

:: Elementary

:: A Drop in the Bucket

:: Level of difficulty and duration: 

Pre-activities:

Students should understand/review percentages and should be familiar with the basic facts relating to the Earth's surface (water types and percentages). (Review the Water Awareness Basic Fact Sheet)

Objective:

Students will calculate the percentage of fresh water available for human use and explain why water is a limited resource. By estimating and calculating the percent of available fresh water on Earth, students understand that fresh water is limited and must be conserved and protected.

Background Information:

Students may know that Earth is covered mainly by water, but they may not realize that only a small amount is available for human consumption.

Ironically, on a planet approximately 71 percent water, this resource is one of the main limiting factors for life on Earth. The Water Availability Table summarizes the major factors affecting the amount of available water on Earth. If all the clean, fresh water were distributed equally among people, there would be about 1.82 million gallons (7 million liters) per person. This is only about .003 percent of the total water on Earth. On a global scale, only a small percentage of water is available, but this percentage represents a large amount per individual. The paradox is that, for some, water may appear plentiful, but for others it is a scarce commodity. Why are some people in need of more water? Geography, climate, and weather affect water distribution. Agriculture, industry, and domestic use also affect availability.

Lesson:

Students will estimate the proportion of potable water on Earth and compare it to the rest of the water on the planet. Students work in small groups. Instruct them to draw a large circle with a marker on white sheet of paper. Offer them two sheets of different-colored construction paper. One color represents available fresh water; the other represents the rest of the water on the planet. Next, inform students that they will be tearing the two sheets of paper into a total of 100 small pieces. Students will estimate how many pieces will represent potable water and how many pieces will indicate the rest of the water on the planet. Instruct each group to tear up their paper and arrange the 100 pieces within the circle so that these pieces reflect their estimates. Have groups record the number of pieces representing "potable" water and "remaining" water.

Note: For simplicity, measurements have been retained in metric.

1. Show the class a liter (1000 mL) of water and tell them it represents all the water on Earth.
2. Ask where most of the water is located. (Refer to a globe or map.) Pour 30 mL of the water into a 100-mL graduated cylinder. This represents Earth's fresh water, about 3 percent of the total.
3. Put salt in the remaining 970 mL to simulate water found in oceans, unsuitable for human consumption.

4. Ask students what is at the Earth's poles. Almost 80 percent of Earth's fresh water is frozen in ice caps and glaciers. Pour 6 mL of fresh water into a small dish or cylinder and place the rest in a nearby freezer or ice bucket. The water in the dish (around 0.6 percent of the total) represents non-frozen fresh water. Only about 1.5 mL of this water is surface water; the rest is underground.
5. Use an eyedropper or a glass stirring rod to remove a single drop of water (0.003 mL). Release this one drop into a small metal bucket. Make sure the students are very quiet so they can hear the sound of the drop hitting the bottom of the bucket. This represents clean, fresh water that is not polluted or otherwise unavailable for use, about .003 percent of the total! This precious drop must be managed properly.
6. Discuss the results of the demonstration. At this point many students will conclude that a very small amount of water is available to humans. However, this single drop is actually a large volume of water on a global scale. Have students use the Water Availability Table to calculate the actual amounts.

Materials:

2 colors of construction paper, sheets of white paper, markers, water, globe or world map, 1000-mL beaker, 100-mL graduated cylinders, small dish, salt, freezer or an ice bucket, eyedroppers or glass stirring rod, small metal bucket, and copies of Water Availability Table.

Post-activities:

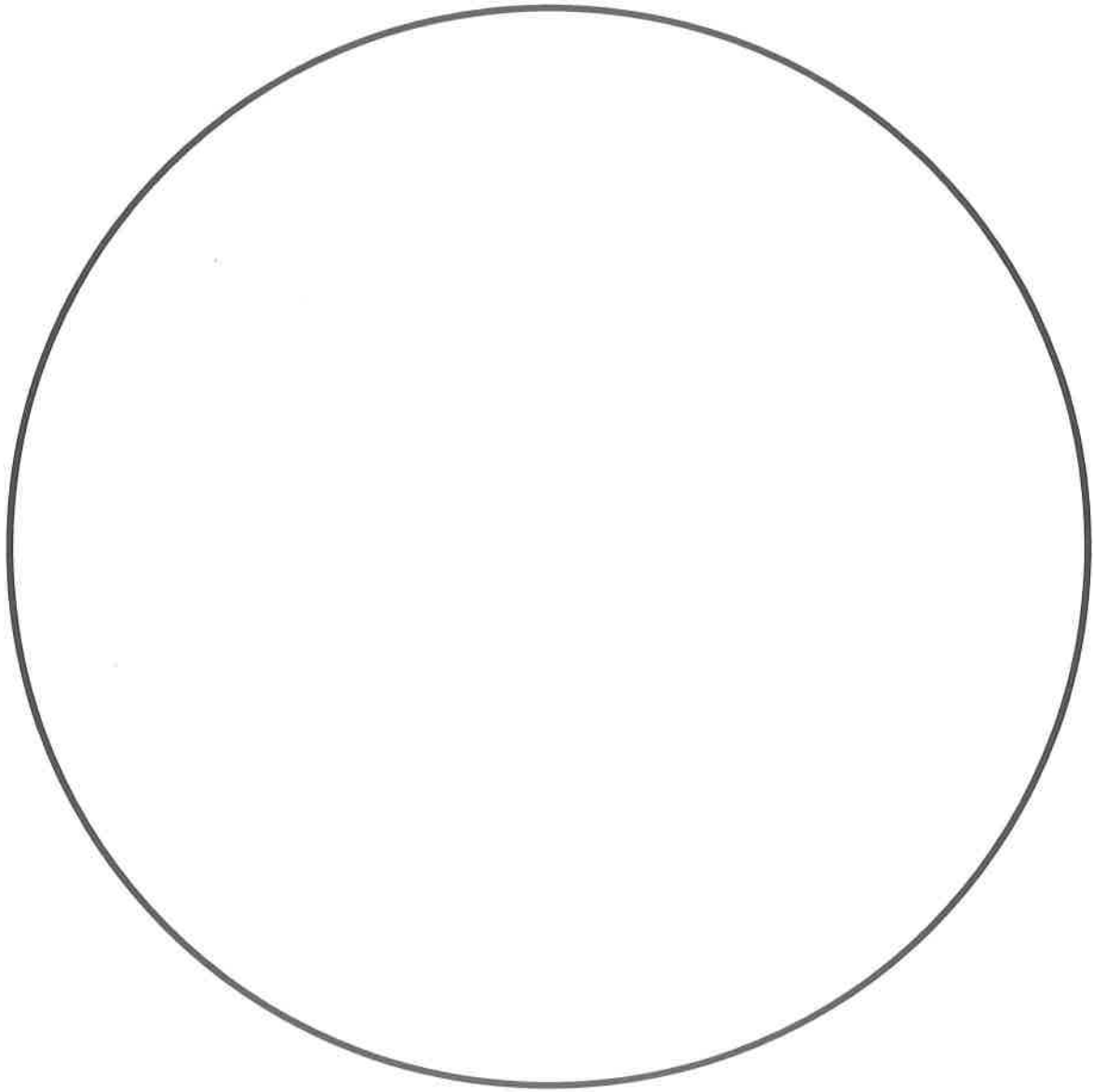
Refer back to students' earlier guesses about how much water on Earth is available to humans and compare the actual percent of Earth's water available. Have students explain their reasoning for their initial estimates. How would they adjust their proportions? (One-half of one of the pieces of paper represents potentially available water [0.5 percent]. Only one small corner of this half [0.003 percent] is actually potable water.)

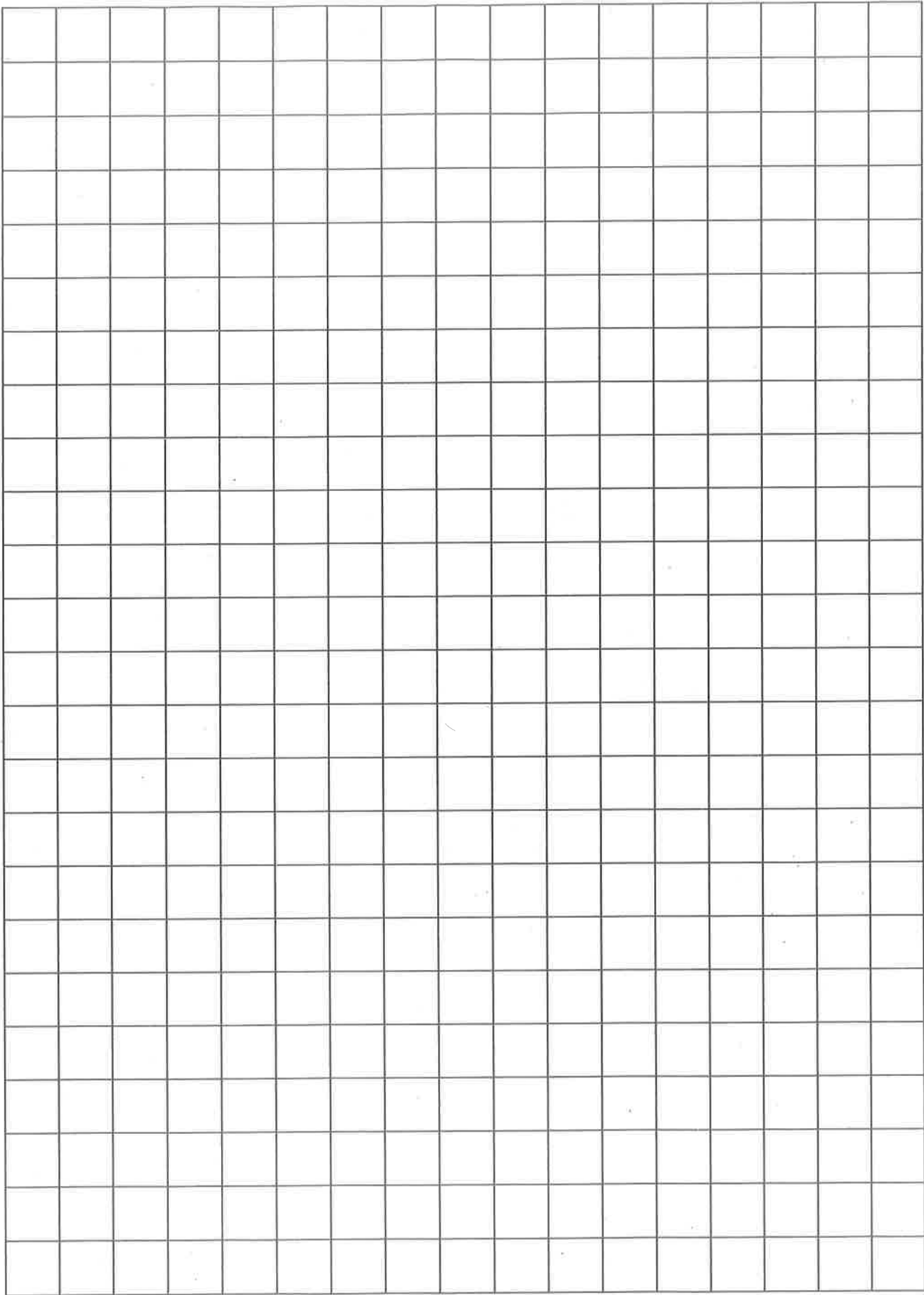
Possible discussion question:

Why does more than one-third of the world's population not have access to clean water?

Discuss the main factors affecting water distribution on Earth. Be sure to consider such influences as drought, contamination, flooding and economic conditions.

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(1 white) (1 green) *dark*

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WATER AVAILABILITY TABLE

Quantity to be divided among people on Earth	Amount Available Liters/person	% of total water
All the water on Earth	233.3 billion	100%
Only the fresh water (calculate 3% of the amount available)		3%
Only the non-frozen fresh water (calculate 20% of the remaining amount available)		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)		.003%

ANSWER KEY

Total water on Earth divided among people	233.3 billion liters/ person
Minus the 97% of each share (226.3 billion) that contains salt	7 billion liters/person
Minus the 80% of this 7 billion that is frozen at the poles (5.6 billion)	1.4 billion liters/person
Minus the 99.5% of the 1.4 billion that is unavailable (1.393 billion)	7 million liters/person