All the Water on Earth

Science and Engineering Practices (SEP) – *Developing and Using Models*

Use the boxes as guidelines to arrive at the NGSS standards which are written in **bold**

Objective: Students will understand how much water is available for human use on Earth.

Background: About 70% of the Earth's surface is covered in water. The water cycle is constantly changing the form this water takes but on average, 97% of the water on Earth is **salt water** and the rest can be found as **ice caps, glaciers, lakes, streams, ground water, soil moisture,** and **atmospheric water.** All of the fresh water on Earth is only 2.54% of the total water and of that, 68% is locked up in glaciers and ice caps and 30% is under ground, leaving only 2% of all fresh water as the type of water that most humans use to survive. Surface water and ground water often switch between the two forms. Surface water seeps into the ground to become ground water and ground water will seep back up to the surface.

Water Location	% All Water	Liters	Milliliters
Earth	100%	12 .0000 L	12,000 mL
Non-drinkable Water	99.22%	11.90124 L	11,901.24 mL
Ocean	97.46%	11.69000 L	11,690.00 mL
Glaciers/Ice Caps	1.76%	0.21100 L	211.00 mL
Soil Moisture	0.00%	0.00012 L	0.12 mL
Atmosphere	0.00%	0.00012 L	0.12 mL
Drinkable Water	0.78%	0.09876 L	98.76 mL
Ground Water	0.76%	0.09000 L	98.76 mL
Lakes and streams	0.02%	0.00776 L	7.76 mL

Introduction:

Develop a model using an analogy

Use a basketball-sized ball (not included) to represent the Earth and the ping pong ball to represent all the water on Earth. If one was to take all of the water off of the Earth, it would fit into the size of a ping pong ball. Ask students:

Do you think this is a lot of water?

How is this similar or different to what you expected?

Activity:

Students will remove portions from all the water on Earth in correct measurements for each type of water.

Develop a diagram to convey a proposed process

Make a T-Chart of water that is drinkable water vs water non-drinkable water

(See chart above)

Even though humans can't drink 99% of the water on Earth, how is it still important to Earth's ecosystems?

Develop a model to describe phenomena.

Explain to students that they are going to create a model to represent the all of the water on Earth.

What is a model?

How could we create a model to describe all of the different types of water found on earth?

1. Fill the large bin with 12 liters of water.

Have students be as involved as possible by measuring and pouring the water themselves.

2. Remove the **ocean water** from the bin and put into a bucket using the 1 liter measuring cup and the 400 milliliter measuring cup.
    a. Use the 1 liter cup 11 times
    b. Fill the 400 milliliter cup up once to the 400 mL blue line
    c. Fill the 400 milliliter cup up once to the 290 mL blue line
    d. Use the scooping cup if needed to help fill the containers as the water gets low.

    11 L + 400 mL +290 mL = All salt water on Earth

3. Remove the **glaciers/ice caps** from the bin using the 300 milliliter cup
    a. Fill only to the blue line at 211 mL
    b. Keep the water stored in that cup

4. Remove the **soil moisture** from the bin using the 1 milliliter dropper
    a. Fill only to the blue line which is approximately 0.12 mL
    b. Pour this water into the Soil Moisture cup

5. Remove the **atmospheric water** from the bin using the 1 milliliter dropper
    a. Fill only to the blue line which is approximately 0.12 mL
    b. Pour this water into the Atmosphere cup

6. Now pour all the water that is left in the bin into the **Drinkable Water** cup

    This is all the drinkable water on Earth – ground water, lakes, and streams

7. Remove the **ground water** from the Drinkable Water cup using the 180 milliliter cup
    a. Fill only to the blue line which is 99 mL

8. Pour the rest into the **Lakes and Streams** cup

    This is should be approximately 7 mL and represents all above-ground water on Earth

Identify limitations of models

Now, take a moment to observe our model:

How does our model match the real world?
What are the strengths of our model?
What about our model doesn't match the real world?

Revise a model

How could we change our model to make it more accurate?
Think about how the climate is changing – in what ways is it changing? How could we model those changes?

Think about the way that humans use water

How many times a day do you turn on the faucet?
What are some other ways that water is used for human consumption besides our personal use?
In what ways can we decrease our water use?

All the Water on Earth kit materials:

Large bin (that holds all the materials)
1 liter measuring cup (ocean)
400 mL measuring cup (ocean)
Two 300 mL measuring cups (glaciers/ice caps and drinkable water)
Two 1.0 mL droppers (soil moisture and atmosphere)
180 mL measuring cup (ground water)
Three small cups (atmosphere, soil moisture, and lakes & streams)
Scooping cup
Ping pong ball
Bucket
Not Included: Basketball or ball of similar size