



Be a Scientist!

You have just learned that hailstones grow by gaining a layer of ice each time they are blown upward in a cloud. Create a model of a hailstone that includes a representation of at least four layers of ice. Write down the materials and steps you will use to make your model. If your teacher approves your plan, make your model.

Be prepared to explain your hailstone model to the class by answering the following questions:

- What stage in the formation of a hailstone does each of your steps show?
- How is the way your model was formed similar to and different from the way a real hailstorm forms?
- How could you improve your model?



Beyond the Book

Search the Internet to learn about hail records and to find a video of a hailstorm in action.

FOCUS Book

Hailstorms



: Science A-Z 

Hailstorms



FOCUS Question

What causes hailstorms?

Cause and Effect

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What Is Hail?

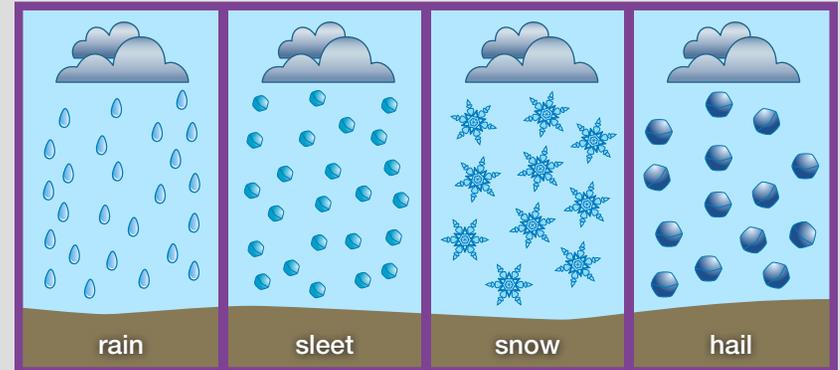
You're walking home on a hot summer day when suddenly the sky becomes dark. A loud *BOOM* of thunder startles you. Then countless balls of ice start falling from the sky. Ice on a hot summer day? You bet—it's a hailstorm!

Hail is a form of frozen precipitation—water that falls from the sky to the ground. It is made up of balls, or *pellets*, of ice. A single piece of hail is called a *hailstone*. Hailstones are usually about the size of a pea, but they can be as large as a grapefruit.



Most hailstones are made up of layers of ice. Air bubbles make some of the layers look cloudy.

TYPES OF PRECIPITATION



Rain forms when condensed water in clouds falls to the ground or when ice melts as it falls.

Sleet forms when rain freezes by falling through cold air near the ground.

Snow forms when water in clouds freezes before falling to the ground.

Hail forms during thunderstorms as strong winds interact with moisture in the air.

The Ups and Downs of Hail

In the United States, the only cold thing people usually think about in summer is ice cream. While sleet and snow fall in winter, hail normally falls in summer from a type of cloud called *cumulonimbus* (KYOOM-yuh-low-NIM-bus). These clouds produce thunderstorms.

Thunderstorms have just the right conditions for making hail. They have *updrafts*—air that flows upward at high speeds—and *supercooled* water droplets. These tiny raindrops are below the freezing point but have not yet frozen solid.

Strong updrafts catch the supercooled droplets, hurling them high up in the cloud. Here, cold air freezes them, either alone or around tiny ice crystals that form the center of hailstones. Once they get heavy enough, the hailstones start to fall.

Cumulonimbus clouds are often flat on top, like an anvil. They form where bodies of air called *air masses* meet. These clouds produce hail, thunder, lightning, and heavy rain.

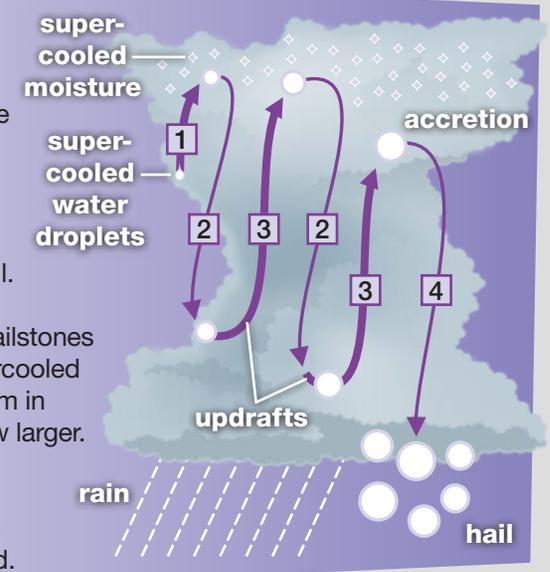


While falling through the air, small hailstones may get caught in updrafts and pulled higher again. More supercooled water freezes around them and they grow. The hailstones grow larger and larger as they gain more layers through a process called *accretion*.

Updrafts can force hailstones upward over and over; the hailstones grow by accretion and then fall. The more often the cycle repeats, the larger the hailstones grow. This cycle continues until the hailstones get too heavy and fall all the way to the ground. Strong storms have powerful updrafts that can make very large hailstones before they fall to the ground.

HOW HAIL FORMS IN A THUNDERSTORM

1. Updrafts carry supercooled raindrops high up, where they freeze to form hailstones.
2. When they grow heavy with ice, hailstones start to fall.
3. Updrafts send the hailstones back up. More supercooled water freezes on them in layers, and they grow larger.
4. Hailstones grow too heavy with ice layers and fall to the ground.



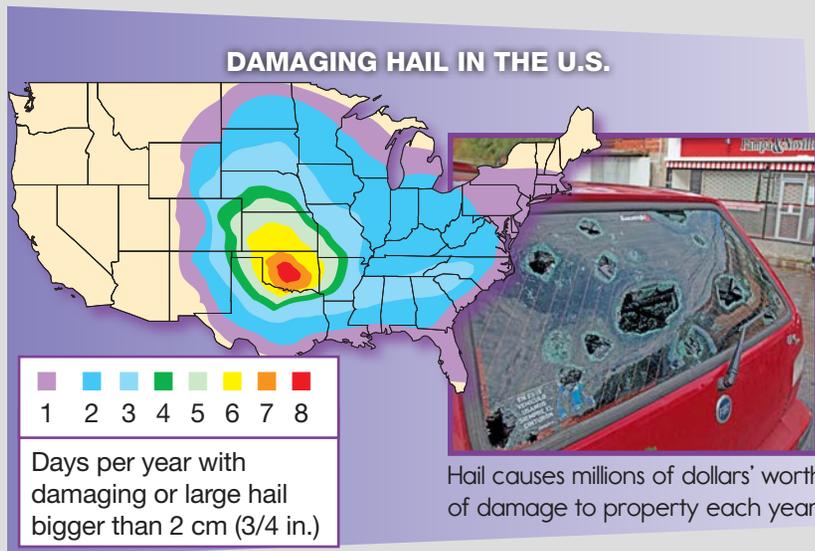
Look Out Below!

Some people refer to hail as “the white plague” because hail can cause millions of dollars in damage! Rock-hard hailstones can cause serious damage to crops, cars, buildings, and aircraft. Even small hailstones can crush plants, dent cars, break windows, and harm animals. Although it is rare, people and other animals can die from hail.

Hailstorms can occur anywhere thunderstorms happen. In the United States, hail most often occurs in the Great Plains states in the middle of the country. This area is known as Hail Alley.

wowser!

Hailstones hurtle toward the ground at speeds up to 145 kilometers (90 mi.) per hour!



Hail Events

On July 23, 2010, a terrible thunderstorm hit Vivian, South Dakota. Afterward, a man named Les Scott spotted something amazing. It was a huge hailstone about the size of a volleyball! His find broke the record for the largest and heaviest hailstone in the United States.

The deadliest hailstorm happened in India on April 30, 1888. The storm killed at least 246 people in an area outside Delhi.

RECORD-BREAKING HAILSTONES IN THE UNITED STATES

Measurement	Data	Date	Location
largest (circumference)	47.6 cm (18.75 in.)	June 22, 2003	Aurora, Nebraska
largest (diameter)	20.3 cm (8 in.)	July 23, 2010	Vivian, South Dakota
heaviest	0.88 kg (1.94 lb.)	July 23, 2010	Vivian, South Dakota



This record-breaking Vivian hailstone was found after a severe thunderstorm.

The Mystery of Skeleton Lake

In 1942, a forest ranger in the Himalayan Mountains of India discovered something shocking. He found the remains of more than two hundred people frozen in a lake. People started calling this place Skeleton Lake.

Scientists learned that the remains were more than one thousand years old. The ice may have helped to preserve them. The scientists noticed that many of the bones had wounds made by large, round objects. But they didn't find any weapons or hard, round objects nearby.

The conclusion? These people were probably travelers trapped without shelter in a hailstorm.



Skeleton Lake's real name is Roopkund Lake. It is located high in the Himalayan Mountains of India.



These human remains were found at Skeleton Lake in India.

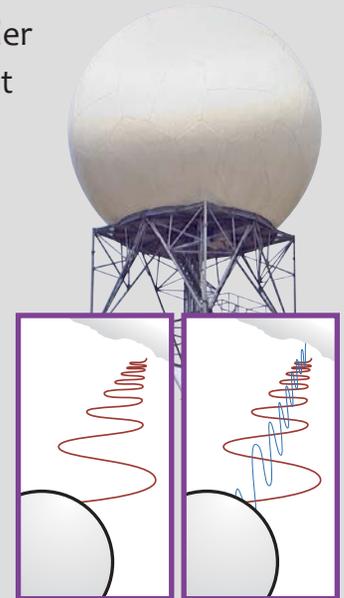


Predicting Hailstorms

Want to avoid hail? Use *radar*! Weather forecasters use it to learn about and predict hailstorms.

For years, forecasters used Doppler radar. This type of radar sends out beams of energy that bounce off the clouds in a storm. The echoes return to a satellite dish, and a computer analyzes them. This data provides information about where and how much precipitation is falling, but it's hard to tell hail from rain.

Now, forecasters use *dual-polarization radar*, which sends out two beams of energy: a horizontal beam and a vertical beam. With echoes coming in from two directions, the computer can tell hail from rain. Forecasters use this information to warn people of hailstorm danger heading their way.



Doppler radar sends out only horizontal beams of energy. Dual-polarization radar sends out both horizontal and vertical beams of energy.



Weather forecasters use radar images like this one to predict hailstorms.

Staying Safe

In the United States alone, about twenty-four people are injured by hail each year. Don't be one of them! Just learn a few do's and don'ts to remain safe.

- ✓ **Do** go indoors! Hail, thunder, and lightning often occur together. Protect yourself from being struck by hail or lightning. Remember this advice: "When thunder roars, go indoors!"
- ✓ **Do** stay informed! Tune in to weather forecasts online, on TV, or on the radio to stay informed about approaching hailstorms.
- ✓ **Don't** try to outrun a hailstorm! If you know or think that a hailstorm is approaching, get inside immediately.
- ✓ **Don't** go near windows or doors! Hail can break glass, and the glass can harm you.



During a hailstorm, get indoors and stay there until hail stops falling and the storm passes.



Stay informed to know when a hailstorm is heading your way.

Read-Think-Write

Write your answers on separate paper. Use details from the text as evidence.

- 1 A single piece of hail is called _____.
 - A an updraft
 - B a hailstone
 - C a hailstorm
 - D an ice cube
- 2 Look at the diagram of precipitation on page 2. How is sleet similar to hail? How is it different?
- 3 How did the record-breaking hailstone found in South Dakota get so large?
- 4 Why couldn't the scientists find the objects that caused the tragedy at Skeleton Lake?
- 5 Why does *dual-polarization* radar help weather forecasters provide more accurate predictions of hailstorms than Doppler radar?

FOCUS Question

What causes hailstorms? Based on the text and the diagrams, write a list of the steps involved in hail formation.

