Build a Rain Gauge!

Name: Teacher Guide Date: _____

Instructions:

1. Gather your materials to build a rain gauge! (recycled 2L clear soda bottle, small rocks, ruler, permanent marker or paint pen (red and black), scissors or bread knife - *use with help from your teacher!* You can refer to the image on page 2 for guidance.

2. Before building your own rain gauge, think about and answer these pre-activity questions:

   a. Where do you live?

   Ask students to write about the relative location of their home. For example, they might say whether they live (1) North, South, East or West, (2) on the windward or leeward side of the island, (3) in the mountains, near a stream, near the ocean, in a city area.

   b. When is it rainiest at your home?

   Ask students to think about seasons or time of year as well as time of day.

   c. What is the rain like on the other side of the island?

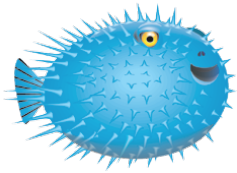
   Ask students what they know about other areas of their island and how the weather might be different.

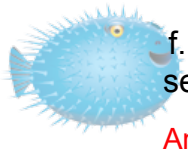
   d. What month is it right now?

   Answers will vary.

   e. What season are you currently in?

   Answers will vary.





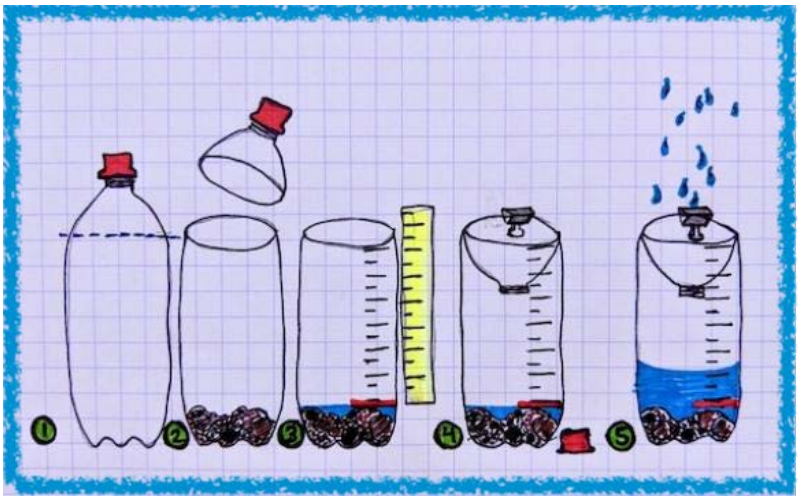
   f. Do you expect there to be a lot or a little rainfall at your given location this season?Explain.

   Answers will vary. If you are in fall season, students may guess that more rain will occur as you approach the rainy season. If students collect data over the summer, they may suspect rainfall to be lower.

Follow these steps to make a simple and recycled rain gauge!

1. If using a plastic water bottle, cut the neck on the cylindrical part where it begins to curve.
   *Note: **Get help from your teacher** to make this cut!*
   If the edge is sharp, use tape to cover it so it is smooth.
2. Fill the bottom of the bottle with about a cup of rocks/pebbles.
3. Choose a spot on the bottle just above the rock line to be your zero mark, or your **baseline**. Draw a line in red.
4. Line the ruler up to the side of the bottle with the "0" in line with your baseline and mark up the bottle every 5 millimeters. Label every other line (counting by 10).
5. Pour just enough water to cover the pebbles and so the water line is even with your zero mark.
6. Invert the top to make a funnel and use the binder clip to attach it to the bottle. This funnel will direct the rainfall and prevent evaporation of water.
7. Place your gauge in a level area that will catch the rain (avoid placing the gauge under a tree or other covered area!).

8. Check the gauge once a week and record the rainfall on your data sheet.
   (*Note: If the value is hard to determine (in between values), use your ruler to help!*)
9. Empty and reset it each time you take a reading.
   (*Note: To reset the gauge, empty the water, replace the rocks in the bottom of the bottle, and refill enough to reach your base line. Place it back on your chosen site.)*



Graph your data!

10. After you have recorded data for each week in the month, add up each number to find the total amount of rainfall for that month.
11. Label the x-axis with the months you recorded (or will be recording) rainfall data.
12. Label the y-axis with rainfall in millimeters (mm). Be sure your scale is large enough that your rainiest months can fit on the graph!
    (*Note: some areas of the islands, such as the windward side, may get 500 mm of rain in a month! The leeward side may only get up to 100 mm.*)

13. As you collect data each month, fill in your bar graph by drawing bars (that correspond to the month on the x-axis) up to the appropriate rainfall total on the y-axis.
14. Observe the pattern in rainfall over time and answer the questions on page 5.

Rain Gauge Data Sheet

Name: Teacher Guide

Location: Honolulu (Airport gauge)

These numbers are based on real daily Hawaii rain gauge data at: https://www.weather.gov/hfo/HRS_archive

Date	Observations	Rainfall Measured (units: mm (rounded to nearest whole number)
Wk 1: Mon, Jan 6	First day setting up the gauge - no rain collected yet!	0
Wk 2: Mon, Jan 13	Not too much rain last week. Pretty sunny	7
Wk 3: Mon, Jan 20	Seemed like only one rainy day last week	15
Wk 4: Mon, Jan 27	No rain this week!	1/2 (basically 0)
Month: JANUARY		Total Rainfall: 22
Wk 1: Mon, Feb 3	No rain this week!	0
Wk 2: Mon, Feb 10	Not that rainy	10
Wk 3: Mon, Feb 17	A little bit of rain	8
Wk 4: Mon, Feb 24	Hardly any rain!	1
Month: FEBRUARY		Total Rainfall: 19
Wk 1: Mon, Mar 2	Not too much rain this week!	4
Wk 2: Mon, Mar 9	Not that rainy	3
Wk 3: Mon, Mar 16	A little bit of rain	8
Wk 4: Mon, Mar 23	Some rain this week	14
Wk 5: Mon, Mar 30	Hardly any rain!	6
Month: MARCH		Total Rainfall: 35
Wk 1: Mon, Apr 6	Hardly any rain!	2
Wk 2: Mon, Apr 13	A little bit of rain	24
Wk 3: Mon, Apr 20		
Wk 4: Mon, Apr 27		
Month: APRIL		Total Rainfall: 26

Rain Gauge Data Sheet

Name: Teacher Guide

Location: Manoa Lyon Arboretum

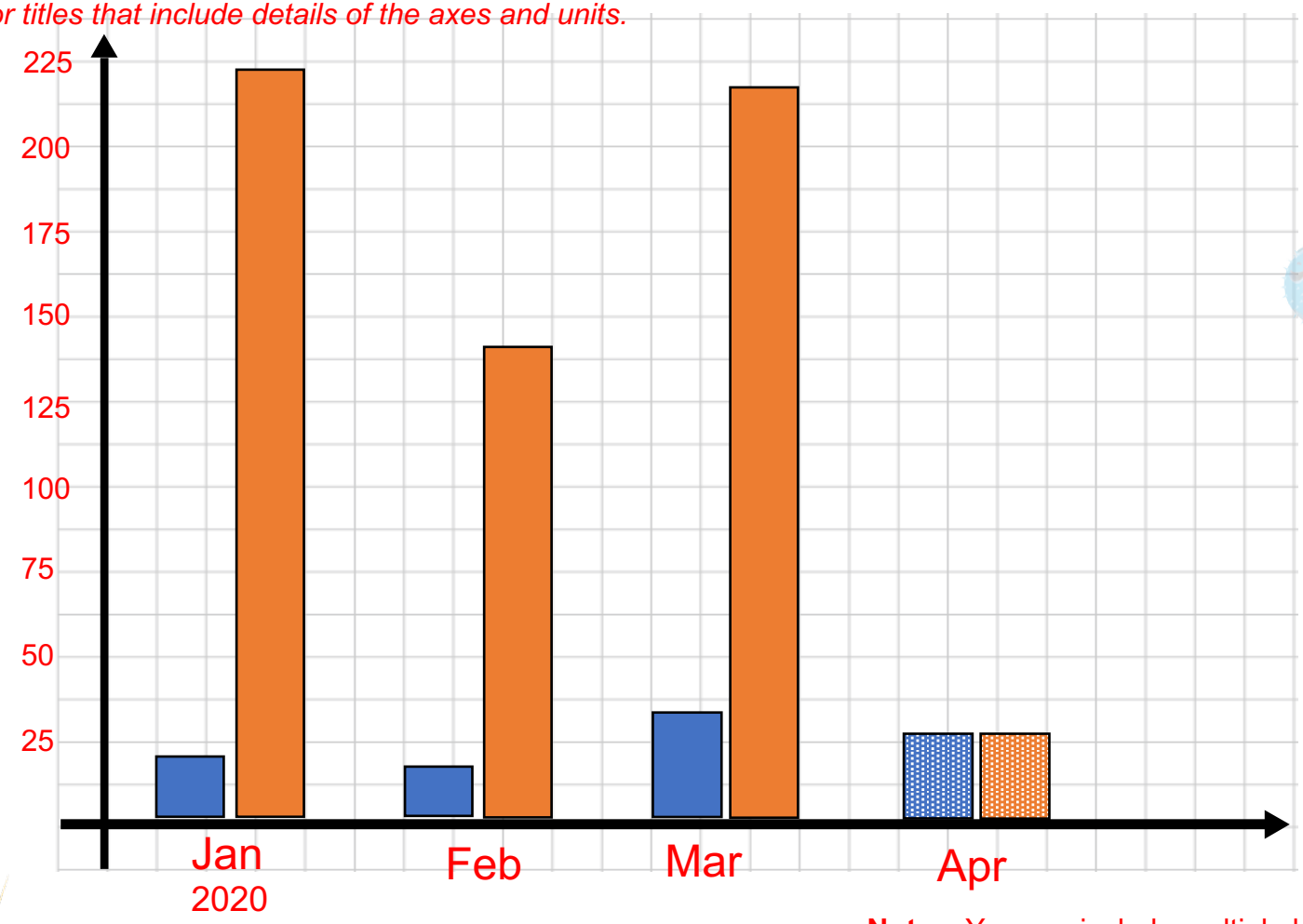
These numbers are based on real daily Hawaii rain gauge data at: https://www.weather.gov/hfo/HRS_archive

Date	Observations	Rainfall Measured (units: mm (rounded to nearest whole number)
Wk 1: Mon, Jan 6	First day setting up the gauge - no rain collected yet!	0
Wk 2: Mon, Jan 13	Rainy week in Manoa!	146
Wk 3: Mon, Jan 20	Not as rainy last week	59
Wk 4: Mon, Jan 27	Not much rain, sunny	17
Month: JANUARY		Total Rainfall: 222
Wk 1: Mon, Feb 3	Not as rainy last week	24
Wk 2: Mon, Feb 10	A little bit of rain last week	47
Wk 3: Mon, Feb 17	Not as rainy last week	21
Wk 4: Mon, Feb 24	More rain	51
Month: FEBRUARY		Total Rainfall: 143
Wk 1: Mon, Mar 2	Not as rainy last week	9
Wk 2: Mon, Mar 9	Rainy week in Manoa!	75
Wk 3: Mon, Mar 16	Some rain!	36
Wk 4: Mon, Mar 23	Some rain!	28
Wk 5: Mon, Mar 30	Rainy week in Manoa!	69
Month: MARCH		Total Rainfall: 217
Wk 1: Mon, Apr 6	Some rain!	22
Wk 2: Mon, Apr 13	A little bit of rain last week	4
Wk 3: Mon, Apr 20		
Wk 4: Mon, Apr 27		
Month: APRIL		Total Rainfall: 26

Instructions: Plot the total rainfall measured from your rain gauge over time. Plot rainfall on the y-axis in the same units you used on your rain gauge. Plot time, in months or days, on the x-axis.

Title: Monthly rainfall (inches) in Honolulu and Manoa Lyon Arboretum in 2020.

Note: Look for titles that include details of the axes and units.



Rainfall (mm)

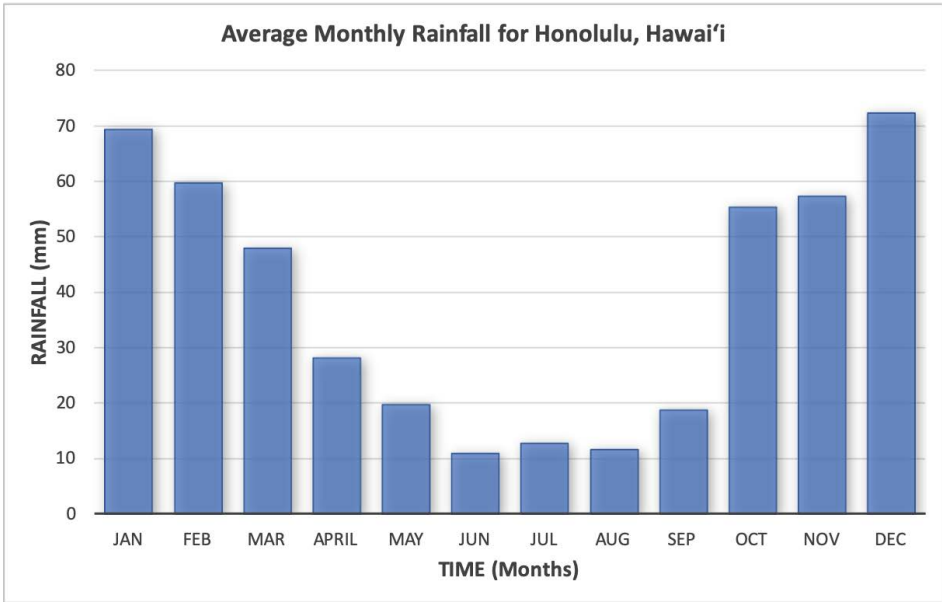
Notes: Be sure to have a scale that will include your largest amount of rainfall. Using mm as units will be easiest to plot to avoid decimals

Notes: Graphs will vary. This example include data from two locations in January, February, March and half of April. You can graph incomplete months and add rainfall week by week by adding vertically as you collect rainfall data.

Time (Months)

Notes: You can include multiple locations over time, like this example, or graph rainfall in a certain time frame from different locations by having "Location" on the x-axis. Longer term monitoring will allow students to recognize the seasonal variation

Activity Questions



This graph shows the average rainfall for Honolulu, Hawai'i each year over a thirty year period. Use the information to answer the following two questions:

1. When are the wettest and driest times of year?

The graph shows that the fall and winter (Oct-Mar) are wettest and the spring and summer (April-Sep) are dryest.

2. Does your answer above make sense with your experience living in hawaii?

Ask students to think about their own experiences. When is there the most flooding? When are the rivers fullest?

3. What will you learn from recording one day of rain?

This question is designed to have students start to think about the difference in collecting data at one point in time verses over a longer period of time. In one day of recording, you can learn about the amount of rain on that day. This information might be important if you are looking to plant, if you are monitoring for flooding, or if you want to know if you need to water your yard.

4. What will you learn from recording one year of rain?

This question is designed to get students thinking over the longer term — and to provide some scale. If you collect data from a year of rain, you will start to have information about seasonal patterns. However, not every year is the same! Notice that the graph above shows average monthly rainfall over many years. (It is a nice representation of the 3-ESS2-1 PE, with data graphically displayed to show typical weather conditions expected during particular times of year/seasons.) If we want to understand patterns, it is important to collect data over long time periods.That is one reason why our kūpuna are so valuable—they have been collecting information for many, many decades!

5. What might be different in a rain gauge in your yard versus one in your classmates?

This question is designed to have students think about variation in patterns. In Hawai'i, there is a lot of geographic variation in weather patterns — on small and large scales. The windward sides of the island tend to be wetter, and the leeward sides tend to be dryer. But there are many micro-climates within these regions, where land features and vegetation both affect the amount of rainfall. Humans can change these patterns, for example, by cutting down trees, which tends to reduce rainfall and also reduces the amount of moisture collected from the air (through condensation on leaves).

6. How can you improve your design of the rain gauge?

Answers to this question will vary. Look for students to evaluate the design of the rain gauge based on their use. Some common themes might include ways to make the numbering stay on longer, make the gauge larger for very rainy areas, make the gauge smaller for very dry areas, make the gauge more sturdy to withstand winds, and making the gauge automated so they do not have to take measurements every day!

7. Why is it important to collect data on rainfall in different parts of the island?

This question is designed to have students reflect again on their knowledge of the island and patterns of rainfall. If they have already done the "Make a Cloud" activity, then they will have experimented with wind movement and cloud formation. This should lead students to ideas about rainfall patterns and the need to have data from windward and leeward areas.