

LESSON: Rainfall Harvest, Home & Earth

GRADE: 5

OBJECTIVES:

Mathematics

Measurement & Data

Geometric measurement: understand concepts of volume and relate volume to multiplication & to addition.

- **5.MD.C.4** Measure volumes by counting unit cubes, using cubic cm, cubic in, cubic feet, and improvised units.
- **5.MD.C.5** Relate volume to the operations of multiplication and addition and solve real world and mathematical problems involving volume.

Science

Earth's Systems

- **5-ESS-2-2** Describe and graph quantities such as area and volume to address scientific questions.

Engineering Design

- **3-5-ETSI-3** Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered.

Science as Inquiry-

Use appropriate tools and techniques to gather, process, and analyze data.

- **S.3-5.SI.4** Students enhance their skills with tools such as rulers, thermometers, balances, spring scales, magnifiers and microscopes.

MATERIALS & RESOURCES:

- Access to internet-[USGS Water Science for Schools-
http://ga.water.usgs.gov/edu/earthrain.html](http://ga.water.usgs.gov/edu/earthrain.html)
and/or library access for printed rainfall data
- 2 liter plastic pop bottle
- Scissors
- Ruler
- Waterproof marker pen
- Heavy flower pot
- Paper and pencil
- Graph-paper
- Handouts with rainfall data for world and US

PRESENTATION:

Discuss with students the important uses of water and the differences in precipitation around the world. Read about storing water in rain barrels. Tell students they will create a rain gauge to measure rainfall. They will also learn how to calculate the amount of water that can be harvested from a given area.

DIRECTIONS:

1. Have an adult cut the top off the plastic bottles with the scissors.
2. Turn the top upside down and wedge it in the bottle to form a funnel. Tape in place with a strong tape.
3. Use a ruler & permanent marker to measure & mark lines on outside of bottles. The lines should match the scale on a ruler beginning with 0 at the very bottom of the bottle. It is only necessary to use English units of measure for this lesson however, if desired, metric can be added.
4. Place the rain gauges in an open container to prevent them from blowing over or dig a hole a few inches deep and place rain gauge in the hole so it can't tip over. It might be helpful for a few students to take rain gauges home so if it rains on the weekend someone can measure and record the amount. Consider the variables such as number of trials, placement of gauges, and other criteria which '*create a fair trial*' in an experiment.
5. Graph the rainfall amounts in a table or on graph paper.
6. Using the data from rain gauges, calculate the potential amount of rainwater that can be harvested from a building roof. (The school building, student's homes, or other building)
7. Using graph paper, plot the perimeter representation of the roof. Then calculate the square footage of the roof. For example; a house/building has a footprint of 20'x40' the area of the roof is likely to be 800 sq. ft. (Some architecture may have extensive roof overhang or other elements which will change the calculation). Your best calculation will still offer a good illustration of water runoff from the roof.

8. Then, using the following information, calculate the volume, in gallons, which can be harvested from a roof.

· 1" of rainfall on 1 sq. ft. = .62 gal of water

$$\begin{array}{r} 800 \text{ sq. ft. roof with 1 inch of rainfall} \\ \times .62 \text{ gal./inch of rain} \\ \hline 496 \text{ gal} \end{array}$$

9. Using data from Internet or other source compare rainfall in locations in the US and around the world. For weather data: [USGS Water Science for Schools & USGS Water Science for Schools; Precipitation](http://ga.water.usgs.gov/edu/earthrain.html) (<http://ga.water.usgs.gov/edu/earthrain.html>)
10. Using the data from question number 8, calculate the amount of water that could be harvested annually. Use data from the maps in this lesson to calculate how much water could be harvested in various locations in order to get a sense of how much water can be harvested.

Example:

If a similar house in Beijing, China is 800 sq. ft.

800 sq. ft. x .62 gal (1" of rain) = 496 gallons of water per inch of rainfall

Beijing, China receives about 25" of rain annually.

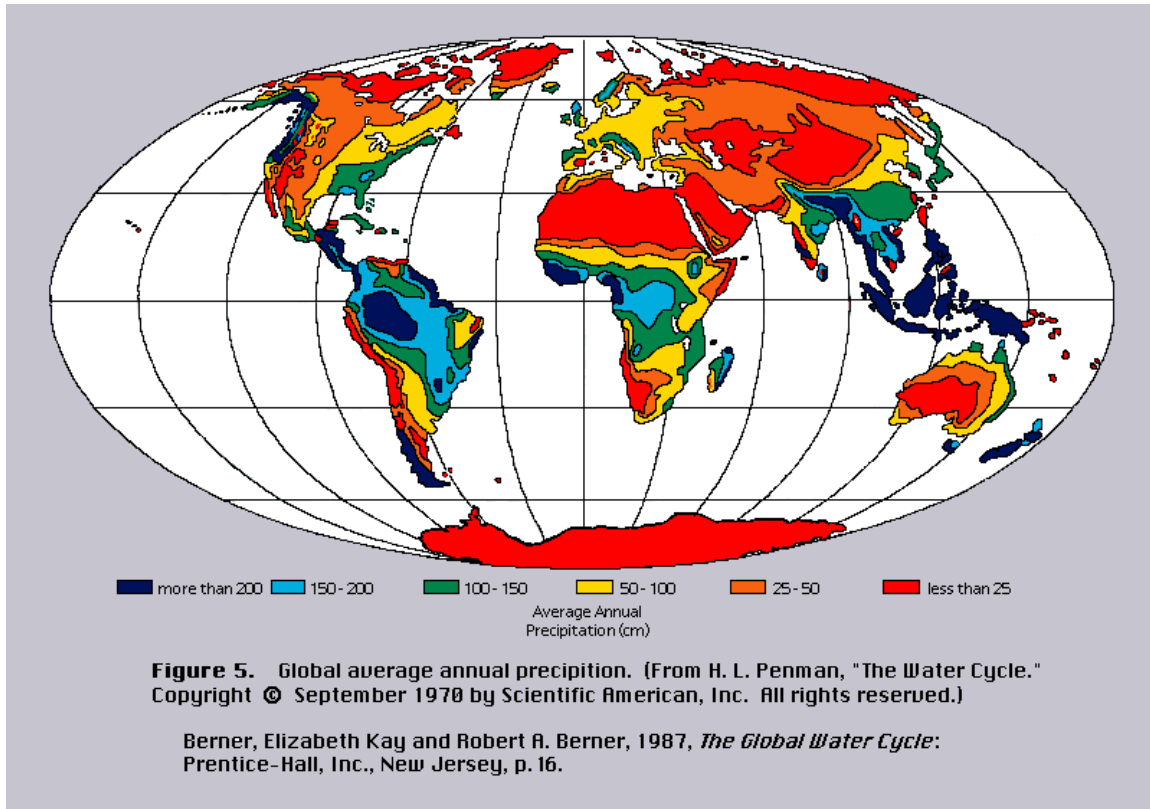
496 gallons x 25" rain per year = 4185 gallons of water that could be harvested annually in Beijing, China from 800 sq. ft. home

Create some problems that include fractions and mixed numbers. If the roof or harvest area is $20\frac{1}{3}$ ft. x $35\frac{1}{2}$ ft., how much water will land on the area with a 1" rain? What if it rains $2\frac{1}{4}$ "?

Now that the students know how much water can be harvested from rooftops, lead a discussion focusing on any ideas they have about water conservation, how buildings are designed and constructed, harvesting systems, storage systems and more. Optional extension- have students brainstorm to create and draw a building designed for rainfall harvest and storage, including their calculations of potential harvest and storage.

TIME:

45-90 min +



Annual Average Precipitation

United States of America

