

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.

Objectives

Students will be able to:

- 1) Describe what causes evaporation and condensation to occur.
- 2) Identify where most rain falls in the islands and explain why.

Time

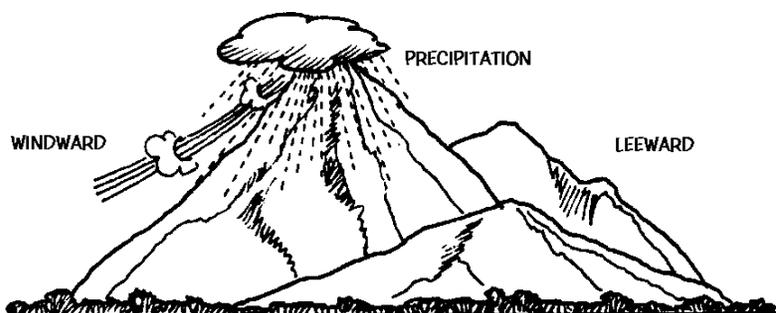
one to two class periods

Subject Areas

science, Hawaiian studies,
language arts, art

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, humid air 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.

In this lesson, students observe a miniature water cycle inside an inverted glass bowl on the schoolyard lawn. Some students may not understand how the sun’s rays can pass through the glass to evaporate 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. Ask students to add the words “evaporating” and “condensing” to the island sketch drawn on the board previously.

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 and ask students to use the cutouts and the words in the word bank to tell the story of mountain rainfall in Hawai‘i.

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).

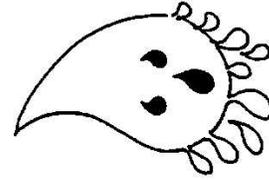
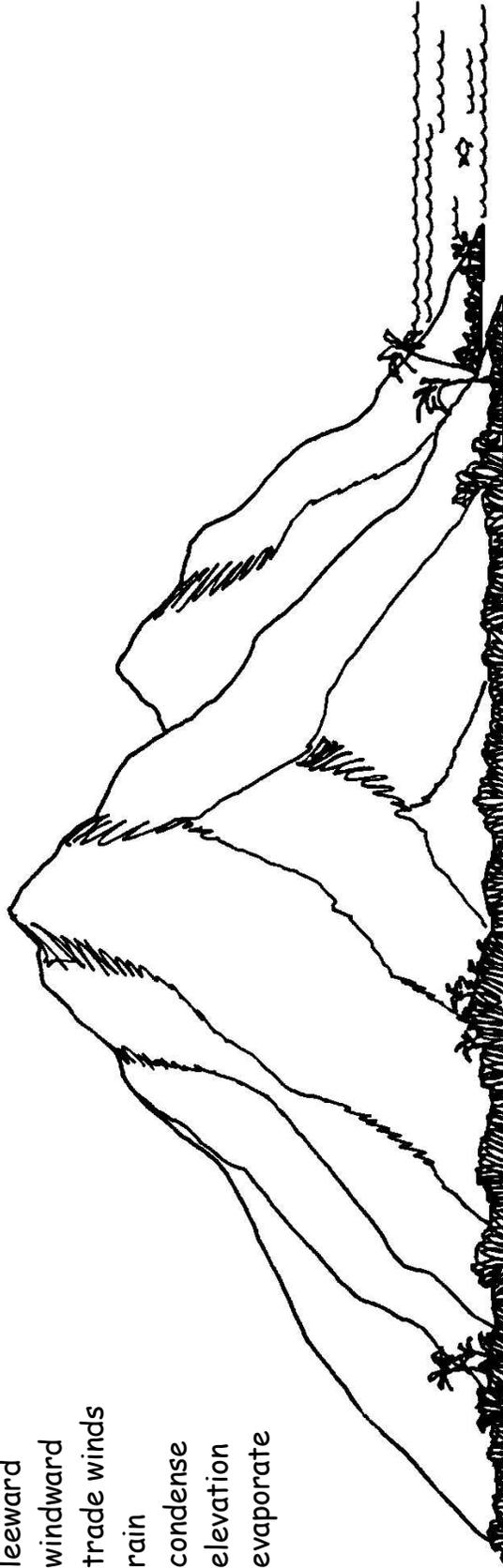
It's Raining, It's Pouring

Student Activity Sheet

Cut out the water drops and paste them onto the island picture. On the other side of this sheet, use words from the word bank to tell the story of where most rain falls in Hawai'i and why.

Word Bank

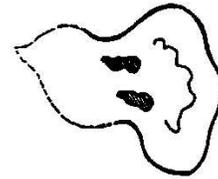
leeward
windward
trade winds
rain
condense
elevation
evaporate



raining



condensing



evaporating