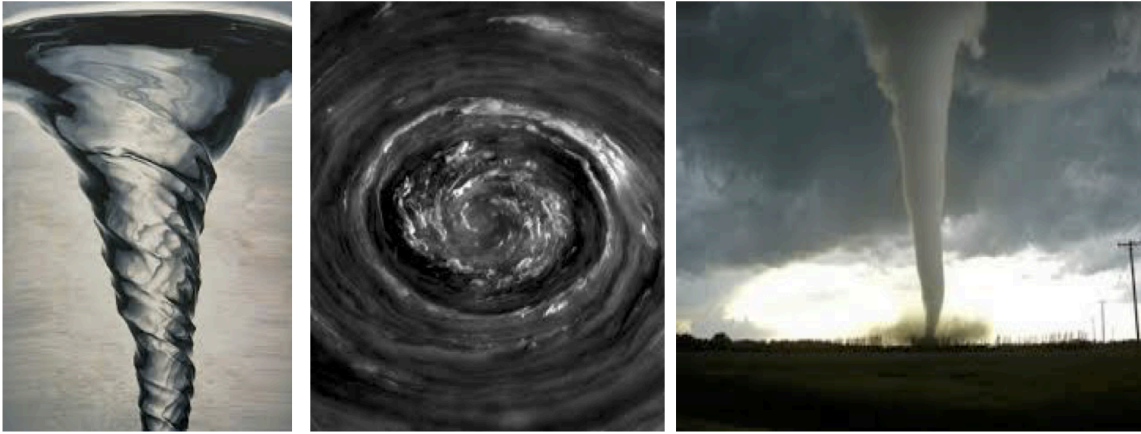


TORNADO IN A BOTTLE

TIME	TASK	DESCRIPTION	NEEDS
5 min	Introduction	The teacher will review the day's tasks.	• have notes in the handout
5 min	What is a Vortex	The teacher will have a brief conversation with students asking them about Vortexes. Have you heard of a Vortex? What is a Vortex?	• have notes in the handout
5 min	Why do Tornados Happen	Students will write a quite response questions: What is a Tornado ? Why do Tornados happen.	• have notes in the handout
10 min	Quick Read	Students will read a quite summary about Vortex rings and Tornados	• have notes in the handout
10 min	Explanation	Students will write an explanation.	• have notes in the handout
20 min	Making TIB	Students will put together their Tornados in a bottle and test them. A) Make one with plain water. Try to make it both ways, B) Add colored water to test the effect	• have notes in the handout
10 min	Explanation	Student will plan to record their explanation video	• have notes in the handout
10 min	Video Explanation	Student will record their video explanation	• have notes in the handout
5 min	Clean Up	Clean up time	• have notes in the handout

What is a Vortex?

A Vortex is a powerful circular current of a liquid or a gas. This can happen in water or in gases. Some examples of a vortex are spinning masses of air or whirlpools. Take a look at the picture below:



This picture shows a whirlpool and the top and side of a hurricane. In all of those examples, air is spinning rapidly around a central point. Then the air or water starts to spin in spins fast and moves together. Scientists call this type of spinning movement of water or gas a Vortex.

Why do Tornadoes Happen?

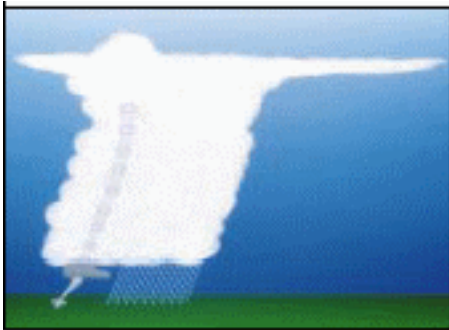
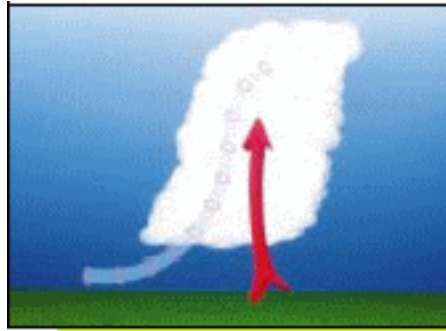
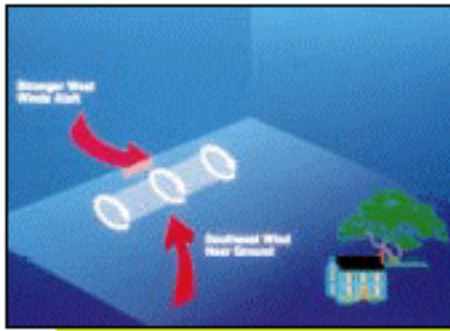
What is a tornado?



A tornado is a violent rotating column of air extending from a thunderstorm to the ground. The most violent tornadoes are capable of tremendous destruction with wind speeds of up to 300 mph. They can destroy large buildings, uproot trees and hurl vehicles hundreds of yards. They can also drive straw into trees. Damage paths can be in excess of one mile wide to 50 miles long. In an average year, 1000 tornadoes are reported nationwide.

How do tornadoes form?

Most tornadoes form from thunderstorms. You need warm, moist air from the Gulf of Mexico and cool, dry air from Canada. When these two air masses meet, they create instability in the atmosphere. A change in wind direction and an increase in wind speed with increasing height creates an invisible, horizontal spinning effect in the lower atmosphere. Rising air within the updraft tilts the rotating air from horizontal to vertical. An area of rotation, 2-6 miles wide, now extends through much of the storm. Most strong and violent tornadoes form within this area of strong rotation.



[Click Here](#) to learn more about tornadoes from NOAA.

What are some other factors for tornadoes to form?

Several conditions are required for the development of tornadoes and the thunderstorm clouds with which most tornadoes are associated. Abundant low level moisture is necessary to contribute to the development of a thunderstorm, and a "trigger" (perhaps a cold front or other low level zone of converging winds) is needed to lift the moist air aloft. Once the air begins to rise and becomes saturated, it will continue rising to great heights to produce a thunderstorm cloud, if the atmosphere is unstable. An unstable atmosphere is one where the temperature decreases rapidly with height. Atmospheric instability can also occur when dry air overlays moist air near the earth's surface. Finally, tornadoes usually form in areas where winds at all levels of the atmosphere are not only strong, but also turn with height in a clockwise or veering direction.

What do tornadoes look like?

Tornadoes can appear as a traditional funnel shape, or in a slender rope-like form. Some have a churning, smoky look to them, and other contain "multiple vortices", which are small, individual tornadoes rotating around a common center. Even others may be nearly invisible, with only swirling dust or debris at ground levels as the only indication of the tornado's presence.

Tornado in a Bottle

1. Remove any label from the soda bottle so you have a clear view of the inside.
2. Fill the soda bottle to the top with water. If you do not have access to a sink nearby or you don't want to move the dinner party to the kitchen, use a large pitcher to fill the bottle.
3. Here's the challenge: How long will it take to empty all of the water in the bottle into the pitcher on the table? Record your prediction on a piece of paper.
4. Without squeezing the sides of the bottle, turn it over and time how long it takes to empty all of the water. You might want to repeat this several times to validate your results. Do the test 3 times and average the results. Keep a table of your results and call this method the Glug-Glug Method. Be sure to use the same amount of water for each of the trials.
5. Fill the bottle to the top with water just as you did before. However, this time swirl the water by moving the bottle in a clockwise or counter-clockwise motion while the water is pouring out. Keep swirling the water until you see the formation of what looks to be a tornado! The water begins to swirl in the shape of a vortex and flows out of the bottle very quickly.
6. Time this method as you did before, only call it the Vortex Method. Repeat the test several times and average the results. Which method allows the water to

Duct tape Metal washer Pitcher



1.

exit the bottle more quickly? Now it's time to create a Tornado in a Bottle that you never have to refill.

1. Fill a one-liter bottle to the top with water.
2. Find a metal washer that fits flush (or as close as possible) onto the mouth of the one-liter bottle.
3. Place another one-liter bottle on the water-filled one-liter bottle so that the washer sits in place between the two.
4. Use duct tape to tape the two bottles and washer in place. Make sure that the connection is as sturdy as possible and that the duct tape does not allow any bending.
5. Turn the apparatus over so that the filled bottle is on top and swirl the water. The water will form a tornado and drain into the other bottle. You can do this as much as you want without refilling it!

Twist of Color - Try adding 2 ounces of colored lamp oil to the water. Lamp oil is available at most department stores where oil lamps are sold. The oil will float on the surface of the water since oil is less dense than water. When the oil

and water swirl together, the less dense oil travels down the vortex first and creates a "colored tornado" effect.

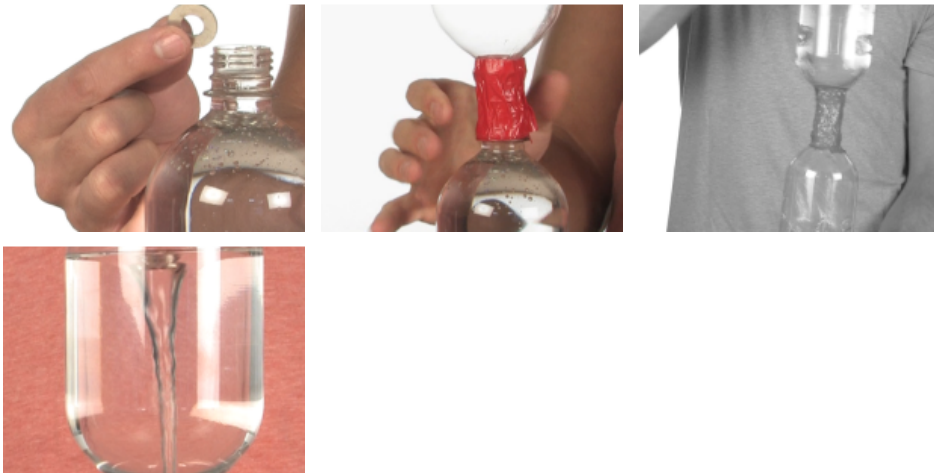
Bubbly Vortex - Try adding a squirt of dish soap to the water. As the twister drains from one bottle to the other, the top bottle will fill with soapy bubbles! This is cool and shows that as the bottom bottle fills with water, the top bottle is filling with air.

Styrofoam Storm - Add some debris to your twister. You can use small items like confetti or glitter (we've even heard of people trying Monopoly hotels), but our personal favorite is tiny styrofoam balls. The balls float but are sucked into the bottom bottle from the power of the spinning vortex. It's really cool to look at!

HOW DOES IT WORK?

If you've ever seen a dust devil on a windy day or watched the water drain from the bathtub, you've seen a vortex. A vortex is a type of motion that causes liquids and gases to travel in spirals around a center line. A vortex is created when a rotating liquid falls through an opening. Gravity is the force that pulls the liquid into the hole and a continuous vortex develops.

Swirling the water in the bottle while pouring it out causes the formation of a vortex. The vortex looks like a tornado in the bottle. The formation of the vortex makes it easier for air to come into the bottle and allows the water to pour out faster. If you look carefully, you will be able to see the hole in the middle of the vortex that allows the air to come up inside the bottle. If you do not swirl the water and just allow it to flow out on its own, then the air and water have to essentially take turns passing through the mouth of the bottle, thus the glug-glug sound.



Explanation

Directions: Use the space below to write a brief explanation of how tornados work. In your explanation use words the work Vortex.

[illegible]