

# Water Wonders

DuneCraft

## Instructions and Experiment Guide

Create exciting action in a bottle with Water Wonders! It is safe for ages 5 up, and is guaranteed to provide ions of scientific fun! Prepare to be mesmerized by the vortex that is created within the bottles, experiment, and find out why! Use these experiments to study kinetic and potential energy, as well as the atmospheric conditions needed to create a tornado vortex. These colorful plastic tubes and connectors are a great introduction to any weather unit.

## Fun Things You Can Do!

- Create your own colorful tornado!
- Add glitter for some extra sparkle!
- For real clean fun, add dishwashing liquid and watch what happens!

### Kit Contains:

- Genuine Tornado Tube
- Fountain Connection
- Water Coloring Tablets

### You Will Need:

- Four 2-Liter Bottles
- Water
- Glitter
- Dishwashing Liquid
- Vegetable Oil

## How it Works

Water Wonders provides a hands on demonstration of Vortex Action. Vortexes are tornados, whirlpools, water-spouts and similar motions in fluids that occur when liquid drops through an opening. The action is in the concentration of kinetic energy, motion of the fluid. In the atmosphere, thermals and wind shear are the source of the energy which produces the tornado vortex. In liquids, such as water, the potential energy (mass) is converted to kinetic energy as it descends, pulled by gravity through an opening. A small initial rotation about the opening becomes more violent (higher rotational velocity) as the molecules come closer to the center. The resulting outward force tends to keep the liquid out of the exact center, maintaining a "hole" in the remaining liquid.

When you add the clear tubes and the bottles are inverted, gravity pulls the water from the upper bottle down through the lower tube and compresses the air in the lower bottle. When water leaves the upper bottle, a decrease in pressure, or partial vacuum, is formed. Air is then forced from the lower bottle, up the fountain tube, and takes the place of the water as it leaves the upper bottle.

If you examine the clear tubes near where they enter the bottle connector, you will be able to see several small holes. When the bottle is turned over, water runs into these small holes and is pushed upwards by the air with enough force to form the fountain at the top of the bottle. This is the same type of action that moves water in fish tank filters and some types of coffee percolators. The tube in the lower bottle has no effect on the formation of the fountain. Try it with one tube removed.

## Company Information

DuneCraft

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**1** How does Water Wonders work with and without the clear tubes?

The clear plastic tubes have holes drilled near the one end. Insert this end into the connector approximately  $\frac{1}{4}$  inch. Next, clean out four plastic 2-liter soda bottles and remove the labels using hot air from a hair dryer. Some soda bottles have separate molded bottoms. It is best to remove this piece for a better view of what happens. This base can be removed easier if it is heated first with hot water or a hair dryer to soften the glue. Press the two sets of bases together to make a stand to hold the bottles upright, or, most of the base can be cut away leaving just the flat section still attached. Lastly, fill one bottle from each set  $\frac{3}{4}$  full with water and connect the two bottles together. The fountain will erupt every time you turn the bottle over in the first set of bottles. The second set of bottles using just the connector creates a tornado. A vortex is created in the middle of the tornado as the bottle is shaken and shaken some more.

**2** Add 4-5 drops of food coloring into the bottles with the water before letting the fountain erupt. What happens with the food coloring?

The food coloring moves throughout the water until all of the water turns colors so it is evenly distributed throughout the water. This movement of water to achieve equal distribution is called osmosis. It is very important in the study of cells and transfer of materials. As the fountain erupts and the tornado is created you'll notice that all the water has turned blue.

**3** Have the same 4 bottles on hand, with the water and food coloring already mixed. Now add a spoonful of glitter to the bottle that is  $\frac{2}{3}$  full of water. Swirl the glitter around. What happens?

The glitter is sucked down by the clear tubes in the first set of bottles until the glitter reaches the bottom 2-liter. In the second set of bottles with just the connector the glitter is being sucked in by the vortex of the tornado. It swirls and swirls to the

bottom bottle. With tornadoes, this is much like how a tornado sucks up houses, signs, cars, etc. in force. The objects are quickly sucked in and are moving towards the vortex of the tornado.

**4** Empty the above bottles and refill one  $\frac{2}{3}$  full of clean water. Now add 5 drops of dishwashing liquid. Again, repeat the above steps as you shake the bottle in a circular motion to create a vortex. Does the dishwashing liquid cause a reaction?

There is an explosion of bubbles when dishwashing liquid is added to the water as the vortex is created in the second set of bottles. As the vortex drops down further and further suds are created above it as bubbles are being transferred into the bottom bottle. There is no chemical reaction with this. In the first set of bottles, bubbles were produced at the bottom but not the top of the fountain.

**5** Do oil and water mix? Add several drops of oil to a plastic bottle that is  $\frac{2}{3}$  full of water. Swish the bottle around for a moment and observe. Now flip the bottle and repeat the steps to achieve a vortex. What happens? Do oil and water mix?

Oil and water do not mix. In this experiment the water becomes thicker and the tornado moves in slow motion. The oil slowly seeps to the bottom bottle. Molecules are classified as polar and non-polar. Polar molecules mix with water while non-polar molecules do not. Polar molecules tend to bond only with other polar molecules. The same holds true for non-polar molecules. Oil is a non-polar molecule therefore it does not mix with water, a polar molecule.

**6** Can you create a partial vacuum in the upper bottle with the clear tubes and connector? Start the fountain and unscrew the lower bottle. Lift the fountain up. Air rushes up the fountain tube to occupy the empty space and takes water with it. Place a tray underneath to catch any spilled water.

**7** Can you demonstrate that air is compressed in the lower bottle in the bottle with the clear tubes? Start by cutting the base off a third bottle and replace this for the upper bottle. Hold your finger on the hole of the tube and fill this open bottle with water. Let go of the tube and the fountain will start. Use a tray underneath to catch any spilled water.