# Water Acrobatics

**Estimated Time: 30-60 minutes**


**SUMMARY**

The density of water depends on the temperature of water. Mixing cold and hot water together creates some interesting flipping. With some food coloring you can watch this happen and this demonstration shows just how waters of different temperatures behave when mixed together.


**WHAT YOU'LL LEARN**

- Hot water is less dense than cold water. Denser liquids sink below liquids that are less dense.
- Moving water doesn't mix and currents can be seen with food coloring.

| **Materials Used** | |
|---|---|
| • Two small containers (wide-mouthed)<br>• Water (hot and cold)<br>• Food coloring<br>• Ruler | • 3 x 5" index cards *or* wax paper<br>• Scissors<br>• Shallow baking pan |
| **Resources Used** | |
| • Hot and Cold Fronts in a Water Tank | |

**DEMO INSTRUCTIONS**

1. Prepare your index card by cutting it into a 3-inch square and cutting two inches from the long end of the card. With wax paper, use your ruler to measure out a 3 inch square. The square should be big enough to cover the mouth of the containers; if your containers are bigger than 3 inches adjust as needed.
2. Fill one of the containers with very hot tap water and a drop of red food coloring. If your tap water isn't that hot, fill the container and microwave it. Place the hot, red water in the baking pan.
3. Fill the other container with cold water and a drop of blue food coloring. If your tap water isn't that cold, fill the container with refrigerated water. Place the cold, blue water in the baking pan.
4. Add a little more water to the cold water container, until the water bulges above the edge of the top of the container. This is called a *meniscus* and it ensures that you have water all the way to the top of the container.
5. Set your square on top of the blue container and tap it *gently* to get a good vacuum seal.
6. Carefully flip the cold water container upside down over the baking pan. The card's vacuum seal should hold it in place so that no water falls out. Gently place the cold water container on top of the hot water container so that they are separated by the square and the mouths of the containers line up.
7. With one hand (or having a partner help you) hold the cold water container in place while you slowly and carefully pull the square free.

**INTERPRETATION AND EXTENSION**

8. What happened to the water in the jars when you pulled the square free? Why do you think this happened?

9. Try the demo again with the hot water on top this time. How does this version compare to the one above? Does it help or hurt your earlier explanation?
10. Try different combinations to see what different results you can get. Your experiments might involve the following variations or anything you can imagine.
    a. What changes when one (or both) of the containers has warm water?
    b. Does anything change when you switch the food coloring colors?
    c. What happens when you leave the containers for a long while after pulling the square out? Do they settle and then sit there or do they continue to change?

**TIPS**

- Tipping the container of water upside down without spilling is a tricky maneuver that goes better with a little practice. Try it out first with regular water until you've done the flip successfully a few times. Then start the demonstration with hot and cold water.
- When the square is pulled out, the cold water mixes into the warm water but because the cold water is denser than the warm water, the cold water will sink to the bottom. You end up with the two types of water flipping their positions, and because they do so quickly they don't mix together very much. Given time, the waters will even out their temperature and begin to mix together to create warm, purple water out of the hot, red water, and the cold, blue water.
- In the Resources section above, there is a link to a video demonstration of a "weather front model" which shows horizontal mixing between hot and cold water. This should look very familiar after the demonstration above and also shows the relationship between density and the behavior of weather fronts with hot and cold air.