



A Drop in the Bucket

This lesson is correlated to Grades 4-8 and recommended for upper elementary and middle school aged children. The lesson is correlated as written in the *Project WET Curriculum and Activity Guide 2.0*. Correlations are meant to show how activities support a standard, performance expectation and/or three-dimensional learning. NGSS correlations are provided in detail in a separate document to demonstrate how the content of the activity provides a three-dimensional learning experience. Common Core State Standards correlations for grade spans assume that teachers will be familiar with the standards for their respective grade level(s) and be able to apply them judiciously.

Summary: By estimating and calculating the percentage of available fresh water on Earth, students understand that this resource must be used and managed carefully.

Common Core: *ELA:* SL.6-8.4; *Math:* 6.RP.3c; 7.NS.3; 7.RP.2

NGSS: 5-ESS3-1, 5-ESS2-2, MS-ESS3-3, MS-ESS3-4

Instructions for Educators

1. Distribute the PDF lesson of A Drop in the Bucket to students.
2. Have them complete the lesson as instructed.
3. Ask students to turn in the completed lesson and student pages to you.
4. Talk to students after the lesson. Were they surprised by the percent of available water on Earth?
5. Discuss why good water resource management and water conservation is important to ensure enough clean water for everyone.
6. Is the availability of water the same for everyone everywhere on Earth? (No!) Why not? How does the availability of clean water change for desert areas versus forested areas?
7. See answer key on the following pages for this lesson.

Materials

Please gather these materials before starting.

Activity

- 1 cup liquid measuring cup with one cup of water
- 1 teaspoon and 1/4 teaspoon measuring spoons
- 1 tablespoon
- Student Pages **Water Calculations** and **What's in a Drop?**

Procedure

Activity

1. If you haven't already, fill your measuring cup to one cup (or 8 oz of water). This cup represents 100% of all water on Earth. Where is most of this water found?
2. If you look at the picture of the Earth on the previous page you will notice that most of the water on Earth is in the ocean. In fact, 97% of water is in the ocean. Calculate the amount of water in the cup that is ocean water. Show your work on the student page **Water Calculations** then enter the answer below.



Ocean water: 7.76 oz.

3. If 97% of water on Earth is in the ocean, then the remaining 3% of water on Earth is freshwater. How much of the 8 oz is freshwater (not ocean water)? Show your calculations the Water Calculations page and enter your answer below.

Freshwater: 0.24 oz

4. For the purposes of this activity you will round to the closest quarter or 0.25. We must now convert ounces to teaspoons in order to move forward in the calculation.

1 oz = 6 teaspoons.

How much does 0.25 ounces equal in teaspoons? Do the calculations on your student page **Water Calculations**.

5. What was your answer?

Try This!

8 oz = 1 cup of water

1oz = 6 teaspoons of water

$$0.25 \text{ oz} \times \frac{6 \text{ tsp}}{1 \text{ oz}} = \underline{1.5} \text{ teaspoons}$$

Did you get 1.5 teaspoons?

6. Take out 1.5 teaspoons of water from the cup and put in a tablespoon. Set the remaining 7.75 ounces of water aside. This is ocean water and is not potable.



7. Unfortunately, not all of the 3% of freshwater on Earth is available for human use. Why do you think that is? Where is the majority of freshwater located?

Ice, frozen, glaciers

8. If you thought that most of Earth's freshwater is frozen, you were correct! 80% of freshwater is frozen in glaciers and ice. Therefore only 20% is non-frozen freshwater.
9. What amount of the remaining 1.5 teaspoons of water is non-frozen freshwater? Do the calculations on the **Water Calculations** page and enter the answer below.

Non-frozen freshwater: 0.3 teaspoons

10. Again, we will round to the nearest quarter of a teaspoon to finish the calculations. Remove 1/4 teaspoon from the 1.5 teaspoons that represent freshwater. Set aside the remaining 1.25 teaspoons. This represents frozen freshwater and cannot be used.



11. Can you estimate what percentage of the cup of water is non-frozen freshwater?

Try this calculation!

8 oz = 1 cup of water

1oz = 6 teaspoons of water

Answer A: 8 oz = 48 teaspoons

$$\frac{0.3 \text{ tsps}}{48} \times 100\% = \underline{0.6} \%$$

12. Unfortunately, not all non-frozen freshwater is available due to it being so deep underground that we can't easily access it or being too polluted to use. Only 0.5% of the remaining 1/4 teaspoon is accessible to us. Dip your finger or a pencil in the water and remove one drop. Let this drop fall on the table, in a cup or on a plate. This represents the amount of water on Earth available for human needs.

13. Calculate the percent of water available to us out of all of Earth's water on the student page **Water Calculations**.

14.

Let's Review!

			
1 cup (100%) = all of the water on Earth	1.5 teaspoons (3%) = freshwater	1/4 teaspoon (0.6%) = non-frozen freshwater	1 drop = available water (0.003%)

15.

Don't Panic!

Although 0.003% of water on Earth seems little, thankfully, there will always be 0.003% of water available because water is renewed through the water cycle.

Water moves throughout different places on Earth, including through humans and animals, but never disappears.



16. Complete the student page **What's in a Drop?**

Water and Population

1. The total amount of water on Earth is an estimated $1,400 \times 10^{20}$ liters. This is an impossible number to comprehend. It is the number 1,400 with 20 more zeros behind it! Write that number here by adding 20 more zeros below:

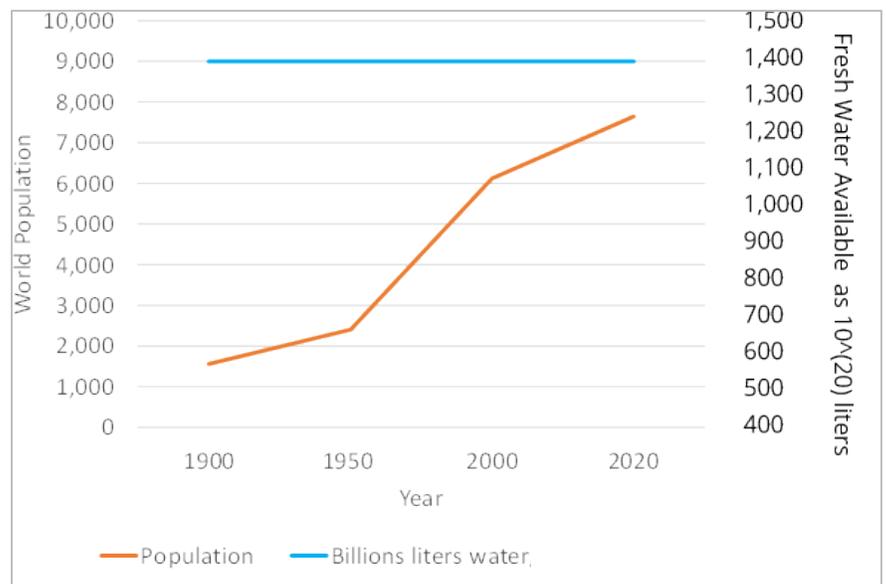
140,000,000,000,000,000,000

2. As the world's population grows and the amount of water available stays constant, what happens to the amount of water available per person? Circle the best answer

More water per person

Less Water per person

It will stay the same



3. No need to panic! There is still plenty of water available. We just need to remember to protect and conserve the clean water we have. Pick the ways you will help to conserve water for everyone. Add your own if they are not listed. **Answers will vary.**

- Turn off the faucet while brushing teeth
- Take shorter showers
- Turn off the faucet while lathering hands with soap (before rinsing)
- Washing full loads of laundry and dishes.

Other ideas:



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A Drop in the Bucket

Water Calculations

Amount of Water representing 100% of water in Earth 8 oz

1 cup = 8 ounces (oz)

Ocean Water: 8 oz oz x 97% = 7.76 oz oz
(100% of water on Earth)

Freshwater on Earth: 8 oz oz x 3% = 0.24 oz oz
(100% of water on Earth)

or

Freshwater on Earth: 8 oz oz - 7.76 oz oz = 0.24 oz oz
(100% of water on Earth) (Ocean water)

Round to the closest quarter ounce (or 0.25 ounce): 0.25 oz

Convert freshwater on Earth to teaspoons. 1 oz = 6 teaspoons (tsp)

Fresh water on Earth = 0.25 oz oz (rounded) = 1.5 tsp

Non-frozen freshwater: 1.5 tsp x 20% = 0.3 tsp
(freshwater)

What percentage of the Earth's water is non-frozen freshwater? Show your calculations below.

Available freshwater: 8 oz = 48 tsp x 0.003% = 0.00144 tsp
(All water on Earth)

Hint: 1 oz = 6 teaspoons



Name: _____

Date: _____

Water Availability Table Quantity to be divided among people on Earth	Amount Available liters/person	% of total water
All the water on Earth	186.7 billion	100%
Only the fresh water (calculate 3% of the amount available)	56.01 billion	3%
Only the non-frozen fresh water (calculate 20% of the remaining amount available)	11.2 billion	0.6%
Available fresh water that is not polluted, trapped in soil, too far below ground, etc. (calculate 0.5% of the remaining amount available)	0.056 billion or 56 million	0.003%

Every five years, the United States Geological Survey (USGS) compiles data to understand how much water was used by diverse water users in the United States. This information assists water managers in planning for present and future water needs by understanding how water resources are used throughout the nation.

In 2015, the USGS estimated the following:

- Total withdrawals were 322,000 million gallons per day
- Fresh water withdrawals were 87 percent of the total
- Surface water supplied 73 percent of all withdrawal

DIRECTIONS: On a separate sheet of paper, use the information in the chart below to represent water use in the United States in 2015 in a way that is graphically interesting. For example, create a pie chart, bar graph or other graphic. To see how the USGS represented this information, follow this link <https://pubs.usgs.gov/fs/2018/3035/fs20183035.pdf> and review their bulletin, "Summary of Estimated Water Use in the United States in 2015."

Water User	% of Water Use	Number of gallons used (million gallons per day or Mgal/day)
Public Supply	11	39,200
Domestic	1	26,600
Irrigation	37	118,000
Livestock	1	2,000
Aquaculture	2	7,550
Industrial	5	114,800
Mining	1	4,000
Thermoelectric Power*	41	133,000

*Very large volumes of water are needed for cooling thermoelectric power plants. For more information about thermoelectric power and water use, refer to the full USGS "Summary of Estimated Water Use in the United States in 2015" report cited above.

Examples of Graphs students may create from the student page, What's in a Drop?

