Section 5

Precipitation

Reading Focus

Key Concepts

- What are the common types of precipitation?
- How is precipitation measured?

Key Terms

- precipitation
- drought
- cloud seeding
- rain gauge

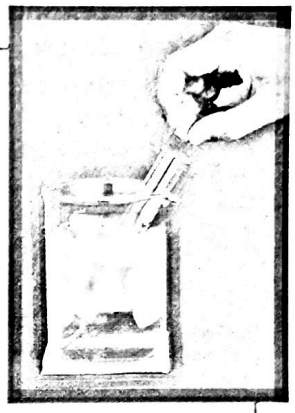
Target Reading Skill

Using Prior Knowledge Before you read, write what you know about precipitation in a graphic organizer like the one below. As you read, write what you learn.

What You Know
1. Precipitation can be rain or snow. 2.

What You Learned
1. 2.

Lab zone Discover Activity



How Can You Make Hail?

1. Put on your goggles.
2. Put 15 g of salt into a beaker. Add 50 mL of water. Stir the solution until most of the salt is dissolved.
3. Put 15 mL of cold water in a clean test tube.
4. Place the test tube in the beaker.
5. Fill the beaker almost to the top with crushed ice. Stir the ice mixture every minute for six minutes.
6. Remove the test tube from the beaker and drop an ice chip into the test tube. What happens?

Think It Over

Inferring Based on your observation, what conditions are necessary for hail to form?

In Arica, Chile, the average rainfall is less than 1 millimeter per year. But in Hawaii, the average rainfall on Mount Waialeale is about 12 meters per year. As you can see, rainfall varies greatly around the world.

Water evaporates from every water surface on Earth and from living things. This water eventually returns to the surface as precipitation. **Precipitation** (pree sip uh TAY shun) is any form of water that falls from clouds and reaches Earth's surface.

Not all clouds produce precipitation. For precipitation to occur, cloud droplets or ice crystals must grow heavy enough to fall through the air. One way that cloud droplets grow is by colliding and combining with other droplets. As the droplets grow larger, they move faster and collect more small droplets. Finally, the droplets become heavy enough to fall out of the cloud as raindrops.

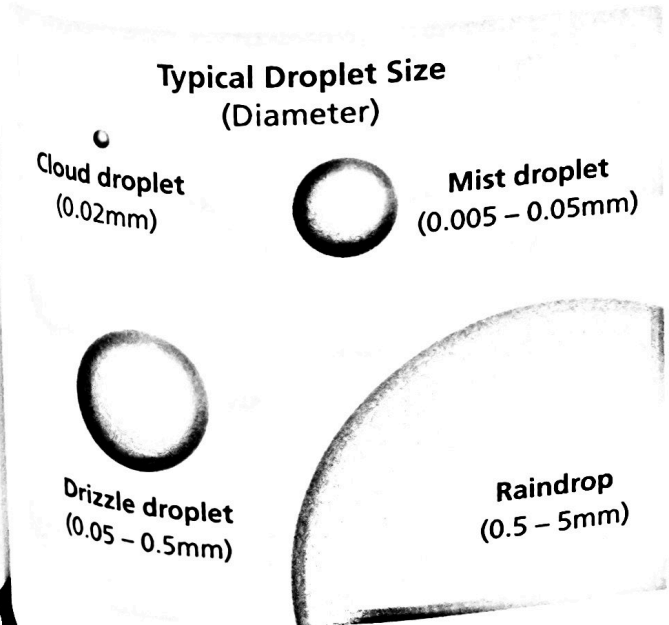


FIGURE 19
Water Droplets
Droplets come in many sizes. Believe it or not, a raindrop has about one million times as much water in it as a cloud droplet.

Go Online
SCILINKS NSTA
or: Links on precipitation
Visit: www.SciLinks.org
Web Code: scn-0925

Types of Precipitation

In warm parts of the world, precipitation is almost always in the form of rain. In colder regions, precipitation may fall as snow or ice. **Common types of precipitation include rain, sleet, freezing rain, snow, and hail.**

Rain The most common kind of precipitation is rain. Drops of water are called rain if they are at least 0.5 millimeter in diameter. Precipitation made up of smaller drops of water is called drizzle. Precipitation of even smaller drops is called mist. Drizzle and mist usually fall from stratus clouds.

Sleet Sometimes raindrops fall through a layer of air that is below 0°C, the freezing point of water. As they fall, the raindrops freeze into solid particles of ice. Ice particles smaller than 5 millimeters in diameter are called sleet.

Freezing Rain Sometimes raindrops falling through cold air near the ground do not freeze in the air. Instead, they freeze when they touch a cold surface. This kind of precipitation is called freezing rain. In an ice storm, a smooth, thick layer of ice builds up on every surface. The weight of the ice may break tree branches and cause them to fall onto power lines, causing power failures. Freezing rain and sleet can make sidewalks and roads slippery and dangerous.

Reading Checkpoint **What is sleet?**

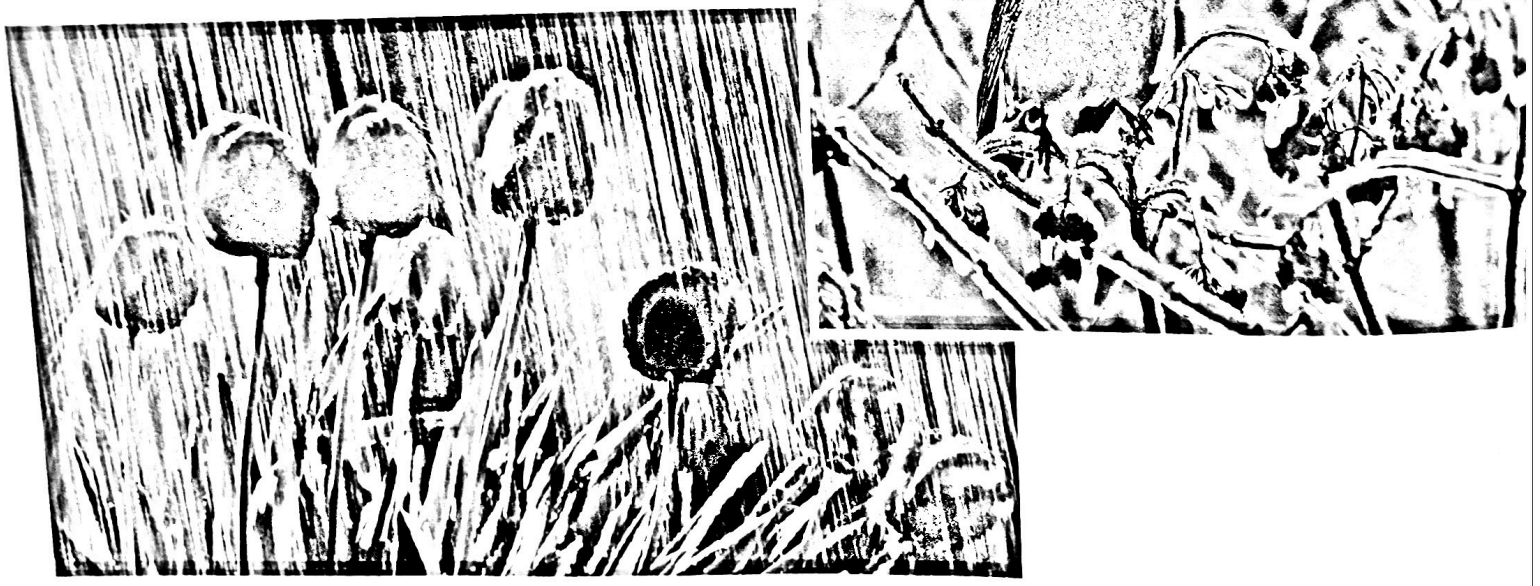


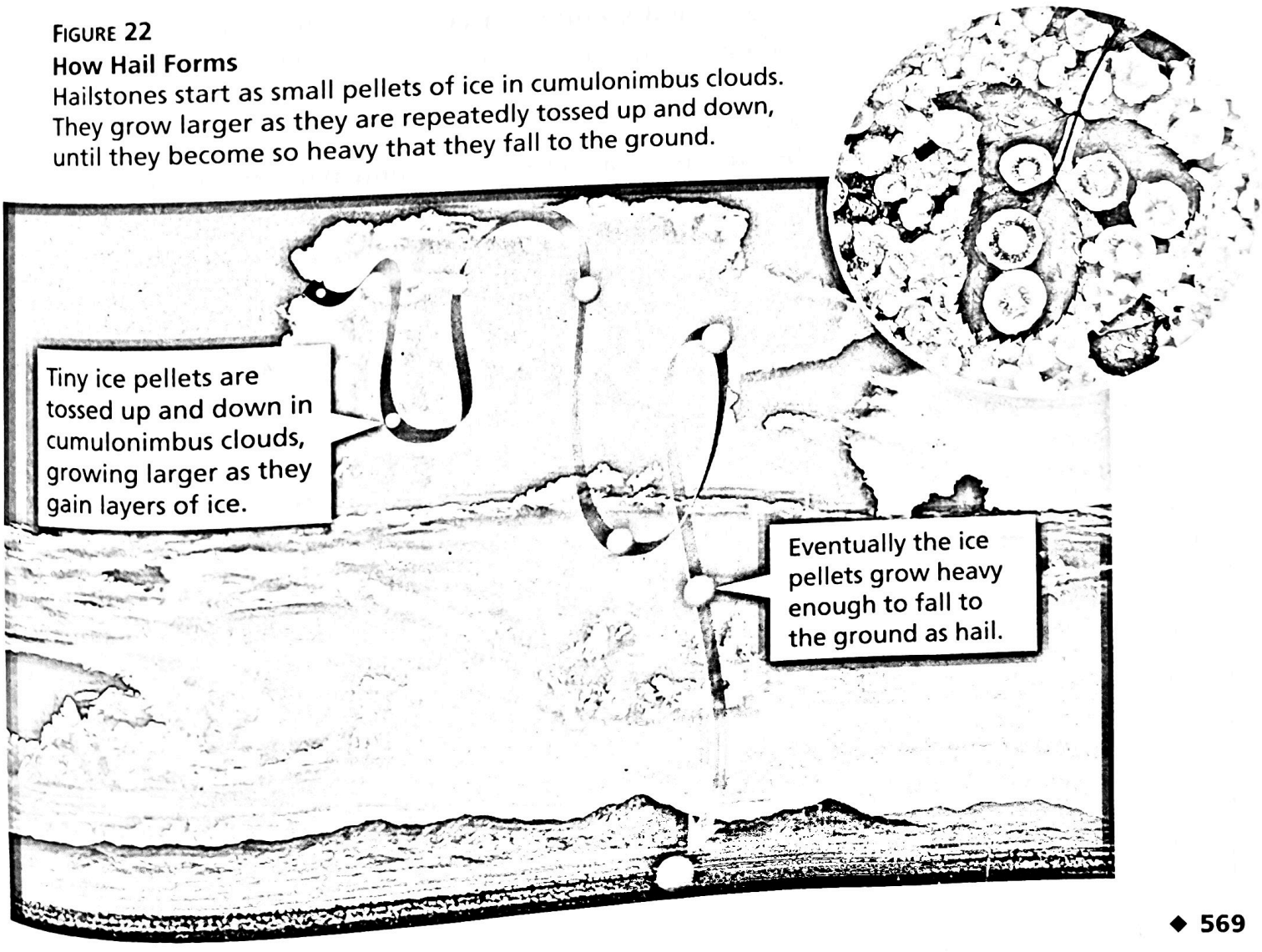
FIGURE 20
Rain and Freezing Rain
Rain is the most common form of precipitation. Freezing rain coats objects with a layer of ice.
Relating Cause and Effect *What conditions are necessary for freezing rain to occur?*

Snow Often water vapor in a cloud is converted directly into ice crystals called snowflakes. Snowflakes have an endless number of different shapes and patterns, all with six sides or branches. Snowflakes often join together into larger clumps of snow in which the six-sided crystals are hard to see.

FIGURE 21
Snowflake
Snowflakes are tiny ice crystals. They all have six sides or branches.

Hail Round pellets of ice larger than 5 millimeters in diameter are called hailstones. Hail forms only inside cumulonimbus clouds during thunderstorms. A hailstone starts as an ice pellet inside a cold region of a cloud. Strong updrafts carry the hailstone up through the cold region many times. Each time the hailstone goes through the cold region, a new layer of ice forms around it. Eventually the hailstone becomes heavy enough to fall to the ground. If you cut a hailstone in half, you often see shells of ice, like the layers of an onion, as shown in Figure 22. Because hailstones can grow quite large before finally falling to the ground, hail can cause tremendous damage to crops, buildings, and vehicles.

FIGURE 22
How Hail Forms
Hailstones start as small pellets of ice in cumulonimbus clouds. They grow larger as they are repeatedly tossed up and down, until they become so heavy that they fall to the ground.



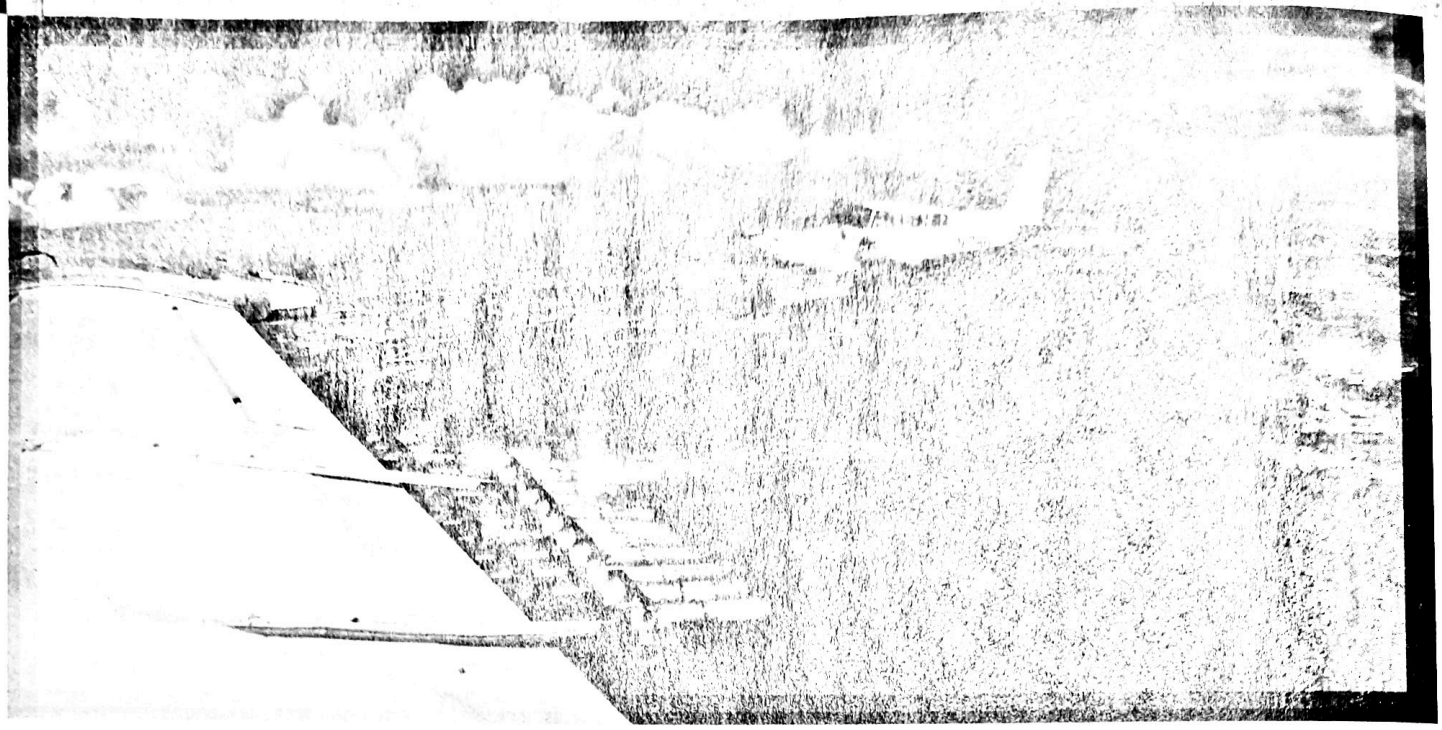


FIGURE 23
Cloud Seeding
Small planes are used to sprinkle chemicals into clouds to try to produce rain.

Modifying Precipitation Sometimes a region goes through a period of weather that is much drier than usual. Long periods of unusually low precipitation are called **droughts.** Droughts can cause great hardship.

Since the 1940s, scientists have been trying to produce rain during droughts. One method used to modify precipitation is called **cloud seeding.** In cloud seeding, tiny crystals of silver iodide and dry ice (solid carbon dioxide) are sprinkled into clouds from airplanes. Many clouds contain droplets of water which are supercooled below 0°C. The droplets don't freeze because there aren't enough solid particles around which ice crystals can form. Water vapor can condense on the particles of silver iodide, forming rain or snow. Dry ice cools the droplets even further, so that they will freeze without particles being present. However, to date cloud seeding has not been very effective in producing precipitation.

Reading Checkpoint **What is a drought?**

Lab zone Skills Activity

Calculating

Make a rain gauge by putting a funnel into a narrow, straight-sided glass jar. Here's how to calculate how much more rain your funnel collects than the jar alone.

1. First measure the diameter of the top of the funnel and square it.
   Example: $4 \times 4 = 16$
2. Then measure the diameter of the bottom of the jar and square it.
   Example: $2 \times 2 = 4$
3. Divide the first square by the second square.
   Example: $\frac{16}{4} = 4$
4. To find the actual depth of rain that fell, divide the depth of water in the jar by the ratio from Step 3.
   Example: $\frac{8\text{ cm}}{4} = 2\text{ cm}$

Measuring Precipitation

There are various ways to measure the amount of rain or snow. **Scientists measure precipitation with various instruments, including rain gauges and measuring sticks.**

Snowfall Measurement Snowfall is usually measured in two ways; using a simple measuring stick or by melting collected snow and measuring the depth of water it produces. On average, 10 centimeters of snow contains about the same amount of water as 1 centimeter of rain. However, light, fluffy snow contains far less water than heavy, wet snow.

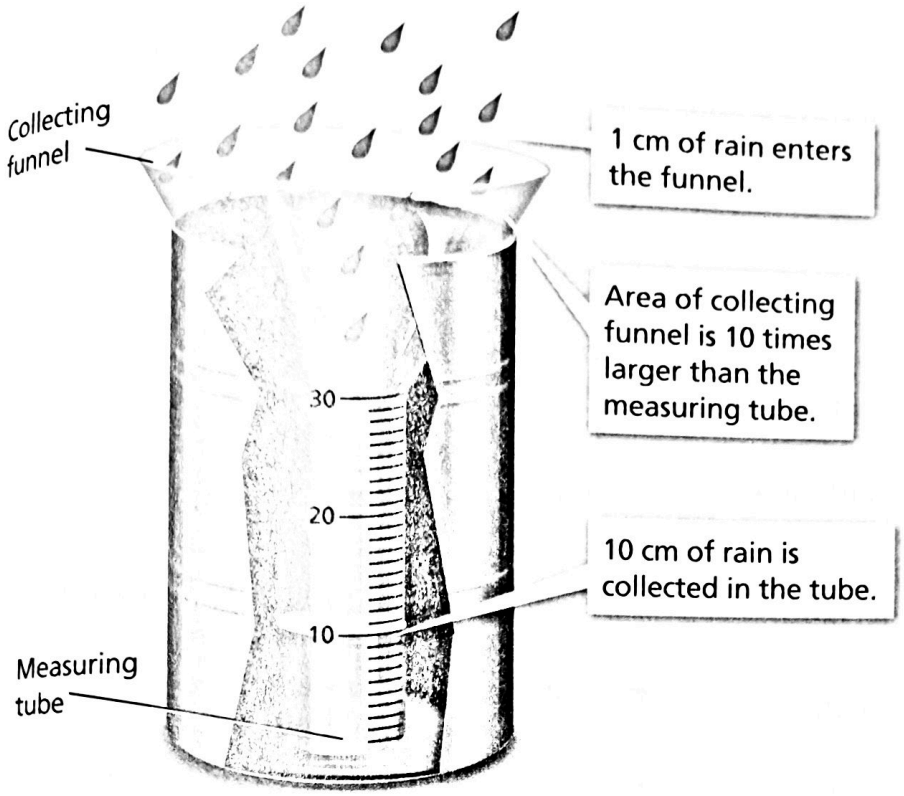


FIGURE 24
Rain Gauge
A rain gauge measures the depth of rain that falls.
Observing *How much rain was collected in the measuring tube of this rain gauge?*

Rain Measurements An open-ended can or tube that collects rainfall is called a **rain gauge.** The amount of rainfall is measured by dipping a ruler into the water or by reading a marked scale. To increase the accuracy of the measurement, the top of a rain gauge may have a funnel that collects ten times as much rain as the tube alone, as shown in Figure 24. The funnel collects a greater depth of water that is easier to measure. To get the actual depth of rain, it is necessary to divide by ten. The narrow opening of the tube helps to minimize evaporation.

Section 5 Assessment

Target Reading Skill Using Prior Knowledge Review your graphic organizer about precipitation and revise it based on what you have learned.

Reviewing Key Concepts

1. a. **Listing** Name the five common types of precipitation.
   b. **Comparing and Contrasting** Compare and contrast freezing rain and sleet.
   c. **Classifying** A thunderstorm produces precipitation in the form of ice particles that are about 6 millimeters in diameter. What type of precipitation would this be?
   d. **Relating Cause and Effect** How do hailstones become so large in cumulonimbus clouds?
2. a. **Identifying** How can a rain gauge be used to measure precipitation?
   b. **Explaining** How does the funnel in a rain gauge increase the accuracy of the measurement?

Writing in Science

Firsthand Account Think about the most exciting experience you have had with precipitation. Write a paragraph about that event. Make sure you describe the precipitation itself as well as the effect it had on you.