering the lawn, cleaning, and so on? Explain. (No, icecaps and glaciers are usually too far away from population centers.)

3. Approximately what percentage of the earth's fresh water is groundwater? (0.4%, or less than one-half of one percent)

4. Where is most of earth's water found? (oceans)

5. Can cities such as San Francisco, Miami, and New York City, which are near oceans, use the water from the oceans for households and industry? Explain. (No, the ocean water contains salts that are harmful to humans, plants, animals, and metals.)

6. Can the salts be removed from water? Why isn't this commonly done? (Yes, but the desalination process is very expensive.)

7. Why is the little bit of water in the atmosphere important to plants, animals, and humans? (Water in the atmosphere is carried inland in the forms of rain, snow, sleet, and hail which supply fresh water sources such as lakes, streams, and groundwater.)

C. Have the students do the demonstration of desalination using solar energy found on the student sheet "Sun Power for Clear Water." (Choose a sunny day.)

1. Divide them into groups of about 5 students each.

2. Give each group the materials. Explain that you will use muddy water instead of salty water so they can see that the distilled water is clean.

3. Take the class outside and let them set up their distillation devices.

4. Allow the students to play or do outdoor education activities for about 20-30 minutes, then begin checking the devices.

5. When clear water has dripped into the glasses, discuss with the students how heat from the sun cleaned the water.

III. Follow-Up

A. Ask the class the following questions:

1. Which kind of water (fresh or salt water) do we have more of on the earth? (salt)

2. Can people drink salt water right out of the ocean? (no)

3. Is there more water underground than in all the lakes and rivers of the world combined? (yes)

4. Can people make fresh water out of salt water? (yes)

B. Have the students draw a picture of the distillation device and write a few sentences describing how it worked.

IV. Extension

A. Have the students write the percentages of water distribution, as given on the teacher sheet. Can they express this in hundredths and thousandths?

B. Have the students think of several ways that salt water could be distilled to make drinkable fresh water. (You might divide them into groups.) Allow them to sketch distillation devices to provide families or communities with large amounts of water.

C. Have the students sing the following song to the tune of "My Bonnie Lies Over the Ocean":

Sing a Sea Song

The Earth is all covered with ocean.
The Earth is all covered with sea.
The Earth is all covered with ocean.
More water than land, don't you see?

Chorus
Water, water, there's water all over the world, the world.
Water, water, there's water all over the world, the world.

So salty and cold is the ocean.
So salty and cold is the sea.
So salty and cold is the ocean.
Too cold and too salty for me.

Repeat Chorus

Atlantic, Pacific, the Arctic,
And then there's the Indian too.
These oceans all over our planet.
I named all of them, now can you?

Repeat chorus

RESOURCES

The Energy Sourcebook: Elementary Unit, Tennessee Valley Authority, 1990.

"Sing A Sea Song," Ranger Rick's NatureScope: Diving Into Oceans, National Wildlife Federation, Washington, DC, p. 8., 1989.

Vandas, S., "Water: The Resource That Gets Used and Used and Used for Everything!" (poster). Available from American Water Resources Association , 5410 Grosvenor Lane, Suite 220, Bethesda, Maryland 20814-2192, 301-493-8600 or The National Science Teachers Association, 1742 Connecticut Avenue NW, Washington, DC 20009, 202-328-5800.

WATER DISTRIBUTION ON EARTH

Earth's Total Water Supply

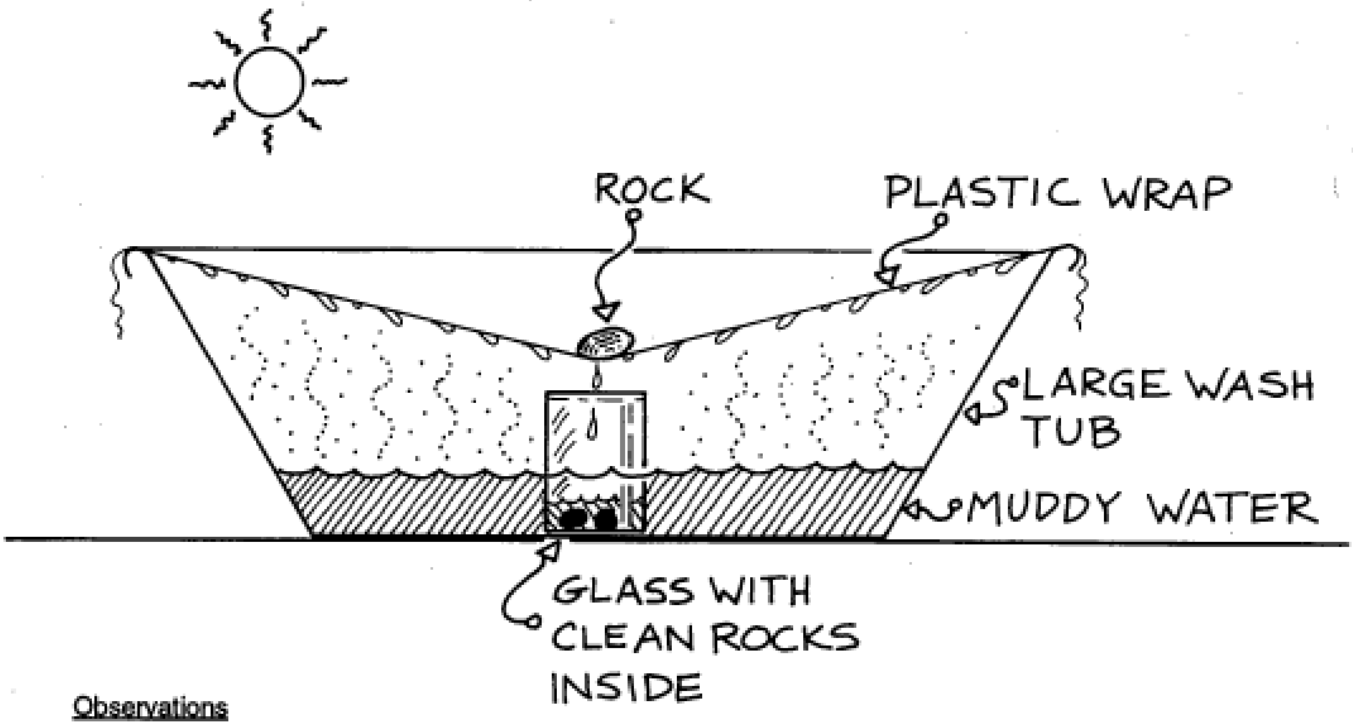
97.2 %	Oceans (salt water)
2.8 %	Fresh water
100.0 %	**Total Water on Earth**

Earth's Total Fresh Water Supply

2.38 %	Icecaps, glaciers
0.39 %	Groundwater
0.029 %	Surface water (lakes, rivers, etc.)
0.001 %	Air and soil
2.8 %	**Total Fresh Water**

SUN POWER FOR CLEAN WATER

1. Put muddy water in a large bowl or pan to a depth of 2 inches (5 centimeters).
2. Set it in a place where it will receive sun all day.
3. Place a small glass right-side up in the middle of the tub. You may have to weight it down by putting two small, clean rocks in it.
4. Cover the tub tightly with clear plastic wrap.
5. Place a rock on the plastic over the center of the glass. Do not let the plastic touch the glass. (Just weight it down in the middle.)
6. Observe what happens. Record your observations. Propose a way that this procedure, called "distillation," might be helpful on a larger scale.



Observations

_____

_____

Questions

1. What kind of energy cleaned the water? _____
2. How might this process be useful to people? _____