

Water Hardness Study

When water passes through or over mineral deposits such as limestone, the levels of certain ions present in the water increase greatly and cause the water to be classified as *hard water*. This term results from the fact that calcium or magnesium ions in water combine with soap molecules. This forms a sticky scum that interferes with soap action and makes it “hard” to get suds. *Soft water*, such as rainwater or melted snow, is mostly free of these ions. Soft water, when mixed with soap will form suds. A Conductivity Probe can be used to test for ions in water. Hard water, because of the ions it contains, gives a high conductivity reading. Soft water gives a low conductivity reading.

In Part I of this experiment, you will learn how to test water hardness and find the hardness of the tap water in your school. In Part II, you will plan and do a water-hardness study.

OBJECTIVES

In this experiment, you will

- Use soap to find water hardness.
- Use a Conductivity Probe to find water hardness.
- Find the hardness of the water in your school.
- Apply what you learn as you do a water-hardness study.

MATERIALS

computer
Vernier computer interface
LoggerPro
Vernier Conductivity Probe
25 mL graduated cylinder
distilled water
very hard water
tap water

3 test tubes with stoppers
test-tube rack
Ivory® liquid soap
dropper
ruler
ring stand
utility clamp
3 small beakers

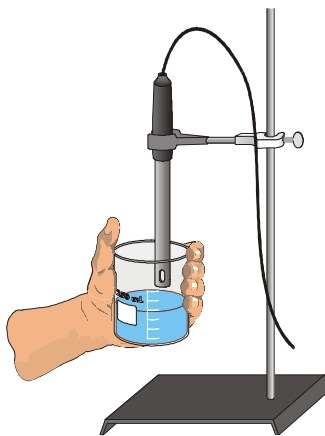


Figure 1

PROCEDURE

Part IA Soap Sudsing Tests

1. Place 10 mL of distilled water in one test tube. Place 10 mL of very hard water in a second test tube. Place 10 mL of tap water in a third test tube.
2. Add one drop of Ivory[®] liquid soap to each test tube and insert the stoppers. Shake each test tube the same number of times.
3. Use a ruler to measure the suds height (in cm) in each test tube. Record the results in your data table.

Part IB Conductivity Tests

4. Fill a clean beaker halfway with distilled water. Fill a second beaker halfway with very hard water, and the third beaker halfway with tap water.
5. Prepare the computer to measure conductivity by opening the file “20 Water Hardness Study” from the *Middle School Science with Computers* folder
6. The Conductivity Probe is already attached to the interface. It should be set on the 0-2000 $\mu\text{S}/\text{cm}$ position.
7. Measure the conductivity for each of the three water samples.
 - a. Raise the beaker until the hole in the probe end is completely submerged in the solution as shown in Figure 1. Swirl the solution briefly.
 - b. Once the reading is steady, record the conductivity reading.
 - c. Before testing the next sample, carefully blot the probe dry with a tissue.

Part II A Water Hardness Study

8. Use the skills you gained in Part I and do a study of water available in your community. You might compare surface water (from streams and ponds) with groundwater (from wells and springs). A study of the different bottled waters sold at local stores can also be done. Explain the hardness of the waters you test.

DATA

	Suds height (cm)	Conductivity ($\mu\text{S}/\text{cm}$)
Distilled water		
Very hard water		
Tap water		

