Activity: Tornado in a Bottle

What You'll Need:

- ❑ One or two 2-liter soda bottles or other large, clear, plastic bottles
- ❑ Metal washer (optional)
- ❑ Duct tape
- ❑ Water
- ❑ Food coloring (optional)
- ❑ Glitter (optional)
- ❑ Dish soap (optional)

Procedure:

<table>
<tr><th>FOR ONE BOTTLE</th><th>FOR TWO BOTTLES</th></tr>
<tr><td>Step 1
Fill your bottle 2/3 full with water</td><td>Step 1
Fill your first bottle 2/3 full with water</td></tr>
<tr><td colspan="2">Step 2
If you want to – add dish soap, glitter, or food coloring to make your tornado extra visible and stylish!</td></tr>
<tr><td>Step 3
Get a big bowl or go to a sink. Place your hand on the opening of the bottle.</td><td>Step 3
Connect your two bottles:
1. If you have a metal washer you can put it on top of the bottle with water.
2. Put the empty bottle upside down on the bottle with water so the openings are together
3. Duct tape the two bottles together</td></tr>
<tr><td>Step 3a
Turn the bottle over the bowl or sink and remove your hand. Observe and listen to how the water comes out of the bottle. Why do you think it’s doing this?</td><td rowspan="2">Step 3
Quickly turn the bottle and set it on a desk or a table so that it’s standing vertically. A few drops might fall into the lower bottle, but not much. Why do you think no water is coming down?</td></tr>
<tr><td>Step 3b
Refill the bottle like in steps 1 and 2</td></tr>
<tr><td>Step 4</td><td>Step 4</td></tr>
</table>

FOR ONE BOTTLE	FOR TWO BOTTLES
With your hand still on the opening, turn the bottle over the bowl or sink and move it in a circle, like you're stirring something. Then remove your hand and see what happens to the water.	Start to move the bottles in a circle, like you're stirring something. Watch what happens to the water.

Did you see a **vortex** form and see the water spiral out of the bottle like a tornado?

OPTIONS

You can try repeating this experiment with different sized bottles or different amounts of water to see how it changes the size and shape of the vortex. Do you think more water will lead to a bigger or smaller vortex? What about a bigger bottle?

The Science Behind It:

If you've ever watched the water drain from the bathtub, you've seen a vortex. A **vortex** is a type of motion that causes liquids to travel in spirals around a center line. The vortex in this experiment is created when gravity pulls the water through a small opening to form a rotating tornado.

Swirling the water in a bottle while pouring it out causes the formation of a vortex, making it easier for air to come into the bottle and allows the water to pour out faster. 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. When you use one bottle, this makes the "glug-glug" sound. But when you use two bottles taped together, the water doesn't really move at all. Why is that?

It's because of something called **pressure**. The two bottles together have a fixed amount of air and a fixed amount of water inside of them. When you flip the bottles, it isn't just about pouring the water into the bottom bottle, it's about having the water trade places with the air. If you flip the bottles quickly, the water will get in the way of the air in the bottom bottle. This creates **high pressure** in the bottom bottle and **low pressure** in the top bottle. When you spin the bottle and create an opening in the water, you're allowing the high pressure air in the bottle to move into the low pressure air in the top bottle and let gravity pull the water down in a vortex.