ACTIVITY-RAING GAUGE EXPERIMENT

Age: This activity is best for kindergarten-4th grade but can be adapted for older grades.r

Time Estimate:

15 minutes (execution & explanation)
Experiment length varies.

Activity Outline

Use measuring skills to create a rain gauge in your garden! Can be used as a long-term or short-term experiment.

Scientific skills: observation, graphing, measurement, accuracy.
Tags: Rain, rainfall, weather, meteorology, observation, graphing, measuring, accuracy,

Materials:

- Clear vessel (washed, dried, with labels removed)
  - Empty 2L soda pop bottle
  - Empty glass jar
  - Empty water bottle
- If using a jar, you will also need a funnel
- Scissors
- Utility Knife
- Duct Tape
- Permanent marker
- Ruler
- Optional: hose clamp to attach to a sign

Tip: Rubbing alcohol makes quick work of removing sticky labels and permeant marker!

Science Background

The ONE thing plants cannot grow without is water. Therefore, when gardening or planting crops, it is important to understand sources of water in your area! Of course, rainwater is likely one of the best sources of water available to you, so it is important to have a way to measure **rainfall**, the amount of rain in a given area over a given time period.

History

Rain gauges have been around for centuries in various parts of the world. Not all of them look like the one you will be creating today! Some have a prism shape, some use buckets

(like the tipping bucket method), and one design even attempted to calculate rainfall per hour using a clock mechanism! You can find explanations and illustrations of these various rain gauges from this publication (Biswas).

The design of common rain gauges used today started appearing around mid-17th century by scientists Robert Hooke (Gresham College) and Richard Townley (Townley Hall in Lancashire). It was not until the 18th century that rules were written to standardize rain gauge instruments. Scientists such as Leupold, Pickering, Dobson, and Dalton realized using a smaller diameter cylinder, typically with a funnel on top to collect water, yielded more accurate results than larger containers.

Why are rain gauges important?

Measuring rainfall tells farmers and gardeners how much water they must add to their plants to help them thrive. If a storm produces a lot of rain, you may not need to water for a few days. Alternatively, if the storm produces a small amount of rain, you may need to supplement with hose or stored water.

Tracking rainfall over a long period of time can also tell us a lot about the weather patterns of our world. **Meteorologists**, or weather scientists, can calculate the amount of water stored in a raincloud by tracking rainfall over time. This can be useful when they predict how long a storm will last, and if there is risk of a **flood**—an overflow of water, especially over an area that is typically dry. Additionally, rain gauges are important to determine droughts. A **drought** is a time of dryer-than-normal conditions. Tracking rainfall with a rain gauge helps scientists establish that "normal" rainfall line and will alert if a place does not receive as much rainfall as it has during that time in the past.

Despite using more advanced technology like satellites and radars to predict weather events, meteorologist still rely on rain gauges because they supply exact measurements and ground confirmation of weather events. In fact, if you have ever had your phone's weather app tell you it is raining when you are standing outside dry, you know how important ground confirmation can be.

It is important to realize that rainfall does not only affect plants. Rainfall amount also affects city water, recreational activities, driving conditions, and much more. So even if you do not garden or farm, it is still important to monitor rainfall!

Video Explanation https://youtu.be/PsMirhgbWdk

Instructor Preparation

Gather materials, clean containers, cut bottles (depending on the age group).

Engage:

- Do you think rain is important? How does rain relate to farming or gardening? Does rain impact our lives even if we do not grow things?
- How do you think we can measure rainfall? Why would we want to measure rainfall?
- What is the best type of graph to display this data?

Explore:

1. Grab a clear, dry container (2L bottle, plastic water bottle, empty jar, etc.). The size does not matter, but it is best if the jar is the same diameter all the way up.
2. If using a plastic bottle: (adult help needed) using a utility knife and scissors, cut the bottle near the top, just before it starts to taper.
3. Cut and apply a piece of duct tape that runs the length of the straight side of your vessel.
4. Using a ruler and a sharpie, make a copy of the ruler, marking every cm and inch along the tape.
    a. If your vessel has a bulge at the bottom, start your "0" mark where the container is straight. You can fill the bottom of this part with rocks to weigh the container down.
5. Add the funnel to the top of your container. You may want to tape it down as well.

<u>User Instructions:</u> Set your jar outside before a rain. Make sure you fill the bottom of the jar with water to the "0" line to ensure an accurate reading! Decide on a set amount of time to measure rainfall (a day, a week, or just during a particular rain shower). At the end of that time, observe your jar to see how much it has rained! You can write your observations in the chart below. Dump out the extra water and you will be ready for the next rainstorm!

Explain:

Ask questions to help kids reflect on their exploration.

1. Why do we add the funnel to the top of the container? What do you think would happen if we did not use the funnel?

    a. Keep out leaves, catch more water for a given area.
2. If you were to do this experiment again, what would you do differently?

Elaborate:

1. Try the experiment again but compare how much water is captured using a funnel vs. not using a funnel.
2. Extension: check rainfall over a set interval during a storm to create a more accurate graph!
3. Ask students what other weather/climate aspects they could measure in their garden. Some examples include cloud cover, wind speed and direction, lunar cycles, temperature, and snowfall.
    a. Consider creating a weather station in the garden to track these things!

Sources:

Biswas, Asit. (1970). History of Hydrology - Chapter 11: Rain Gauges in The Seventeenth and Eighteenth Centuries. Downloaded from ResearchGate.

Merianos, Nick. "Project Weather School: Importance of a Rain Gauge." *Spectrum Bay News 9*. 16 Nov. 2020. Web. 09 Aug. 2024.

Lesson based off The STEAM Powered Family and the American Museum of Natural History.

Name: _____

Rain Gauge Experiment Worksheet

Part 1: Terminology Match
Directions: match the term to its definition

_____	Rainfall	_____	An overflow of water, especially over an area that is typically dry.
_____	Meteorologist	_____	A device consisting of a funnel and a clear container with markings that is used to measure rainfall.
_____	Flood	_____	The amount of rain in a given area over a given period of time.
_____	Drought	_____	A scientist who studies patterns in weather.
_____	Rain gauge	_____	A time of dryer-than-normal conditions.

Part 2: Experiment
In this experiment, we will be using our rain gauges to measure rainfall in our school garden. Read through the entire procedure before starting.

Procedure:

1. Fill the bottom of your rain jar with water to the "0" line.
2. Set your jar outside in an open area before a rain. Make sure there is nothing over your jar, like a tree, a table, or the roof of the building, or your results will be inaccurate.
3. We will be measuring rainfall for _____.
4. At the end of this period of time, observe your jar to see how much it has rained! Measure and write your observations in the chart below.
5. Dump out the extra water and you will be ready for the next rainstorm!

Name: _____

Collect Data:

My Weather Chart

Location of jar: _____ Diameter of funnel (in cm): _____

To calculate rainfall, use the following equation:

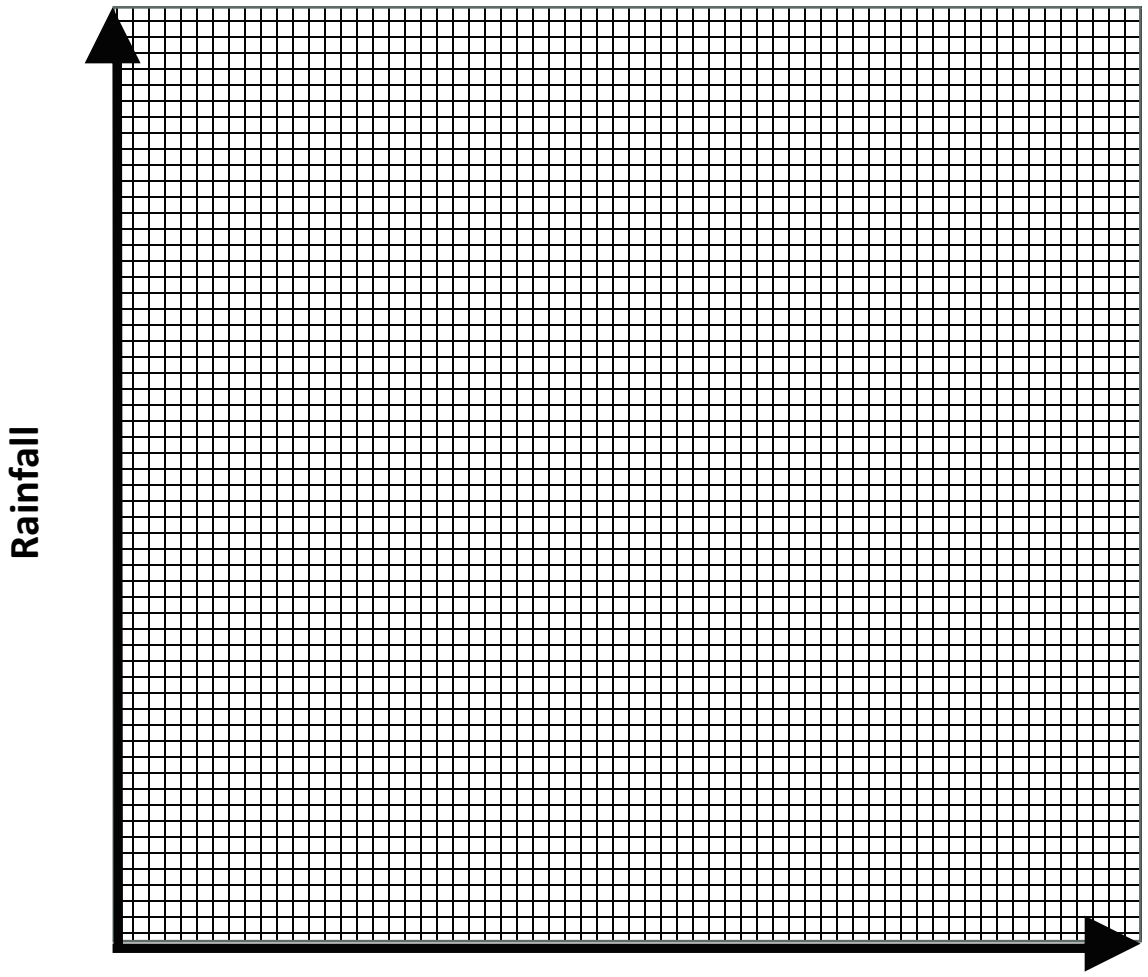
Rain Gauge Reading (cm) x Length of Time x Area of Funnel (cm) = Rainfall (cm/time)

Date	**Rain Gauge Reading** (cm)	**Length of Time**	**Rainfall** (cm)	**Notes**

Analyze Data:

Name: _____

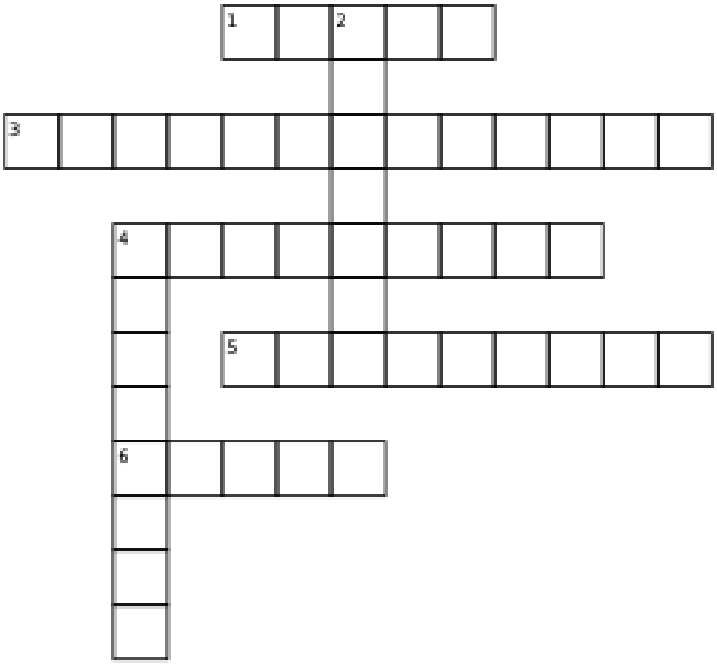
Now that you have calculated rainfall for each date, it is time to graph it!



What does this graph tell you about the rainfall in your garden? To calculate average rainfall, add all the values for rainfall together and divide by the number of points on your graph.

Name: _____

Crossword Puzzle



Down:

2. no water
4. water from the sky

Across:

1. sends out high frequency waves--instrument
3. weather scientist
4. measuring tool for rainfall
5. instrument that orbits
6. overflow of water

Name: __KEY_____

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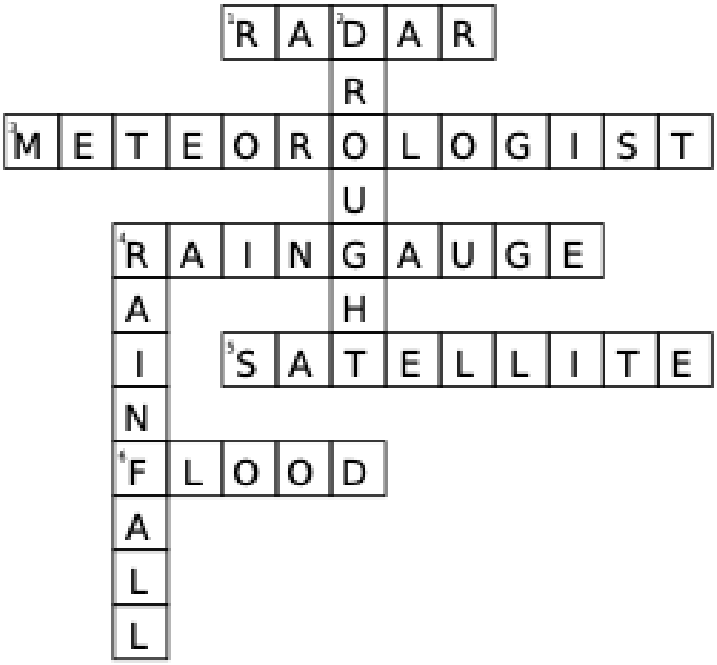

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