What causes lightning and thunder?

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TOP: Lightning strikes near a rainbow over Lake Mead National Recreation Area July 1, 2015 in Lake Mead, Nevada. The storm brought very little rain to the lake, which was at a historic low. BOTTOM: Ice crystals and water droplets bump together and move apart to create a cloud with two charges. NASA.

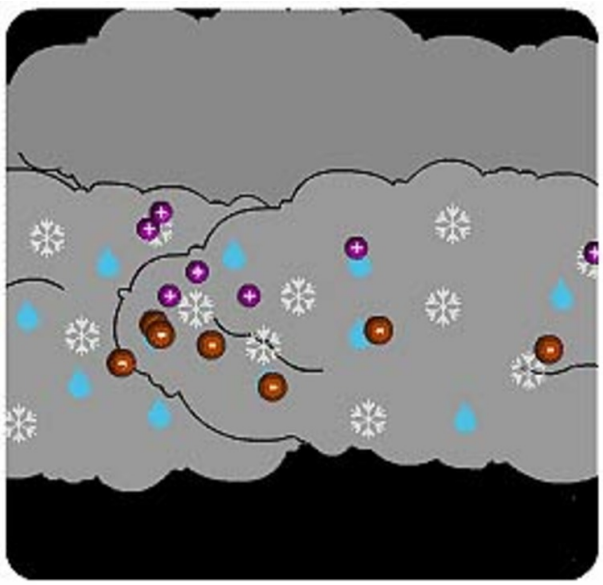
A person shuffling their rubber-soled feet across the carpet touches a metal doorknob. They get an electric shock. It's not exactly lightning, but it's the same idea.

What causes the shock? The rubber-soled shoes pick up stray electrons from the carpet. Electrons are the tiny, negatively charged particles that form an electric current. The stray electrons build up on the shoes, giving them a static charge. This is an imbalance between the positive and negative charges in an object. It's called static charge because the charge stays in one spot, rather than flowing to another spot. The word "static" means not moving.

Static charges are always "looking" for the first opportunity to "escape," or discharge. Opposite charges attract, so the electrons want to flow toward a positive charge. Touching a metal doorknob — or anything that conducts electricity — presents that opportunity, so the extra electrons jump at the chance.

What Causes Lightning?

Thunderclouds don't have rubber shoes, but there is a lot of shuffling that goes on inside them.



Lightning begins as static charges in a rain cloud. Winds inside the cloud are very wild. An upward-pushing wind lifts water droplets from the bottom part of the cloud to great heights, where the much colder atmosphere freezes them. Meanwhile, a downward-pushing wind pushes ice and hail down from the top of the cloud. When the ice going down meets water coming up, electrons are stripped off the water droplets.

The result is a cloud with a negatively charged bottom and a positively charged top. These electric fields become incredibly strong. The atmosphere acts as an insulator between them. An insulator is something that prevents the flow of electricity or heat.

The strength of the charge can sometimes overpower the insulating properties of the atmosphere, though. Then lightning happens.

How Does The Lightning "Know" Where To Discharge — Or Strike?

The electric field looks for the closest and easiest path to release its charge. Often lightning occurs between clouds or inside a cloud.

Lightning can also travel from clouds to the ground, though.

As a storm moves over the ground, the strong negative charge in the cloud attracts positive charges in the ground. These positive charges move up into tall objects like trees, telephone poles and houses. A channel of negative charge descends from the cloud looking for a path toward the ground. It is called a "stepped ladder," because it pushes toward the ground bit by bit in search of a positive charge. This phase of a lightning strike is too rapid for human eyes. It can only be seen in slow-motion video.

As the negative charge gets close to the ground, a positive charge reaches up to meet it. This positive charge is called a streamer. Lightning appears when the two channels connect. Several strokes may appear along the same path before the electrical discharge is complete. This gives the lightning bolt a flickering appearance.

What Causes Thunder?

In a fraction of a second, lightning heats the air around it to amazing temperatures. It can get as hot as 54,000 degrees Fahrenheit. That's five times hotter than the surface of the sun.

The heated air expands explosively. This creates a shockwave as the surrounding air is rapidly compressed. The heated air then contracts rapidly as it cools. This creates the first loud, cracking sound, which is followed by rumbles as the column of air continues to vibrate.

Lightning always appears before the sound of thunder. That's because light travels much faster than sound waves. By counting how many seconds pass between lightning and thunder, you can

estimate the distance of the lightning. It takes about five seconds for the sound to travel one mile. If the thunder follows the lightning almost instantly, the lightning is very close.

What Does Lightning Look Like From Space?

Lightning is an important part of weather forecasting. A new tool will map lightning activity over nearly the whole Western Hemisphere. This complete picture of lightning at any given time will help scientists. It will allow them to track dangerous thunderstorms, tornadoes, hail and flash floods.

Quiz

1 Read the sentences below.

1. *Lightning occurs when negative charges connect with positive charges.*
2. *Static charges occur when positive and negative charges are not balanced in an object.*
3. *An electric shock occurs when a person rubs his or her shoes across a carpet and then touches a metal doorknob.*
4. *Thunder occurs as a result of hot air rapidly expanding and then rapidly contracting.*

Which TWO sentences are MAIN ideas of the article?

(A) 1 and 2

(B) 2 and 3

(C) 2 and 4

(D) 1 and 4

2 Which statement would be MOST important to include in a summary of the article?

(A) The electric fields inside a rain cloud are very strong.

(B) Stray electrons can build up on shoes with rubber soles.

(C) A lightning strike can be seen in slow-motion video.

(D) Scientists want to be able to track lightning.

3 Which answer choice BEST describes the relationship between positive charges and negative charges when lightning travels from clouds to the ground?

(A) The positive charges in the clouds search for the negative charges deep in the ground.

(B) The positive charges in the clouds overpower the negative charges rising from the ground.

(C) The positive charges in the ground are attracted to the negative charges descending from the clouds.

(D) The positive charges in the ground are released after the negative charges from the clouds hit the ground.

4 Which sentence describes the connection between thunder and lightning?

(A) Thunder causes lightning to heat up the surrounding air.

(B) Thunder enables lightning to be observed more easily.

(C) Lightning is observed before thunder is heard.

(D) Lightning causes the sound waves of thunder to explode.