BUILD YOUR OWN RAIN GAUGE

LEARNING GOALS

By the end of the lesson, students will be able to:

- Build a rain gauge to measure precipitation
- Measure precipitation using a rain gauge to the closest 0.5 inch
- Record measurements, observations, and predictions in a journal
- State observations and predictions using key vocabulary and compound sentences

Approximate time: 60 minutes, plus follow up

MATERIALS

- Single serving (12-16 oz) water bottle, cut in half by teacher
- 0.5 cup of water
- Two (or more) paper clips
- Thin permanent marker
- Ruler, American standard (with inches)
- Scissors
- Knife
- Index cards with key vocabulary
- UHU
- Article on water cycle (page 11)
- Handouts: How to Build a Rain Gauge (pages 3-6), journal (page 8), data analysis (page 9-10)

SEQUENCE

Activate Prior Knowledge	5 minutes	Read or tell a local legend about rain, and then discuss the importance of rain in daily life Ask students what they observe before it rains: Can you tell when it's going to rain? How? What does the sky look like? Is it cooler or hotter?
Building Key Vocabulary (Reading & Word Wall)	10 minutes	Read together a short article on the water cycle that contains key vocabulary words Diagram water cycle and highlight precipitation Word Wall: Show visual for each key vocabulary word, informally define each, and post words with visuals on board or wall

Hands On	30 minutes	Students work in pairs, triads (threes), or individually to build rain gauges. **See *How to Build a Rain Gauge* handout and worksheet on page 3-7**. Teachers can ask "Engineering Questions" out loud throughout the exercise or use the worksheet to help student think about the design of rain gauge. Have students place the rain gauges outside over an extended period (2-4 weeks). Students record results, observations about the weather, and predictions in a field journal. **See *My Rain Gauge Journal* worksheet on page 8**.
Wrap Up	5 minutes	Review key vocabulary from the word wall and diagram. Set up rain gauges outside away from trees and rooftops.

FORMATIVE & SUMMATIVE ASSESSMENT IDEAS

- Thumbs up/Thumbs Down to see if students agree with measurement given by teacher during demonstration
- Teacher checks students' journal results and predictions for 2-4 weeks
- Class creates a school "rain report" bulletin board with data and predictions
- Data analysis (tie to math lessons on finding averages): After students collect 2-4 weeks of data in journals, data can be used to determine when it rained the most. Data can be graphed onto a bar graph. **See *Data Analysis and Graphing* worksheet on page 9-10**.

EXTENSION IDEAS

- Investigate the importance of rain locally (e.g., supply of water for drinking, growing food): Interview older family or community members and write a news article.
- Investigate recent periods of rain and drought locally: Interview older family or community members, conduct internet or book research, and create a timeline.

HOW TO BUILD A RAIN GAUGE

Materials

Single serving (12-16 oz) water bottle, cut in half by teacher

0.5 cup of water

Two (or more) paper clips

Thin permanent marker

Ruler, American standard (with inches)

Scissors

Knife

Funnel and Cylinder

Your teacher has cut a water bottle into two pieces: a funnel and a cylinder.

Engineering Questions

a. Why are we using a clear plastic container?
b. Why did we remove the top of the bottle?

Drawing the Scale

1. Use your ruler to mark a baseline as about one inch up from the bottom of the cylinder. Label it "0."

2. Continue to draw a line on the cylinder every 0.25 inches above the baseline. Number every fourth mark to indicate each full inch. [*Hint: Work with a partner. One person can hold the cylinder and ruler while the other person marks the inches.*]

Assembling the Rain Gauge

3. Turn the funnel upside down and place it into the cylinder. Use the 2 paper clips on either side of the gauge to hold the pieces together.

4. Fill the rain gauge water up to the baseline ("0").

You have completed your rain gauge!

Engineering Questions

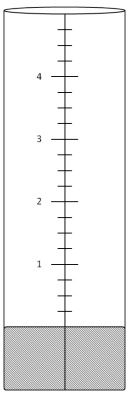
c. How can the funnel be useful?
d. Will the funnel affect the measurement?
e. Why are we filling up the water bottle with water to the baseline ("0")?

Setting Up the Rain Gauge

5. Place your rain gauge outside in an uncovered area where it can collect rain. Be careful not to put it under trees, plants, or buildings.

6. Secure your rain gauge to keep it from blowing over. You can place rocks, bricks, or dirt around it. Or you can place your rain gauge in a small hole in the ground or in pot filled with sand or dirt.

Recording Data



7. Check the rain gauge at least once per day.

8. If it has rained a lot and liquid is close to the top of the rain gauge, carefully remove the paperclips and lift the funnel out.

9. Measure the amount of rain using the scale on the bottle.

10. Use your journal to:
    - Record the height of the liquid in the rain gauge above the baseline
    - Describe the weather
    - Predict the weather for next time

Resetting the Rain Gauge

11. After you record the data, pour out all of the liquid and refill the gauge up to the baseline.

Engineering Question

f. What can be done to ensure that we are taking accurate measurements every time?

HOW TO BUILD A RAIN GAUGE

Engineering Questions

a. Why are we using a clear plastic container?

b. Why did we remove the top of the bottle?

c. How can the funnel be useful?

d. Will the funnel affect the measurement?

e. Why are we filling up the water bottle with water to the baseline ("0")?

f. What can be done to ensure that we are taking accurate measurements every time?

HOW TO BUILD A RAIN GAUGE

Engineering Questions (teacher support)

a. Why are we using a clear plastic container?

It is clear so we can see the amount of liquid inside. We use a plastic container because it is waterproof to withstand the rain.

b. Why did we remove the top of the bottle?

It will keep out debris. We remove the top of the bottle and turn it into a funnel to create a cylinder with a nearly consistent diameter so that we can collect the amount of rainfall that would have fallen on the ground in the area that the bottle is covering.

c. How can the funnel be useful?

Lessens evaporation because the opening is smaller.

d. Will the funnel affect the measurement?

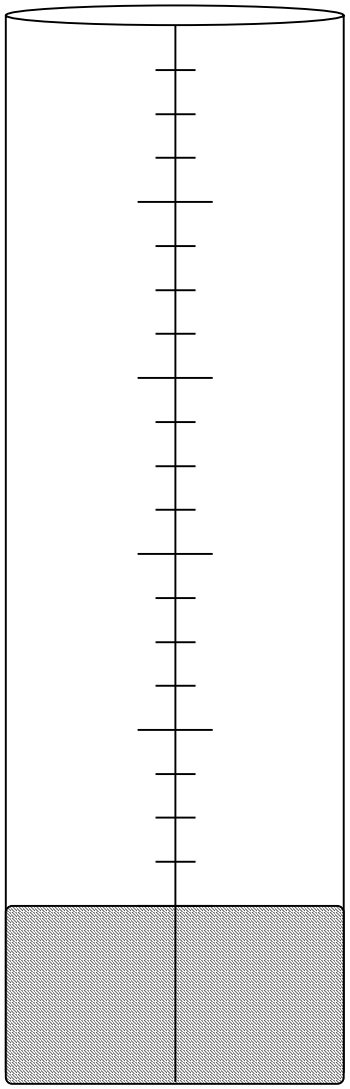
No, not if we remove it carefully before taking measurements.

e. Why are we filling up the water bottle with water to the baseline ("0")?

The bottom of the cylinder is also curved, so filling the bottle up with about an inch of water gets the water level past the curve of the bottle and helps to create a cylinder with a more consistent diameter

f. What can be done to ensure that we are taking accurate measurements every time?

Refilling the rain gauge level to the baseline every time after you take a measurement. When you're taking measurements: (1) putting the rain gauge on a solid surface (like a table) and (2) reading your measurement/results at eye level.



Name: _____

Today is _____ Time: It is ____:____ ___.m.

What does the rain gauge tell us about the weather?

My rain gauge collected _____ inches of rain today.

Observations: Record what you actually see and do during the investigation

Today, I observed that the weather is _____. *I noticed* _____.

Compared to yesterday, today _____.

_____

_____

Predictions: State what you think will happen and give a reason or explanation

I predict that the weather tomorrow will be _____. *This is because* _____.

I think _____ *because* _____. *If* _____, *then* _____.

_____

_____

DATA ANALYSIS AND GRAPHING

Directions: Display data on **amount of rain (inches) per day** in a table and in a bar graph and answer the following questions.

Create a Table

How any columns do we need? _____

How many rows to we need? _____

What will be the column titles? _____

What is the total number of inches it rained? _____

To create a table:

1. Draw the correct number of columns and rows
2. Label the columns
3. Fill in data in each column

Create a Bar Graph

What data will be put on the horizontal axis? _____

What data will be put on the vertical axis? _____

How many intervals for each axis? _____

To create a bar graph:

1. Draw the horizontal axis and vertical axis
2. Draw in the correct intervals for each axis
3. Label each axis
4. Draw a bar for each day to the correct height

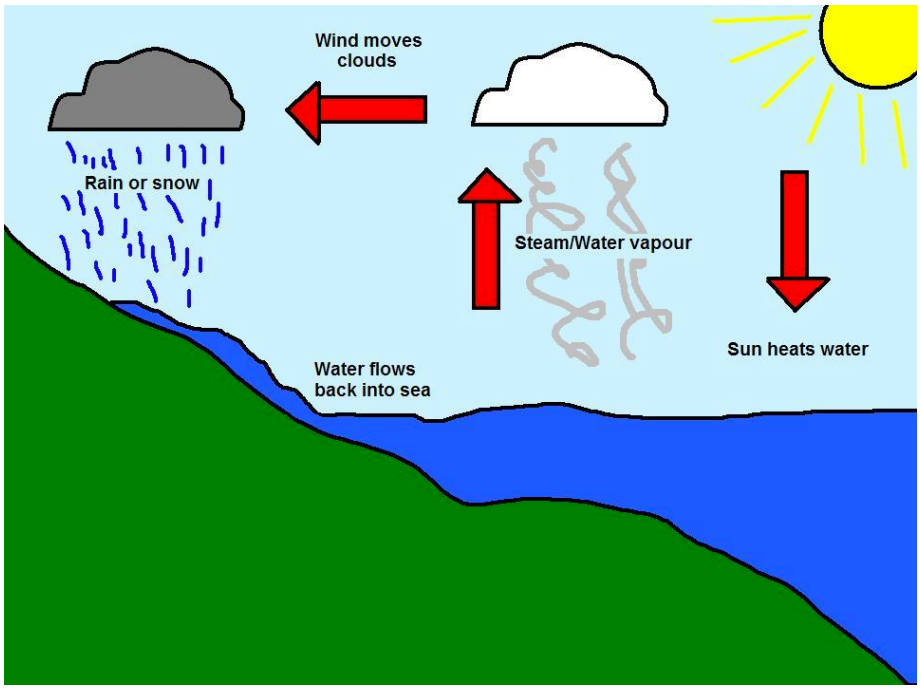
Use your table and bar graph to answer these questions:

1. How many inches did it rain in total?

2. When did it rain the most? How many inches did it rain that day?

3. What does the rain gauge tell us about the weather?

The Water Cycle
By Sharon Fabian
Rewritten as a short reader by Brandi Waters



Have you ever thought about where the rain comes from? It falls from the sky and waters our crops. The rain fills our lakes and rivers. It gives us water to drink. But where does it come from? There is no water in space. The rain does not come from the sun, the moon, or the stars. All of the water that has ever been on Earth is the same water that we use today.

The Earth uses the same water over and over again. It does this through the water cycle. First, water from the ground moves into the air. This is called **evaporation**. Liquid water is heated and turns into **water vapor**. If the water is dirty, the dirt will stay on the ground. The water vapor is made up of clean water. This is one way that the water cycle keeps our water clean. Next, the water vapor mixes with the air and moves up into the sky. This is the first part of the water cycle.

The next part of the water cycle is called **condensation**. As the water vapor moves farther and farther up in the sky, it cools down. When it cools down, it turns back into water. When water vapor in the sky turns into water, it forms a **cloud**. A cloud is a group of very small drops of water. The drops are so small that they do not fall to the ground. The cloud gets bigger and bigger as more water vapor condenses in the cloud. Soon, the drops are too big to remain in the cloud. This causes **precipitation**, like rain or snow, to fall back on to land and into the ocean.

from http://edhelper.com/ReadingComprehension_54_2218.html