Title:	**Grade:** 6	**BIG Idea:**
Water Everywhere: A Math-Science Lesson Combination	*Review of fifth-grade CCGPS standard – multiplication of fractions; sixth grade division of fractions	Composition of earth's surface – science Fractions - math

CCGPS Standards Addressed:

S6E3. Students will recognize the significant role of water in earth processes.

a. Explain that a large portion of the Earth's surface is water, consisting of oceans, rivers, lakes, underground water, and ice.

MCC5.NF.4 Apply and extend previous understandings of multiplication to multiply a fraction or whole number by a fraction.

MCC6.NS.1 Interpret and compute quotients of fractions, and solve word problems involving division of fractions by fractions, e.g., by using visual fraction models and equations to represent the problem.

Characteristics of Science

S6CS3. Students will use computation and estimation skills necessary for analyzing data and following scientific explanations.

a. Analyze scientific data by using, interpreting, and comparing numbers in several equivalent forms, such as integers and decimals.

S6CS5. Students will use the ideas of system, model, change, and scale in exploring scientific and technological matters.

b. Identify several different models (such as physical replicas, pictures, and analogies) that could be used to represent the same

Learning Goals:

1. Students will describe the surface of the earth as being mostly water.

2. Students will determine what fraction of the earth's surface is water, potable (drinkable) and non-potable, and land inhabitable and uninhabitable.

3. Students will use a visual representation to help them determine the fractional values of earth's land and water.

thing, and evaluate their usefulness, taking into account such things as the model's purpose and complexity. **Standards for Mathematical Practice** 2. Reason abstractly and quantitatively. 4. Model with mathematics. 5. Use appropriate tools strategically. 7. Look for and make use of structure.	

Materials:

For Teacher:

PowerPoint Presentation

Per Student:

Grid paper handout – attached
Ruler (to be used as a straight edge)
Colored pencils (or crayons) – green; blue; one other color

Teacher Notes:

According to the National Oceanographic and Atmospheric Administration, the earth's surface is about 71% composed of water (source: http://www.noaa.gov/ocean.html). For the purposes of the following lesson, the percentage has been increased to 75. By using 75%, instead of 71%, students are able to work with "friendly" fractions and still generate a reasonably accurate model of the composition of the earth's surface.

The teacher will use the PowerPoint (PPT) presentation to guide students through the lesson exploration. Students will use a rectangular grid to mimic the actions shown on the PowerPoint.

Discuss with students the picture on **Slide #1** of the PPT. Highlight ideas such as the blue versus green regions (e.g., land versus water). Ask them to predict the following: the fractional amount of earth's surface that is water; the fractional amount of earth's surface that is land; and the fractional amount of water that is potable.

Beginning on **Slide #2** of the PPT, tell students they will use their rectangular grids to

represent the earth. The commentary for each slide is not intended to be a script for the teacher to follow. Rather, it is the math and science information the teacher needs to complete the activity. Additional commentary and questions are expected to be provided by the teacher.

1. **Slide #2:** To represent the earth, half your paper. Then, half each half. Now there are four equal pieces representing *fourths*. Symbolically, we can express our actions as $\frac{1}{2} \div 2$ or $\frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$.

2. **Slide #3:** Identify three of the fourths ($\frac{3}{4}$) as *oceans.*

3. **Slide #4:** Identify one of the fourths ($\frac{1}{4}$) as *land*.

4. **Slide #5:** Focusing on only land now, half the one-fourth. Symbolically, we can express our actions as $\frac{1}{4} \div 2$ or $\frac{1}{4} \times \frac{1}{2} = \frac{1}{8}$. The entire earth is now divided into eighths. Label this one-eighth of land area as *uninhabitable* (e.g., deserts, ice, swamps, mountains)

5. **Slide #6:** If $\frac{1}{8}$ of the land area is uninhabitable, the other one-half of the one-fourth land area, or $\frac{1}{8}$, is *habitable* (e.g., able to support growth of food). Working with the $\frac{1}{8}$ land area, section it into four equal pieces. Symbolically, we can express our action as $\frac{1}{8} \div 4$ or $\frac{1}{8} \times \frac{1}{4} = \frac{1}{32}$. Our one-eighth land area is now sectioned into thirty-seconds ($\frac{1}{32}$).

6. **Slide #7:** Cross out $\frac{3}{32}$ of the *habitable* land piece. Label the remaining $\frac{1}{32}$ piece as "food" to indicate the land supports food growth. Note that $\frac{4}{32}$ simplifies to $\frac{1}{8}$.

7. **Slide #8:** Of the $\frac{1}{32}$ area of land that supports food growth, only a slight portion of that space is potable water.

Using the grid paper, have students count the number of dots per square, vertically and horizontally. The dimensions of an individual square are 12 dots x 12 dots. Therefore, there are 144 dots per square (144 u^2). 144 dots/square multiplied by 5 squares per $\frac{1}{32}$ of the area of the entire sheet is…

$$\frac{144\ dots}{square} \times \frac{5\ squares}{\frac{1}{32}\ area} = \frac{720\ dots}{\frac{1}{32}\ area}$$

Since there are 720 “small” squares inside of a $\frac{1}{32}$ strip of the entire space on the grid,

there are 720 x 32 = 23,040 total “small” squares. One “small” square, then, represents $\frac{1}{23,040}$ of the area of the entire grid.

Have the students draw a 1 dot by 7 dot rectangle on one of the $\frac{1}{32}$ of the *habitable* land.

Symbolically, this 1 dot x 7 dot rectangle is equal to $\frac{7}{23,040}$ of the area of the entire grid (e.g., earth).

The approximate decimal equivalent of this fraction is 0.0003 (0.03%). This value, 0.0003 or 0.03%, represents the amount of potable water on the earth. The focus here should be what a small amount of the entire earth is potable water, especially in light of the fact that three-fourths or 75% of the earth is covered with water!

8. **Slide #9:** Switch the focus back to the three-fourths of the earth’s surface that is covered by oceans. Select one of the fourths, and segment it into two parts. Symbolically, we can express our actions as $\frac{1}{4} \div 2$ or $\frac{1}{4} \times \frac{1}{2} = \frac{1}{8}$. Our earth is, again, segmented into eighths.

Label this one-eighth of the earth’s oceans as *photic/productive*. Sunlight penetrates this part of the ocean, so photosynthesis may take place.

If one-eighth of the world is *photic*, five-eighths of the world is *aphotic*, also called *non-productive* and/or the *midnight* zone. In this *aphotic* zone, sunlight does not penetrate this area. Symbolically, we can express this relationship as $\frac{6}{8} - \frac{1}{8} = \frac{5}{8}$.

Remind students that using mathematics is a helpful way to interpret the world around them. This task, as a real-world application of fractions, should help them better understand how the area of the earth is divided. Students can see the areas of land versus water relative to each other and the earth as a whole. They also have concrete, relevant examples of when they might need to operate on fractions!
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