

## 23.1

## Water

Question: What are the properties of water?

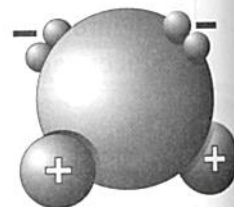
In this Investigation, you will:

1. Observe the properties of water.
2. Use electrolysis to explore the molecular composition of water.

Water is a polar molecule. This means that it has a negative end (pole) and a positive end (pole). In a water molecule, the electrons are shared unequally between oxygen and hydrogen. This is because oxygen atoms attract electrons. In other words, the electrons are pulled toward the oxygen atom and away from the two hydrogen atoms. The oxygen side of the molecule (the side with the lone pairs of electrons) therefore has a partially negative charge and the hydrogen side of the molecule has a partially positive charge.

In this Investigation, you will explore the properties of water.

Oxygen end —



Hydrogen end +

A Water Molecule

## 1

### The shape of a water droplet

1. For this part of the Investigation, you will have a small beaker of water with a pipette, a small piece of wax paper, a small piece of copy paper, and a glass slide.
2. Place one drop of water on the wax paper, the copy paper, and the glass slide. Write down what you observe in Table 1. For each situation, write come up with an explanation of your observations
3. Answer the questions following Table 1.

Table 1: The shape of a water droplet

	Describe shape of water droplet	Why does it look this way?
Wax paper		
Copy paper		
Glass slide		

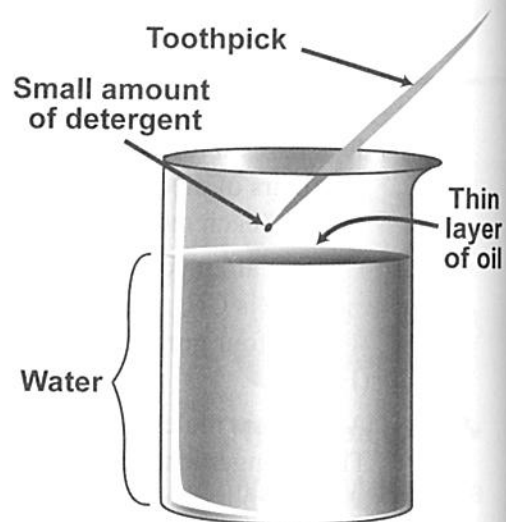
- a. Of the three surfaces—wax paper, copy paper, and glass—which is polar and which is nonpolar?
- b. Fill the pipette with some water. Release water drops from the pipette so that they fall to the floor. Describe the shape of the water droplets. Come up with an explanation of the shape of these falling droplets. When you have answered this question, be sure to dry the floor with a paper towel.
- c. The falling water droplets are most like which of the droplets that you placed on the three surfaces? Why do you think the shape of this water droplet resembled a falling water droplet?


## 3

**Polarity versus nonpolarity**

Water is a polar substance, and oil is a nonpolar substance. This usually means that these two substances don't mix. However, detergent molecules have a polar and nonpolar end. In this part of the Investigation, you will demonstrate how detergent interacts with both water and oil.

1. Fill up your beaker with water so that it is three-fourths full.
2. Add some vegetable oil to the water's surface. Add just enough so that a thin layer covers the water's surface. Observe the thickness of this layer from the side.
3. Now, use a clean toothpick to try to see if you can mix the oil layer into the water. Observe what happens.
4. Using a fresh toothpick, dip the tip into some detergent.
5. Poke the tip of the toothpick into the center of the oil layer on the water and then pull it out. Observe what happens.
6. Now, answer the following questions.



- a. Describe what happened when you first tried to mix the oil and water. What evidence did you observe that proves that oil and water do not mix?
- b. What happened when you added a little detergent to the oil layer? In particular, describe how the oil layer "reacted" to the detergent.
- c. At the end of step 5, there are three kinds of molecules in the beaker—water, oil, and detergent. Make a diagram that shows how these molecules interact with each other in the beaker.
- d. Now that some time has passed, do you notice any changes? Try to stir the oil into the water. What happens? Explain your observations.
- e.  Having done this demonstration, do you think detergent would be useful in cleaning up an oil spill in the ocean? What would be the advantages or disadvantages of using detergent to clean up an environmental problem like an oil spill? You may do research on the Internet or in your local library to answer this question.