# Where's the Water?: 40-60 minutes

**Objectives:** Students will assess the relative amounts of within Earth's reservoirs through a hands-on activity.

## Materials

- Projected world map
- Water distribution worksheet (one per student or one per group)
- For each group of students:
  - 12 quart water container (1 per group)
  - Graduated cylinders (1 per group)
  - Eye droppers (1-2 per group)
  - 10 liters of water
  - Small clear containers (6 per group)

## Explanation

- Class Time: 40-60 minutes
- Purpose/Objectives:
  - To identify the reservoirs of the Earth's water cycle (e.g., ocean, ice caps / glaciers, atmosphere, lakes, rivers, biosphere, groundwater) 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% 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 of the water on 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.

| **Reservoir** | **Approximate % of the total amount** | **Measurement** |
|---|---|---|
| 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 contamination. Therefore, the actual amount of water that is usable by humans is very small (approximately 0.00003%).

- Instructions:
    - Show students a map of the world. Ask what the color blue represents (water). Ask students what percentage of the globe/earth is covered in water (72%). Is all of that water usable by humans?
    - Ask students to identify the various reservoirs of water on earth other than oceans. As they give answers, make a list of the board in front of the room. Student's responses may include reservoirs like dams, which would be included with lake or rivers; wells, which come from groundwater; springs, which may be included in rivers, and so forth. The final list should be ice caps/glaciers, groundwater, freshwater lakes, inland seas/salt lakes, atmosphere, and rivers.
    - When the list on the board is complete, pass out the water the water distribution worksheet (one per student or one per group) and divide the students into groups.
    - Divide students into groups of 3-5 people. Give each group 10 liters of water in a bucket (approximately 2.5 gallons), graduated cylinders, eye droppers, and six small clear containers. Explain that the 10 liters represents all the water on the earth.
    - Have students label the six small containers with the various water reservoirs (ice caps/glaciers, groundwater, freshwater lakes, inland seas/salt lakes, atmosphere, and rivers).
    - Ask the students to estimate the percentage of water in each reservoir. Have them measure the appropriate amount of water for each reservoir and record their data on the water distribution worksheet. Remind them that they will leave the ocean water in the bucket.
    - Discuss the results of the groups' estimations. Where did they think most of the water was located? Is there more water in rivers or in the atmosphere?
    - After discussing the initial estimations, demonstrate to the class the actual amounts found in each reservoir (found on the table on the first page of this activity. Be sure to have the class fill in the correct amounts on the student worksheet.
    - Engage in classroom discussion using discussion questions provided below.

## Discuss

- How much of the water on the earth is actually available for human use?
    - Logically, one would assume if you add the percentage of usable water resources, you would find the total amount of usable water. This does not work out to be true because the amount is reduced by pollution and availability (location). The actual amount is approximately 0.00003%

- How can students 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.
        - Wash your car or dog on the lawn instead of the driveway. This way your lawn gets watered too. What are the pros and cons to this? Can we mitigate the risks of "killing our lawns"?
            - Use of biodegradable soaps
            - Xero-scaping/gravel packing our yards
        - Only wash full loads of dishes and laundry.
- 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 litterbug. 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, and even cats and dogs.
    - Walk only on existing trails when near the water to help reduce erosion.
- After having completed this activity, how can students use the water from the activity sustainably? Where should the water go?
    - From the students' perspective, is it an effective teaching tool to use this amount of water in an educational exercise?
    - Reinforce the limited amount of freshwater that is available for human use - Do we, as a populating, generally use water responsibly? What might we do to improve our behaviors to conserve water?

Supplemental Documents (found at the end of this document)

- Water Distribution Worksheet
- Measurement Conversion Resource

Modified from Original Source
http://streamsidescience.usu.edu/lessons/5-12/wheres-the-water/index

## Texas Assessments of Academic Readiness Resources - TEKS

§111.26. Grade 6, Adopted 2012.

(b) Knowledge and skills.

(5) Proportionality. The student applies mathematical process standards to solve problems involving proportional relationships. The student is expected to:

(A) represent mathematical and real-world problems involving ratios and rates using scale factors, tables, graphs, and proportions;

(B) solve real-world problems to find the whole given a part and the percent, to find the part given the whole and the percent, and to find the percent given the part and the whole, including the use of concrete and pictorial models;

§112.32. Aquatic Science, Beginning with School Year 2010-2011 (One Credit).

(c) Knowledge and skills.

(7) Science concepts. The student knows the origin and use of water in a watershed. The student is expected to:

(A) identify sources and determine the amounts of water in a watershed, including rainfall, groundwater, and surface water;

(9) Science concepts. The student knows the types and components of aquatic ecosystems. The student is expected to:

(A) differentiate among freshwater, brackish, and saltwater ecosystems;

§112.36. Earth and Space Science, Beginning with School Year 2010-2011 (One Credit).

(c) Knowledge and skills.

(11) Solid Earth. The student knows that the geosphere continuously changes over a range of time scales involving dynamic and complex interactions among Earth's subsystems. The student is expected to:

(E) evaluate the impact of changes in Earth's subsystems on humans such as earthquakes, tsunamis, volcanic eruptions, hurricanes, flooding, and storm surges and the impact of humans on Earth's subsystems such as population growth, fossil fuel burning, and use of freshwater.

(13) Fluid Earth. The student knows that the fluid Earth is composed of the hydrosphere, cryosphere, and atmosphere subsystems that interact on various time scales with the biosphere and geosphere. The student is expected to:

(D) discuss mechanisms and causes such as selective absorbers, major volcanic eruptions, solar luminance, giant meteorite impacts, and human activities that result in significant changes in Earth's climate;

§112.37. Environmental Systems, Beginning with School Year 2010-2011 (One Credit).

(5) Science concepts. The student knows the interrelationships among the resources within the local environmental system. The student is expected to:

(B) identify source, use, quality, management, and conservation of water;

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 and 1ml ~ 5 drops

Measurement Conversion Resource

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% | ~ ¾ cup |
| Groundwater | 0.7% | ~ ¼ cup |
| Freshwater lakes | 0.006% | ~ ⅛ tsp. |
| Inland seas / salt lakes | 0.004% | ~ 1/12 tsp. |
| Atmosphere | 0.001% | ~ 1 drop |
| Rivers | 0.0001% | ~ 1 flick |