

Lesson Title	Develop and Use a Rain Gauge
Timeline	1-2 45-minute class periods

STANDARDS

4th Grade:

S4E4. Obtain, evaluate, and communicate information to predict weather events and infer weather patterns using weather charts/maps and collected weather data.

a. Construct an explanation of how weather instruments (thermometer, rain gauge, barometer, wind vane, and anemometer) are used in gathering weather data and making forecasts.

Earth Science:

S6E3. Obtain, evaluate, and communicate information to recognize the significant role of water in Earth processes.

a. Ask questions to determine where water is located on Earth's surface (oceans, rivers, lakes, swamps, groundwater, aquifers, and ice) and communicate the relative proportion of water at each location.

b. Plan and carry out an investigation to illustrate the role of the sun's energy in atmospheric conditions that lead to the cycling of water.

MATERIALS LIST

- empty two-liter plastic bottle
- scissors
- ruler
- 1 cup of clean pebbles or marbles
- 2 cups of water
- permanent marker
- masking tape

INTRODUCTION

Do you know where your water comes from? In some places, water utilities pull fresh water from groundwater sources like aquifers. Some communities rely on water from wells. And some places, like counties and cities in metro Atlanta, rely on surface water. Surface water is water that flows on the surface of the earth, like rivers, streams, and creeks. Metro Atlanta, in the northern part of Georgia, sits on a thick layer of granite that covers most of the region. This unique geological feature prevents access to groundwater sources, which means that 99% of the region's water comes from surface water. Luckily for metro Atlanta, the region receives an average of 50 inches of rain per year.

How do we know this? How are we measuring rainfall? In this lesson, students develop a rain gauge to collect rainfall measurements over a course of time. The tasks are tailored for upper elementary students, and specifically align to 4th grade science standards. The tasks also have potential to support middle school earth science standards.

Before beginning, instructors should have students watch the "What Is Stormwater?" video from Georgia Public Broadcasting's Georgia's Water Virtual Learning Journey at gpb.org/water-journey. Instructors should also gather and prepare all materials to meet their students' needs.

GUIDING QUESTIONS

Elicit student thinking about the landscape of campus. Ask guiding questions like:

- Have you noticed any hills on campus?
- Where do we have flat land?
- Where do we have tree coverage?
- What is it like _____?
- How might we represent these landscapes/features on a map?
- What kinds of things do you think would be important to include in the key?

ENGAGE

Provide time and support as needed for students to develop their model of campus/outdoor grounds. Then, transition student thinking toward determining a good location to collect rainfall data. Ask students to use the model to mark the best location, and then add the symbol in the key. Finally, provide opportunity for students to wonder about related ideas of rainfall. Encourage students to ask questions about rainfall and where it goes once it hits the ground. (see student guide)

How are we measuring rainfall?

Instructions for making a rain gauge are listed below. Modify as you see appropriate for your students' needs.

INSTRUCTIONS FOR MAKING A RAIN GAUGE INSTRUMENT

1. Use the scissors to carefully cut the top of the two-liter bottle just below the neck, where the widest part begins.
2. Remove the cut part and place the pebbles or marbles in the bottom of the bottle to weight it down. Add water to the bottle until it is level with the pebbles or marbles.
3. Measure and cut a piece of tape six inches long. Stick the tape vertically on the outside of the bottle, being careful to line up the bottom of the tape to the top of the pebbles or marbles.
4. Line up the end of your ruler with the bottom of the tape and mark every $\frac{1}{4}$ inch. Then label each inch along the tape.

Once the rain gauge is constructed, approve student locations (or suggest alternate locations) for collecting rainfall data. Support students in collecting rainfall data as weather occurs (see student guide for suggested data table).

Some considerations are outlined below:

5. Using a weather tracking website or app, pay attention to the weather in your area. When there is rain in the forecast, set your rain gauge in a flat, open area. Make sure there is nothing hanging over the rain gauge that could block the rain.
6. After the rain ends, check your rain gauge to see how much rainfall occurred using the tape measurements you created. Record the date and the amount of rain.
7. Then observe and record other conditions or changes, such as sky conditions and changes to the surrounding environment.
8. Empty the excess water and refill water to the top of the pebbles or marbles so you can be ready to measure the next rain event.

EXPLAIN

How are we measuring rainfall?

Once students have recorded at least 8 to 10 data entries, support them in presenting their data in a bar graph. If your students are familiar with graphing, redirect their attention to the data and allow them to determine the following:

- a. Type of graph
- b. Labels and spacing for the x- and y-axis
- c. Colors and title for the graph

If your students are not familiar with graphing, then walk them through the creation of a bar graph using $\frac{1}{4}$ inch measurements for the Y-axis (like the tape measurements on the rain gauge) and dates of the rainfall for the X-axis. An image has been provided as a model on the student guide.

SUMMARY

To finalize the explanation, support students in captioning their bar graph. Guiding questions have been outlined on the student guide. Responses to these guiding questions should be part of the caption. Consider providing a model, sentence starters, and/or a word bank to support students in their constructed explanations. Suggested resource: northgeorgiawater.org/current-water-stats/monthly-rainfall-for-metro-atlanta/

Sample Caption/Answer:

A rain gauge was used to measure the amount of rainfall at the southeast corner of the soccer field on our school campus. Using the rain gauge to measure rainfall allowed us to accurately record our local weather. As seen on the x-axis of the graph, data collection began January 2024 and continued for approximately six weeks into February. As shown on the y-axis, the amount of rainfall over the course of these 10 rain events ranged from 1 cm to 17 cm. With average rainfall at 6.5 cm for the six weeks, the rainfall on this part of our campus was just lower than the state average during this same time frame.

Explain 2: Where did the water go?

Re-engage students by asking them to re-create their model/map of the school campus. Then ask them to consider ways to include other observations made during the investigation, such as sky conditions and any changes to soil, sediment, and the landscape. Support students in adding these additional observations to their new model, as well as including a key to help improve understanding of what is drawn. (see student guide).

Finally, support students in constructing an explanation via a caption for where the rainwater goes. Encourage students to make predictions based on how they understand the natural flow of water (downhill). You may even consider taking a tour of campus to locate places where water collects, or perhaps even gather aerial map views of the campus that identify nearby a nearby creek, pond, or river where the water might flow.

As before, student supports for writing this caption may include sentence starters, a word bank, or modeling.

Sample Caption/Answer:

Some of the rainfall that hit the soccer field on our campus was absorbed by the ground. This was evidenced by the squishy grass and mud. Other rainfall flowed downhill. The rainfall that flowed downhill collected small pieces of sediment with it that we observed along an eroded path. These pieces of sediment were collected at the spot marked with a triangle on the map. Using an online map to determine where the water moved after leaving our campus, it was predicted that the water eventually flowed into Nickajack Creek, which is five miles southeast of our school.

Once students have completed their captions, consider a whole group reflective discussion on what was learned, new questions that have come to mind, and advantages/disadvantages of the rain gauge used to collect data.