

Thunderstorms



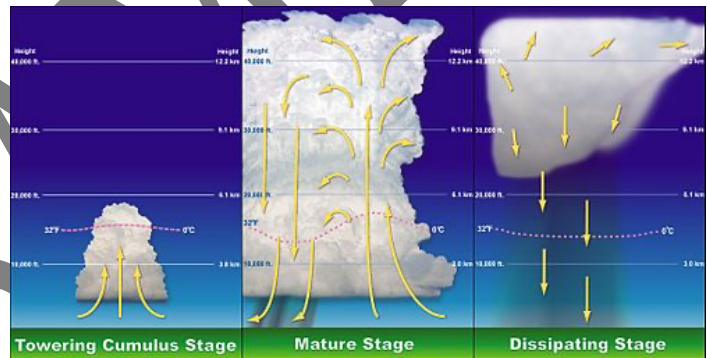
Thunderstorms are rainstorms with thunder and lightning.

What is a thunderstorm?

A **thunderstorm** is a rainstorm with thunder and lightning. The rain of thunderstorms can be heavy, accompanied by heavy winds, and there can even be hail or a tornado.

What causes thunderstorms?

Thunderstorms form in a specific type of cloud: **cumulonimbus clouds**. Clouds form when the Sun heats up large bodies of water until some water evaporates. As the water vapor rises, it condenses into clouds. When increasingly more wet air continues to rise after a cloud has formed, the cloud gets bigger and bigger, piling up into a towering cumulonimbus cloud. Cumulonimbus clouds can extend 10 km (33,000 ft) or higher into the atmosphere. As more water condenses within clouds, the droplets start to become too heavy to remain suspended and fall back to Earth as precipitation. Large water droplets condense in the middle and bottom of a cumulonimbus cloud and ice crystals form near the top (because it is colder the higher in the atmosphere you go). As the precipitation falls through the cloud, it brings air along with it, resulting in wind radiating out from the bottom of the cloud.



Cumulonimbus clouds result in thunderstorms.



Thunder is caused by lightning.

What is thunder?

Thunder is the sound of **lightning**. Lightning generates heat, which heats up the air around it. Lightning can heat surrounding air up to 50,000°F (27,760°C), three times hotter than the surface of the Sun. This heat causes the cylinder of air around a bolt of lightning to rapidly expand and contract, generating vibration. The vibration makes the loud thunderclap that characterizes thunderstorms. These vibrations continue, becoming smaller and smaller, causing a low rumbling sound.

What is lightning?

Lightning is a bright flash of electricity. It happens when ice and water particles bump into each other in a thundercloud and create an electrical charge. This happens because air is

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Cloud to ground lightning is the product of negative charges in the cloud and positive charges on the ground rushing to meet.

Recall that the negative charges in a cloud are falling. This means that the negative charge builds up in the bottom of the cloud. Because positive and negative charges attract, positive charges begin to build up on the surface of Earth beneath the cloud. Because of these positive charges, the electrons condensed in the cloud's base can discharge to Earth. They do this by descending in a jagged line, called a **stepped leader**. The positive charge from the ground begins ascending to meet it in a **streamer**. This happens too fast for us to perceive. We

just see a bolt of lightning reaching from the storm cloud to the ground. Tall things, such as trees, buildings, and mountains are struck by lightning more often than shorter things because the charges have a shorter distance to travel to reach these objects. In addition, metal conducts electricity well, so metallic objects will be more likely to be struck by lightning than non-metals. However, where lightning strikes is most dependent on where the positive charge builds up. The electric field generated between the ground and the

cloud isn't nearly as strong as the one within the cloud itself, so most lightning occurs inside the cloud.

What is hail?

Hail is produced by thunderstorms. So, even though it's frozen, it isn't confined to the winter months. Rising air within thunderstorms whisks raindrops up into very cold parts of the atmosphere. At these altitudes, raindrops freeze into hail, or balls of ice. As more and more raindrops are pushed up into these cold areas, they combine with already-formed hail to create bigger and bigger hailstones. The stronger the force of the updraft, the longer hailstones remain suspended, and the bigger they can grow. When hail becomes too heavy for the updraft to hold, or if the updraft weakens, they fall.



Hailstones are balls of ice.



Thunderstorms can generate tornadoes.

What are tornadoes?

Thunderstorms can be severe on their own or turn into **tornadoes**. Tornadoes are destructive, spinning vortexes of air that can generate wind speeds of 250 miles (400 kilometers) an hour or more. Fewer than one percent of thunderstorms have associated tornadoes. They form when warm air traveling up becomes trapped beneath a layer of cold air. The warm air has nowhere to go; it can't sink because it is less dense than the air below it. But the molecules keep moving, swirling around and around each other until a tornado forms. Tornadoes are generated from two types of thunderstorms, **supercell** and **non-supercell**.

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Are thunderstorms dangerous?

Thunderstorms are dangerous for aircraft, but also result in heavy winds, driving rain, and sometimes hail. In addition, while the likelihood of being struck by lightning is low, the effects can be severe. Between 2003 and 2012, an average of 35 people per year were killed by lightning in the United States alone. Thunderstorms can last for hours and spread



Thunderstorms are dangerous for aircraft.



Hail damages vehicles.

over 10 km wide. They can be responsible for such natural disasters as flooding or hailstorms.

Hailstones can grow from about $\frac{1}{4}$ inch in diameter to above 4 inches. The largest hailstone measured in the United States

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If a thunderstorm generates a tornado, things can be much worse. Tornadoes are the most destructive natural disaster on our planet. They can cause severe property damage through winds alone or objects picked up by the winds. They can rip through buildings, bridges, and trees, flip trains over, toss automobiles around, and even suck water out of a riverbed. While such winds can easily pick up humans, most injuries and deaths from tornadoes are due to being struck by flying objects.



Tornado damage can be severe.

Reading Comprehension Questions:

1. What
2. How are
3. Explain
4. What is thunder? Explain.
5. Explain
6. What is hail and how does it form?
7. Describe
8. What kind of thunderstorm usually leads to tornadoes and what characteristic of that storm type is responsible for the tornado formation?
9. What
10. List three dangers of thunderstorms.

Extension Questions

11. Using a template from
12. Using your search engine, find out how to tell how close a thunderstorm is. Explain here and include your source.
13. Based on what you have learned, how might you be able to predict if a thunderstorm is about to start?

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