

☀ Atmospheric Science Explorers



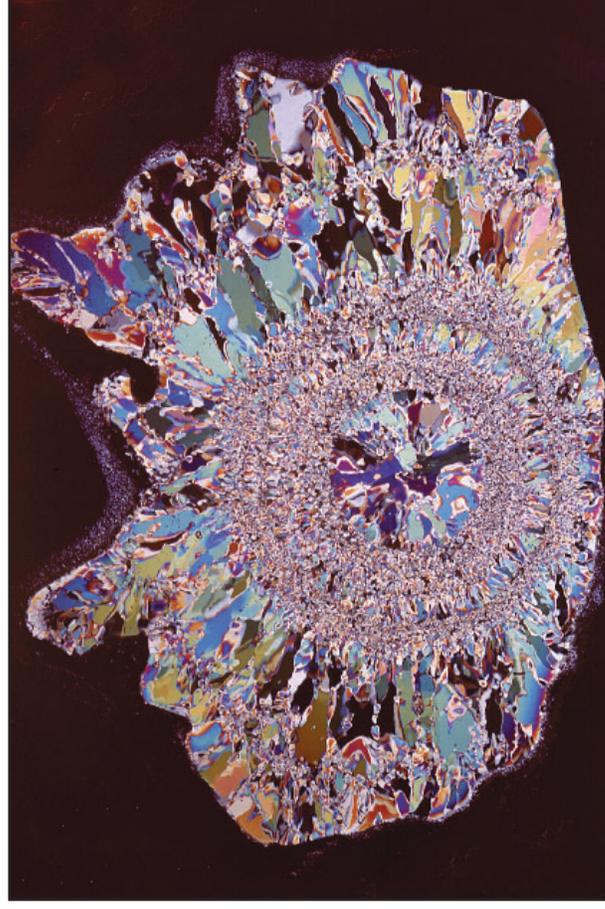
Thunderstorm - Great Plains



Tornado - Texas Panhandle



Lightning - Boulder, CO



Hailstone (under polarized light) - Coffeyville, KS

Tornado in a Bottle

How does a tornado get its twist? Make this tornado in a bottle and you'll see.

Gather the following materials:

- 2 empty 2-liter soda bottles
- 1/2" washer
- tape (duct or electrical)

Here's how to do it:

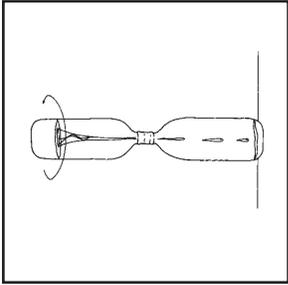
1. To make the tornado, you need a narrow circular opening from one bottle to the next. This opening needs to be smooth and free of plastic shards, burrs, etc. There are several ways to do this, but the easiest is to find a washer with a 1/2 inch hole and tape it between the two bottles or buy a Tornado Tube™ from a toy store.
2. Fill one bottle 2/3 full of water.
3. Attach your fitting.
4. Hold your tornado bottle so that the bottle with water is on top. Give it a strong swirl by moving your arms in a large circular pattern.

What's going on:

Hopefully you saw a tornado form as the water from the top bottle drained into the bottom bottle. How did this vortex get started? When you gave the bottles a spin, the water in the upper bottle

started rotating. The vortex is formed as the water drains into the lower bottle.

How does a real tornado get its twist? First the atmosphere starts rotating, but, unlike your tornado bottle, the atmosphere starts rotating while it is laying flat. The atmosphere is rolling along the ground like a barrel. It gets stood on end when it come across a strong updraft. You can try the same thing with your tornado bottle. Keep the bottle flat and start the water rotating. Then, when the water is rotating pretty fast stand the bottle on end. Did you get a tornado?



Let's Make a Cloud

What do you need to make a cloud? In this experiment you'll create your own cloud in a bottle.

Gather the following materials:

- a large glass
- warm water
- scissors
- flashlight
- a large balloon
- matches

Here's how to do it:

1. Position the flashlight so that it shines through the jar and toward you.
2. Cut the neck off the balloon. The balloon needs to stretch across the mouth of the jar. Don't make it too tight because you need to be able to pull the balloon up, while it is still attached to the jar.
3. Take the balloon off the jar. Pour enough warm water to barely cover the bottom of the jar.
4. Light a match and drop it into the jar.
5. Stretch the balloon over the top of the jar.
6. Turn on the flashlight. Now pull up on the balloon, but don't pull the balloon off the jar. What do you see inside the jar?

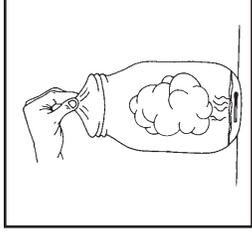
What's going on:

When you pulled up on the balloon, you should have created a small, swirling fog in your jar. How did it get there? In the jar you had all the ingredients

to make a cloud: 1) invisible water vapor in the air (that is why you added the warm water); 2) tiny particles for the water to condense onto (that is why you added the smoke); 3) a drop in pressure and temperature (that is why you pulled up on the balloon).

The temperature of the air dropped because it expanded. When you pulled the balloon up, the air inside the jar had more room. To fill that extra room it had to expand. When air expands it cools, and when air cools it might form a cloud.

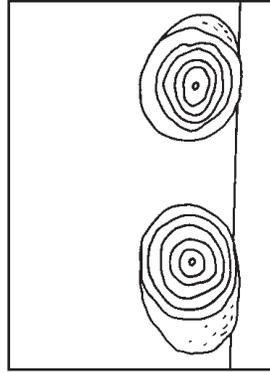
When you released the balloon the cloud disappeared. This is because the pressure and temperature of the air inside the jar rose, and the liquid water in your cloud went back to being invisible water vapor.



Dissecting Hailstones

times the hailstone went up and down inside the cloud before it got too heavy and fell to earth.

How did the hailstone stay in the cloud? Thunderstorms have powerful updrafts that kept the hailstone aloft until it was just too heavy. Compare your tracing to the ones here.



Homemade Lightning

Lightning is the atmosphere's grandiose display of static electricity. How can you make a safe lightning bolt in your home? This shocking experiment will show you.

Gather the following materials:

- a wool sock
- Styrofoam tray
- pencil with a long eraser
- thumbtack
- disposable aluminum pie plate

Here's how to do it:

1. Poke the thumbtack up through the middle of the pie plate.
2. Stick your pencil's eraser onto the thumbtack. Your pencil is now a handle.
3. Turn the Styrofoam plate upside down. Energetically rub the wool sock across the bottom of the Styrofoam plate for about a minute.
4. Put the metal pie plate on top of the Styrofoam tray.
5. Briefly touch the metal plate with your finger. You might get a shock!
6. Hold onto your pencil handle and lift the metal plate off the Styrofoam plate.
7. Your metal plate is now charged. Hold the metal plate close to a door knob and look for your homemade lightning.

Lightning, really just a big spark, occurs because the cloud and the ground have different charges. When you rubbed the wool sock on the Styrofoam tray, you gave the plate a negative charge. When you got your finger close to the aluminum plate you got a small shock because your finger tip and the plate had different charges. In thunder clouds updrafts and downdrafts act to separate electric charges. The top of a cloud usually has a positive charge while the bottom has a negative charge. It takes about 10,000 volts to make a spark 1 inch (2.54 centimeters) long. Imagine how many volts it takes for a spark to jump from the bottom of a cloud to the ground.

