Where's the Water?

Purpose: To identify the reservoirs of the Earth's water cycle (e.g., oceans, icecaps / glaciers, atmosphere, lakes, rivers, ground water) locally and globally and graph or chart relative amounts in global reservoirs.

Summary: Students will use 10 liters (approximately 2.5 gallons) of water to represent all the water on the earth. They will be given the percentage for each water source in relation to the total amount, and asked to divide the 10 liters of water to demonstrate this.

Background: Approximately 72 percent of the earth is covered with water. Sources of water are the oceans, icecaps and glaciers, groundwater, freshwater lakes, inland seas and salt lakes, the atmosphere, and rivers. In this activity, 10 liters of water in a bucket are used to represent all the water on the earth. See the table below for the percentage of each water reservoir in relation to the total amount, and the appropriate measurement for each reservoir.

RESERVIOR	APPROXIMATE % OF THE TOTAL AMOUNT	MEASURMENT
Oceans	97.25	All water left in bucket
Icecaps / glaciers	2.0	~200 ml
Groundwater	0.7	~70 ml
Freshwater lakes	0.006	~3 ml
Inland seas / salt lakes	0.004	~4 drops
Atmosphere	0.001	~1 drop
Rivers	0.0001	~1 flick

The percentage of usable freshwater is reduced by pollution and availability (location). Therefore, the actual amount of water that is usable by humans is very small (approximately 0.00003 percent).

Duration:
Classroom
40 minutes

Setting:
Classroom

Core Sandards:

6th grade Science ILO's: 1a, 1c, 1d, 2a, 2c, 4a, 4b,

7-8th grade Science ILO's: 1d, 4e

High School Science ILO's: 1h, 1i, 4e

Earth Systems Science: 4.1a

Biology: 1.2b

Geography for Life: 2.1b, 5.2b

Where's the Water?

Materials:

- Map of world or globe
- 2.5 gallon water container (to hold the 10 liters)
- Graduated cylinders
- Eye dropper
- 10 liters of water
- 1 small clear container (e.g., 500 ml beaker or pint jar)
- Water distribution worksheet

Classroom Activity:

1. Show the students a map of the world or the globe. Ask them what the color blue represents *(water)*. Ask them what percentage of the globe/earth is covered in water (*72%*). Is it all usable by humans? (*No*)

2. Ask the students to identify the various reservoirs of water on the earth other than oceans. As they give answers, make a list in the front of the room. Use the following categories for student responses: icecaps / glaciers, groundwater, freshwater lakes, inland seas / salt lakes, atmosphere, and rivers.
NOTE: Students will have many ideas. For this exercise freshwater lakes would include ponds, reservoirs and wetlands; groundwater would include wells; and rivers would include springs, canals, and small streams.

3. When the list on the board is complete, pass out the water distribution worksheet and divide the students into groups.

4. Ask the students to estimate the percentage of water in each reservoir. Based on their estimation, have them calculate the volume of each reservoir, and record their data on the water distribution worksheet.

5. Discuss the results of the groups' estimations. Where did they think most of the water was located?

6. After discussing the initial estimations, demonstrate to the class the actual amounts found in each reservoir (table included in background information). As you mention each reservoir measure out the actual volume and add it to your small container.

7. Show the small container to the students and ask if all this water is actually available for human use (no). Discuss each reservoir and remove the volumes not available for human use. See discussion question 1 for more details. This can lead to a discussion on water conservation and protection from pollution. See discussion questions 2 and 3.

ACTIVITY EXTENSIONS:

- Have students explore actual percentages of the different reservoirs that are impacted by pollution.
- Have students research water availability and use in your home state. See USGS Water Science Center website for state information. http://www.water.usgs.gov

Applying the Data:

Have students create pie charts of water reservoirs on Earth. A second pie chart could show AVAILABLE water reservoirs on Earth to compare to the first.

Further Discussion:

1. How much of the water on the earth is actually available for human use?

Logically, one would assume if you added the percentages of the freshwater sources, you would find the total amount of usable water. The actual amount is reduced by pollution and availability. For example, about 40% of U.S. freshwater is too polluted to use; about half of earth's groundwater is not accessible; and frozen ice caps and glaciers are generally not available for use. When all of this is taken into account, only about 0.003% of the earth's water is available for human use. (This can be demonstrated by a flick of water from your 10 l reservoir).

For more facts about polluted water in the U.S. and the world, see: http://www.waterbenefitshealth.com/water-pollution-facts.html.

2. How can students conserve water?

There are many ways students can conserve water. Discuss the following tactics with your students:

- *Don't leave the water running while brushing your teeth.*
- *Limit your showers to 10 minutes or less.*
- *Look around your house for leaky faucets. Ask your parents to fix them immediately.*
- *Keep a pitcher of water in the refrigerator so you don't have to run the faucet and wait for the water to cool.*
- *Clean your sidewalks with a broom, not a hose.*
- *Wash your car or dog on the lawn instead of the driveway. This way your lawn gets watered too.*
- *Only wash full loads of dishes and laundry.*

3. How can students help reduce pollution to the already small amount of water that is available for human use?

- *Don't use excessive amounts of fertilizers or pesticides around your house. They can wash into the storm drains and end up in a stream.*
- *Never put something down a storm drain that may hurt a fish.*
- *Don't be a litter bug. Always dispose of trash in a proper container, not in the water.*
- *Make sure that your family car doesn't leak oil or antifreeze. This can wash into the water and be dangerous for fish, birds, even cats and dogs.*
- *Walk only on existing trails when near the water to help reduce erosion.*

This activity adapted from Activity D-1: Sources of Drinking Water in the manual *Water Conservation and Nonpoint Source Pollution* by Dr. Kitt Farrell-Poe

Water Distribution Worksheet

Name: _____

Date: _____

Estimate the percentage of water in each reservoir. Measure the appropriate amount in milliliters. (Remember that the total amount is 10 liters)

RESERVOIR	APPROXIMATE % OF THE TOTAL AMOUNT	MEASUREMENT
Oceans		All water left in bucket
Icecaps / glaciers		
Groundwater		
Freshwater lakes		
Inland seas / salt lakes		
Atmosphere		
Rivers		

As your teacher demonstrates the true percentages and measurements found in each source, record the data below.

RESERVOIR	APPROXIMATE % OF THE TOTAL AMOUNT	MEASUREMENT
Oceans		All water left in bucket
Icecaps / glaciers		ml
Groundwater		ml
Freshwater lakes		ml
Inland seas / salt lakes		drops
Atmosphere		drops
Rivers		

Conversion hints...
1 liter = 1000 ml
1 ml ~ 5 drops

Measurement Conversion to Cups

If you would like to convert the measurements for this activity to cups, use the table provided below.

RESERVOIR	APPROXIMATE % OF THE TOTAL AMOUNT	MEASUREMENT
Oceans	97.25%	All water left in bucket
Icecaps / glaciers	2.0%	~3/4 cup
Groundwater	0.7%	~1/4 cup
Freshwater lakes	0.006%	~1/8 tsp
Inland seas / salt lakes	0.004%	~1/12 tsp
Atmosphere	0.001%	~1 drop
Rivers	0.0001%	~1 flick

Notes