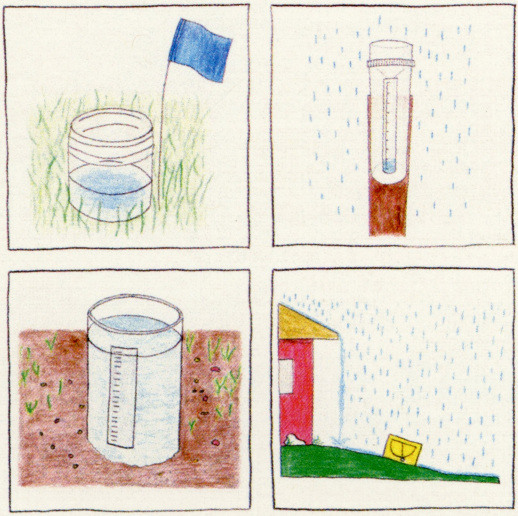

School Water Budget

Precipitation Team

College of Natural Sciences
Education & Outreach Center

Colorado State University

NATIONAL PARK SERVICE

Precipitation Team

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Nature Active Publishing

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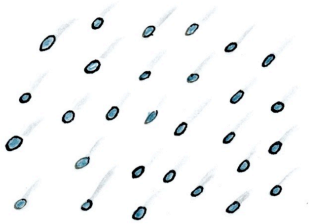
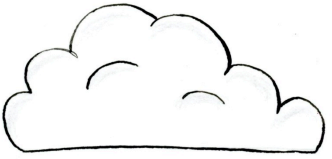


Introduction

Precipitation is simply water that falls from the sky. Precipitation can be in the form of rain, hail, or snow. Precipitation comes from clouds. Warm air can hold more moisture than cool air. As moist warm air rises, it begins to cool high up. The air is now too cool to hold all of the moisture it carried when it was warm. So the moisture condenses onto tiny particles of floating dust, forming a cloud. When the concentration of water droplets gets high, the droplets merge together and eventually get heavy enough to overcome the rising warm air from below and the droplets fall to the ground.

The Precipitation Team has four tasks:

1. Learn how clouds and rain form.
2. Learn how precipitation volume is measured.
3. Teach the rest of the class how to explain and measure rain.
4. Answer a challenge question that will be used in the final class discussion.



Make a Cloud

To make a cloud, you need a jar filled ~1/3 with warm water. Warm water will evaporate faster than cold water. You also need a temperature gradient like you find in the atmosphere. As you go higher, the air gets cooler. So, we will use a baggie filled with ice to generate the temperature gradient. The last thing you need is dust particles in the air. The dust particles will serve as places for water droplets to condense on to form the cloud. We will use smoke from a match to generate the dust particles.

Do this:

1. Fill the Mason jar 1/3 of the way with warm tap water.

2. Fill the ziplock baggie with ice.

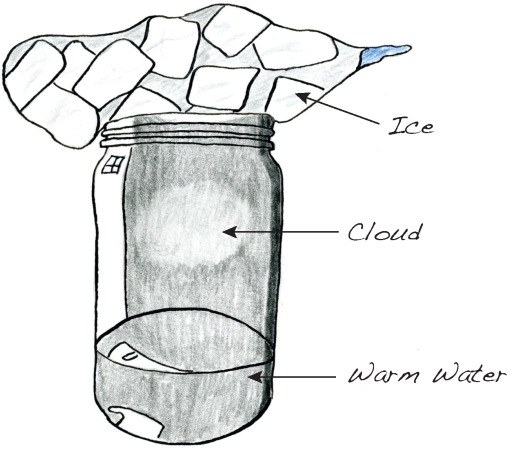
3. Carefully light the match, let the flame burn ¼ of the matchstick, and then blow out the flame.

4. Wait 2 seconds.

5. Drop the match into the jar and perch the baggie of ice on top of the jar making a tight seal.

6. Watch for the formation of a faint cloud.

Science Notebook: Describe how you made the cloud and what it looked like in your science notebook.



How Precipitation is Measured

Examine the rain gauge. It has three parts, a large cylindrical container, a smaller calibrated tube, and a funnel.

Do this:

1. Remove the funnel and calibrated tube from the rain gauge.

2. Pour 0.1 inch of water into the large cylindrical container. Use your ruler to get it exactly 0.1 inch.

Science Notebook: How difficult is it to measure 0.1 inches of rain in this gauge? Explain.

Do this:

3. This will take two people.

4. Hold the funnel over the smaller calibrated tube.

5. Pour the 0.1” of water from the large cylinder

into the funnel without spilling.

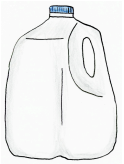
6. Read the scale of the calibrated tube.

Science Notebook: What do you notice? What is the purpose of the funnel and the calibrated tube?

Do this:

7. Repeat steps 1 through 6 using 1.0” of water.

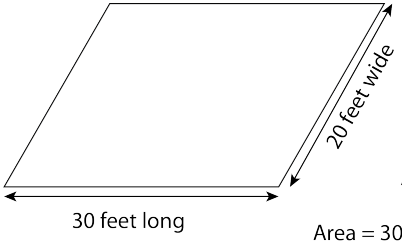
Science Notebook: Write and draw diagrams showing what you just did.



How Much Water Falls?

A rain gauge just tells you how deep the water that falls could get if you collected it in a straight walled container. To determine how much water falls on your schoolyard, we need to first figure out how big your schoolyard is. We do this by measuring the area of our study site. To keep this simple, we will use a rectangular study site. The ***Area*** is defined by multiplying the length by the width of the rectangle.

Do this: Use the measuring tape to measure the length and width of the study site. Use feet as your units. Multiply these two numbers together to get the Area.



Area = Length x Width

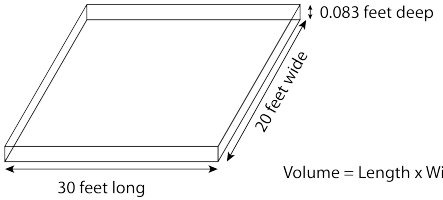
Area = 30 feet x 20 feet = 600 square feet

Next: Let's pretend we just got 1" of rainfall. How many gallons would that be over the area covered by your study site? To answer this question, we need to:

1) convert our rain depth from inches to feet

$$1 \ \cancel{\text{inch}} \times \frac{1 \text{ foot}}{12 \ \cancel{\text{inches}}} = 0.083 \text{ feet}$$

2) multiply our water depth by our area



Volume = Length x Width x Depth

Volume = 30 x 20 x 0.083 = 49.8 cubic feet

3) convert cubic feet of water to gallons.

$$49.8 \ \cancel{\text{cubic feet}} \times \frac{7.48 \text{ gallons}}{1 \ \cancel{\text{cubic foot}}} = 372.5 \text{ gallons}$$

Science Notebook: Show your work step by step in your science notebook.

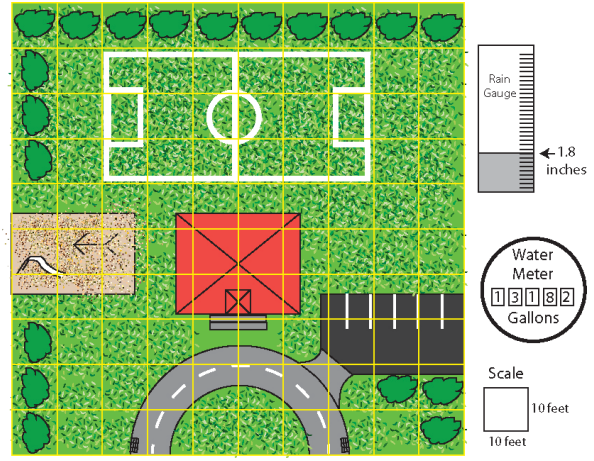
****Be prepared to teach the rest of the class what you learned.**

Team Challenge

There were four rainstorms last month at Clearview School. The ground remained wet for two days after each storm. The rain gauge shows how much rain fell last month. The water meter shows how much water was used by the school last month.

A. How much water fell within the boundary of the school property? Show your work in your science notebook.

B. Within your team, discuss the following question: Is the water that falls from the sky pure? If so, why? If not, explain what could be in the water. Record your ideas in your science notebook.



How Much Water Does Your School Use?

Can you use the skills and techniques we learned to figure out how much water falls on your entire school lot in a year? How much evaporates, infiltrates, and runs off? Ask your principal to tell you how much water the school uses in a year. Is it more or less than what falls from the sky? If your school uses more water, where does the extra water come from? Is your school using water in a sustainable way?

Tip: The website: www.arcgis.com/explorer/ has a nice map measuring tool that you can use to quickly measure your school grounds.

Materials Needed

Rain gauge (CoCoRaHS style)
Ruler (Inch units marked in tenths)
Half liter bottle of water
Quart-sized ziplock filled with ice
Quart-sized Mason jar filled 1/3 with warm tap water, wrapped half way with black paper.
Box of matches
50 foot measuring tape
Calculator
Science notebooks and colored pencils

For more information, visit:
www.cns-eoc.colostate.edu/schoolwaterbudget.html

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