



NSF GK-12 Graduate Fellows Program
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How Soft Or Hard Is Your Water?

Activity Instructions

by
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HOW SOFT OR HARD IS YOUR WATER?

Objective: To test samples of water to determine how a chemical water softener (borax, washing soda) affects water's ability to form suds.

Materials:

- Borax or washing soda
- Different samples of water
- Distilled water
- Second timer
- Bottles with caps
- Pipettes
- Soap
- Pencil
- Student sheets

Background Information:

Water that contains large amounts of dissolved calcium or magnesium is considered to be "hard." The chemical weathering of rocks causes minerals to leach into groundwater supplies or streams and is often the source of hard water for home use. Hard water causes several problems in homes.

A reaction occurs when hard water comes in contact with detergents. During this process, the calcium ions precipitate the fatty acids from the soap. A form of scum or gelatinous, gray curd forms. This curd forms as calcium ions are removed from the water. This process occurs until all of the calcium ions are bound up in the curd. For this reason, households that have hard water must use larger amounts of detergent.

"Soft" water carries ions that do not react with the soap and therefore allows lathering. Water softeners are available for home use that replaces calcium ions with sodium ions. The sodium ions do not affect lathering or cause scaly deposits to build up.

Experiment:

A. Untreated Samples

1. Using a pipette, add ten drops of the soap solution to bottle #1.
2. Close the bottle, shake for several seconds and lay the bottle on its side. Observe the suds in the bottle.
3. If, at the end of one minute, no suds remain, continue to add the soap solution one drop at a time until some suds remain at the end of one minute.
4. Record on the student sheet the total number of drops of soap solution needed for the water sample to contain suds.
5. Repeat this same procedure for bottles #2-4.
6. This set of bottles (#1-4) will be called the "Untreated Samples"



B. Treated Samples

1. Add a few crystals of borax to bottles #5-8.
2. Repeat the same procedure as before for bottles #5-8.
3. Record on the student sheet the total number of drops of soap solution needed for the water sample to contain suds.
4. This set of bottles (#5-8) will be called the “Treated Samples”

Questions:

1. Using the data you recorded on your student sheet, which water sample was the softest? Which was the hardest?
2. List all of the samples in order of hardness, beginning with the softest.
3. Why is the method used in this experiment a way of determining the relative hardness of water rather than the actual hardness of water?
4. How were the results different when the samples were treated with a water softener?
5. What conclusions can you draw from the results observed when the chemical water softener was added to the samples?



STUDENT SHEET

UNTREATED SAMPLES

Bottle # and type of water	# Drops of Soap Solution Added	Description of Sample
1. Distilled		
2. Faucet		
3. Lake		
4. River		

TREATED SAMPLES

Bottle # and type of water	# Drops of Soap Solution Added	Description of Sample
1. Distilled		
2. Faucet		
3. Lake		
4. River		

