

# IT'S RAINING, IT'S POURING!



Grade 2

## Lesson at a Glance

After observing a demonstration of a miniature water cycle and conducting a simple condensation experiment, students use illustrated paper water drops to tell the story of mountain rainfall in Hawai'i.

## Key Concept

Rainfall in Hawai'i occurs primarily in windward and mountain areas, where moist northeast trade winds rise, cool and condense to form clouds or rain.

## Hawai'i Content and Performance Standards III, Science

Strand		The Scientific Process	
Standard 1: The Scientific Process: SCIENTIFIC INVESTIGATION: Discover, invent, and investigate using the skills necessary to engage in the scientific process.			
Topic		Scientific Inquiry	
Benchmark SC.2.1.1		Conduct a simple investigation using a systematic process safely to test a prediction	
Sample Performance Assessment (SPA)		The student: Makes predictions based on observations about the world around him or her.	
Rubric			
Advanced	Proficient	Partially Proficient	Novice
Make logical predictions based on justified inferences from observations.	Make predictions based on observations.	With assistance, make predictions partially based on observations.	Make inaccurate predictions or make predictions not based on observations.

Strand		The Scientific Process	
Standard 1: The Scientific Process: SCIENTIFIC INVESTIGATION: Discover, invent, and investigate using the skills necessary to engage in the scientific process.			
Topic		Scientific Inquiry	
Benchmark SC.2.1.2		Develop predictions based on observations.	
Sample Performance Assessment (SPA)		The student: Implements a simple procedure safely to answer a question or test a prediction that relies on careful observations (e.g., collects, records, and organizes data).	
Rubric			
Advanced	Proficient	Partially Proficient	Novice
Consistently conduct a simple investigation using a systematic process safely to provide a valid test of a prediction.	Usually conduct a simple investigation using a systematic process safely to provide a test of a prediction.	Sometimes conduct a simple investigation using a systematic process safely to provide a test of a prediction.	Rarely conduct a simple investigation using a systematic process safely to provide a test of a prediction.

## Objectives

Student will be able to: 1) describe what causes evaporation and condensation to occur; and 2) identify where most rain falls in the islands and explain why.

## Time

one to two class periods

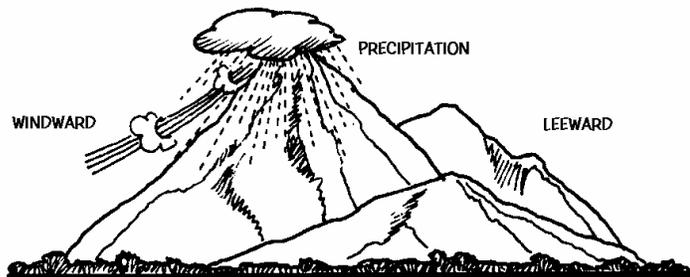
## Subject Areas

science, social studies

**Science/Doing Scientific Inquiry:** students demonstrate the skills necessary to engage in scientific inquiry. Performance Indicators: 1) generate ideas, questions, and/or predictions about objects, organisms, events, places, in his/her environment; 2) Describe a plan to answer a question or test a prediction. Uses a procedure that is systematic and relies on careful observations; 3) collect and organizes data using simple tools, equipment, and techniques; 4) studies data and tells what the data means; 5) appropriately communicates (group or personal) investigations to an audience; 6) talks about ideas based on evidence and revises them when faulty or inadequate.

## Materials

student activity sheet (provided)  
glass bowl  
6 large plastic cups  
small bag of ice cubes  
paper towels  
paste or glue  
scissors



## Preparation

Fill six plastic cups with ice water immediately before beginning this activity.

## Teacher Background

The water cycle is the continual flow of water between land, ocean and air. Energy from the sun evaporates water from the land and ocean, changing it into water vapor. This water vapor is stored within the air. Warm air can “hold” more water vapor than cold air.

In general, air temperature drops with elevation. As a pocket of warm, moist air rises up to higher elevations it will begin to cool. Eventually, it may become so cool that it can no longer “hold” all the water vapor that was in it at sea level, and the excess will begin to condense as clouds. By the same principle, condensation forms on a can when it is taken out of the refrigerator. As the air around the can cools, water vapor it cannot “hold” condenses to form water droplets, making it appear as though the can is perspiring.

If the air is cool enough and is carrying sufficient water vapor, condensation may eventually lead to precipitation (rain, snow, or fog). Water then falls to the ground and the water cycle is complete.

In Hawai‘i, northeasterly trade winds carry warm air holding water vapor across the oceans to the windward coasts (facing the wind). As this air rises over the mountains, it cools. If there is sufficient moisture in the air, precipitation will fall. This is called mountain-induced, or orographic precipitation from the Greek words *oras* (mountain) and *grafikos* (written or transmitted). As the air approaches the leeward side (the side sheltered from the wind), it

descends and warms, and any moisture still condensed will evaporate. As a result, the leeward sides of our islands are very dry. In fact, without mountains, our islands would receive about the same amount of rain that falls over the open ocean, approximately 500 mm (25 in) per year.

On Maui and Hawai‘i, the air loses most moisture before it ever reaches the highest mountain crests so the summits of Haleakalā, Mauna Kea and Mauna Loa are very dry. When there is precipitation on these cold summits, it sometimes falls as snow.

Every living thing on Earth depends on water for without it, there would be no life. Water is also a basic component of many ecosystems. An **ecosystem** is a community of living things, people, their environment and the way they interact with one another. An example of an ecosystem is our native mountain rainforests. For more information on our rainforests and their relationships to water, see Grade 2, Geography, “Be a Water Watcher.”

In this lesson, students observe a miniature water cycle inside an inverted glass bowl on the school lawn. The sun’s rays will pass through the glass to evaporate the water. The sun’s rays travel in waves. The shorter, more powerful rays readily pass through glass, bringing both light and warmth. If they didn’t, it would be dark and cold inside a car parked in the sun in the middle of the day! Water vapor cannot pass through glass. Thus, while water on the ground may be evaporated by the sun’s energy, it cannot get beyond the glass barrier.

### Teaching Suggestions

- 1) Ask students to describe what makes rain. Discuss whether it rains in some places more than others. For example, does it rain more in the mountains or at the beach? Why?
- 2) Tell students they are going to do a simple experiment to find out why it rains more in the mountains.
- 3) Draw a simple sketch of an island on the board to introduce the terms “windward,” “leeward,” and “trade winds.” Ask students if they think the air is cooler or warmer at higher elevations. Save the sketch for later use.
- 4) Divide the class into six groups. Give each group a cup of ice water and a paper towel. Have students wipe the outside of the cups dry and place them on a table.
- 5) Ask students to predict what will happen if the cups are left on the table for a while.

### Discussion Questions

- Will any water form on the table under the cup?
  - If so, where will the water come from?
  - Can the water leak out of the cup? Hold up the cup. Is water leaking out of it now?
- 6) While waiting for condensation to appear on the cups, take the class outdoors and place a glass bowl over some damp grass in the sun. (You may need to water the grass beforehand.) Watch the water evaporate, condense against the sides of the glass and drip down as “rain.” Ask students to explain what is causing the evaporation, and discuss other examples of evaporation such as puddles drying in the sun or clothes drying on a clothesline.

- 7) Return to the classroom to observe condensation around students' cups of ice water. Ask students where the water comes from. Explain that the cold water cooled the air around the cup, causing the water drops to condense out of the air. Be sure they understand that the cups did not leak.
- 8) Compare the cool air around the cups to the cooler air at higher elevations in the Islands. Explain that the warm sun causes water to evaporate and the cool mountain air causes water to condense, form clouds and precipitate. Add the words "evaporating" and "condensing" to the island sketch previously drawn on the board.

### **Discussion Questions**

- How do mountains affect rainfall in Hawai'i? (They cause warm air to rise, cool, and condense.)
  - What might happen if we had no mountains? (The same amount of rain that falls on the ocean around us would fall on the Islands.)
- 9) Distribute the activity sheets. Ask students to use cut out the water drops and paste them onto the island picture to illustrate the water cycle. On the other side of the sheet, ask the students to write a sentence about the water cycle using word(s) from the word bank below. Ask students to share with the class their sentences. As a class, use the word bank below to tell the story of mountain rainfall in Hawai'i.
    - leeward
    - windward
    - trade winds
    - rain
    - condense
    - elevation
    - evaporate

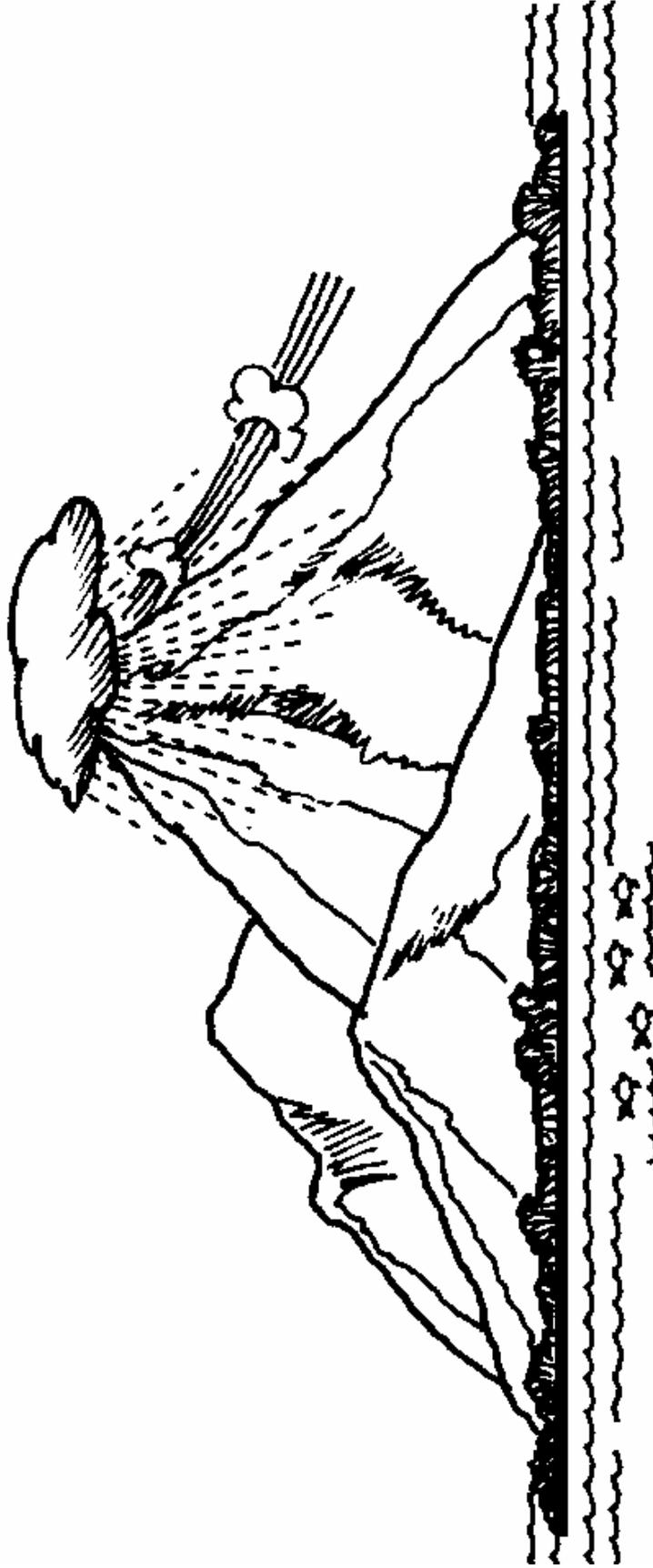
### **Extended Activities**

- Heat water on a portable burner in class and observe the water vapor (steam) rising. Hold a chilled, long-handled metal spoon over the steam. The water vapor will condense on the spoon and drip down like rain.
- On a day when students can see clouds and/or rain forming over the mountains, or clouds disappearing as they come down the leeward sides, take the class outside to make observations.
- Introduce students to *The Cloud Book* by Tomie de Paola to learn more about cloud formation (see Unit Resources).

# It's Raining, It's Pouring Student Activity Sheet

Name: \_\_\_\_\_

Cut out the water drops and paste them onto the island picture to show the water cycle. Turn your sheet over and write a sentence about the water cycle.



raining



condensing



evaporating

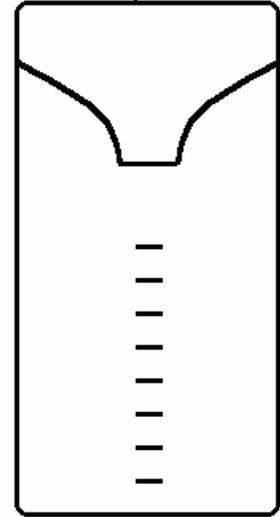
How often does it rain at your school? You can measure rainfall by using a rain gauge. Rain gauges are like tall measuring cups. Usually they are tall cylinders and placed high up to help prevent water from splashing in. You can keep track of the rainfall in your school by making your own rain gauge.

### Materials

ruler and waterproof marker  
measuring cup  
large plastic water bottle  
scissors  
heavy flower pot

### Instructions

- 1) Cut off the top of the plastic water bottle.
- 2) Fill your measuring cup to the 1/4 cup line.
- 3) Pour into water bottle. Mark the level of the water with a marker.
- 4) Keep doing this until you reach the top of the bottle. Each mark you make will be an increment of 1/4 cup.
- 5) Empty the bottle but save the water for later use.
- 6) Place the top of the bottle upside down into the bottle so that the top is like a funnel.
- 7) Leave your rain gauge outside in the open to measure rainfall. Do not leave it under trees or structures that could prevent rain from falling in your rain gauge.
- 8) To keep it from tipping over or blowing away, place your gauge firmly in the flower pot.
- 9) Watch for rain overflow. If it looks like your gauge will overflow, empty the rain into another container. Measure the overflow and remember to include it with the measurement in the gauge.
- 10) When measuring the rain in the gauge, make sure your gauge is on a level surface.
- 11) Record your findings weekly. You can make weekly or monthly tallies depending on how long you do it.
- 12) Chart your results and share.
- 13) What periods were the rainiest? The driest?



You can try this experiment at home and somewhere else where the environment is different. Compare the results of the two environments. Store the rain water in your gauge for later use.

