

## Surface Tension Activity

### Overview:

In this activity we'll learn about surface tension and how it helps us keep afloat! You are probably used to seeing things float, be it ice cubes in your drink, a rubber duck in your bathtub, or a boat on the water. But did you ever wonder how the same water that you drink, splash and dive into can support the weight of giant ships?

### Background:

Water molecules like to cling to one another via hydrogen bonds. The strength of this cohesive force creates surface tension, a property of a liquid that allows it to resist external forces. If you drop a small amount of water on a piece of wax paper, you can see a great example of surface tension in action. Instead of splashing or flattening, the water will form small, round droplets on the paper. These water droplets can hold their shapes because water molecules are more attracted to one another than they are to the wax paper. The strength of that attraction helps hold a water droplet together.

In this activity we'll be exploring surface tension with water and some household products. Get ready to make a splash!

### What you need:

- Bowl or any container that can hold water
- Water
- Pepper
- Dish soap
- Cooking oil
- Milk
- Toothpaste
- Toothpicks
- Paper
- Pencil

### Procedure:

- Use your paper and pencil to create a table with two columns and five rows. Label the first column "household product" and the second column "behavior of pepper." Add the following words to the rows in the left column: "oil," "dishwashing liquid," "milk" and "toothpaste." This will help you record your observations during this activity.
- Fill the bowl with about an inch of water.

- Sprinkle pepper evenly across the surface. Try not to sneeze! Observe the behavior of the pepper. *Does the pepper sink or float? Does it spread out or clump together? What else do you notice about the pepper?*
- Carefully dip the end of your toothpick into the cooking oil. You only need a tiny bit of oil at the end of the toothpick!
- Dip the oil-coated end of the toothpick into the water with the pepper. Observe what happens when the oil comes in contact with the water. *Does the movement of the pepper flakes on the surface of the water change when you add oil? What else do you notice about the oil and the pepper?*
- Write your observations in your table. Discard the toothpick.
- Empty and rinse your bowl.
- Fill the bowl back up with about an inch of water.
- Sprinkle pepper evenly across the surface. Again take a minute to observe how the pepper moves in the water.
- Carefully dip the end of a clean toothpick into dishwashing liquid.
- Dip the dishwashing liquid end of the toothpick into the water with the pepper. Observe what happens when the dishwashing liquid comes in contact with the water. *Does the movement of the pepper flakes on the water's surface change when you add the dishwashing liquid? In what way?*
- Write your observations in your table. Discard the dishwashing liquid toothpick.
- Empty and rinse your bowl with water.
- Again, fill the bowl with water.
- Sprinkle a teaspoon of black pepper over the water. Again take a minute to observe how the pepper moves in the water.
- Repeat these steps with each of the remaining testing ingredients. Rinse and refill the bowl with clean water between each ingredient. Record your observations in your table.

## Results:

During this activity you tested different household products to see how they affected the movement of pepper flakes in water. The first thing you may have noticed is that at least some of the pepper flakes floated on the water's surface. Pepper is hydrophobic, which means water is not attracted to it. Therefore, unlike salt or sugar pepper will not dissolve in water. The pepper is able to float on the surface because water molecules like to cling to one another. They arrange themselves in a way that creates surface tension on the top of the water. This tension keeps the pepper flakes floating on top instead of sinking to the bottom of the bowl.

You should have observed a change in the behavior of the pepper flakes when you added different household products. Adding some of the products—the dishwashing liquid and toothpaste—to the water should have caused the pepper flakes to instantly dart away from the toothpick. In contrast the oil and milk should have had very little or no effect on the pepper's behavior, although you could probably see the oil droplet floating on the surface. Before we break down why this happens can you think of anything that dishwashing liquid and toothpaste have in common?

If you said that they both clean things—you're right! And that important trait helps explain why the pepper was chased away by each of those products. Soaps and cleaners are designed to break down the surface tension of water. This helps make them good cleaning tools. When you add the dishwashing liquid or toothpaste to the water it breaks up the surface tension. The water molecules, however, want to stick together and maintain that tension, so they move away from the soap, carrying the pepper with them!

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