PHASE ONE: BREAK DOWN
BUBBLE BATTLES

Mission: What combination produces the most bubbles?
Age: 8+
Materials: $19
Time: 30 min
(Set-up: 10 min Activity: 15 min Clean-up: 5 min)

Safety Note: Grownups, supervise children so they do not accidentally inhale powdered detergent. If detergent comes into contact with eyes, flush with plenty of water.

What you need:

Materials:
- 1 cup distilled water, found in the bottled water section
- 1/4 tsp. Epsom salt
- 3/4 tsp. powdered laundry detergent containing aluminosilicates (like Tide)
- 3/4 tsp. of bar soap without EDTA, grated (like Ivory)

Equipment:
- 4 small jars with lids, like baby food jars
- Measuring cup
- Measuring spoons
- Marker
- Masking tape

What to do:

1. Using a marker and labeling tape, label your jars. Two will start with "S" for "soft" water and two will start with "H" for "hard" water. We call distilled water "soft" because it doesn't have any minerals in it and hard water "hard" because it's loaded with minerals, like salt. Then in each pair, label one with "S" for "soap" and one with "D" for "detergent". Your jars will be labeled like this: "SS", "SD", "HS" and "HD."

2. Soft Water Bubble Battle: Add 1/4 cup distilled water to both jars, starting with the label "S." Then add 1/4 tsp. of detergent to one jar and 1/4 tsp. of soap to the other. Close the jars and give 5 strong shakes to them at the same time. Which makes more bubbles, soap or detergent? Write down your observations.

3. Hard Water Bubble Battle: First, mix 1/2 cup of distilled water with 1/4 tsp. Epsom salt to make hard water, then pour your mixture into both jars starting with the labeled "H." Repeat Step 2 using the hard water. Which makes more bubbles, soap or detergent? Write down your observations.

4. Bonus Bubble Battle: Repeat the same experiment using your tap water. If you compare the bubbles to your previous results, do you think that the mineral content of your tap water is closer to hard or soft water?

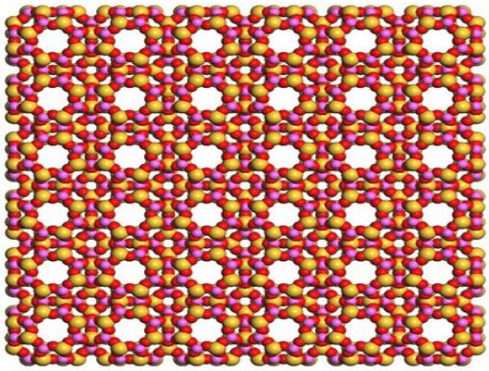
Clean-up:

All disposable materials can be thrown away in the regular trash.

What's Happening?

You may have noticed that the detergent created more bubbles than soap in hard water. When water is hard, the minerals in the water prevent soap from bubbling, creating soap scum. Since we don't want soap scum on our clothes, we use detergent instead, which is combination of soap and a type of material called sodium zeolite A. When you use detergent in hard water, the zeolites trap the minerals that cause soap scum. This helps your clothes get clean even if your tap water is hard.

So What?



Zeolites are materials that have empty spaces in their molecular structure that can trap other molecules. This property makes them versatile materials that can be used to clean and collect molecules. Zeolites can remove toxic chemicals in the atmosphere. They can be used to combat excess carbon emissions from power plants by trapping some of the carbon dioxide that is generated when burning coal. Zeolites were also used to clean up radioactive molecules in the water that was polluted in the 2011 Fukushima nuclear accident.

Scientists can design better zeolites for different applications. A new use of zeolites is in collecting lithium from sea water. Lithium is an essential component in the batteries we use to power our technology every day, from cars to cell phones. The demand for lithium is high, so zeolites create an alternative way to collect lithium.

DATA SHEET

Bubble Battle

MATERIALS	OBSERVATIONS	BUBBLE BATTLE WINNER
Soft Water + Soap		
Soft Water + Detergent		
Hard Water + Soap		
Hard Water + Detergent		

NGSS Alignment of Bubble Battles Activity

The information below may not include every area that this activity can be linked to NGSS concepts

Disciplinary Core Ideas

PS1.A: Structure and Properties of Matter

- **Grade 2**
  - ◇ Different kinds of matter exist and many of them can be either solid, liquid, depending on temperature. Matter can be described and classified by its observable properties.
- **Grade 5**
  - ◇ Matter of any type can be subdivided into particles that are too small to see, but even then the matter still exists and can be detected by other means. A model showing that gases are made from matter particles that are too small to see and are moving freely around in space can explain many observations, including the inflation and shape of a balloon and the effects of air on larger particles or objects.
- **Middle School**
  - ◇ Substances are made from different types of atoms, which combine with one another in various ways. Atoms form molecules that range in size from two to thousands of atoms.

Performance Expectations

2-PS1-1: Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties.

5-PS1-1: Develop a model to describe that matter is made of particles too small to be seen.

MS-PS1-1: Develop models to describe the atomic composition of simple molecules and extended structures.

Crosscutting Concepts:

Patterns

- Grade 3-5
  - ◇ Patterns of change can be used to make predictions.
  - ◇ Patterns can be used as evidence to support an explanation.
- Middle School
  - ◇ Macroscopic patterns are related to the nature of microscopic and atomic-level structure.
  - ◇ Patterns can be used to identify cause can effect relationships.

Engineering and Science Practices

Planning and Carrying Out Investigations

- Grade 3-5
  - ◇ Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered.
  - ◇ Make observations and/or measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon or test a design solution.
  - ◇ Make predictions about what would happen if a variable changes.
- Middle School
  - ◇ Conduct an investigation and/or evaluate and/or revise the experimental design to produce data to serve as the basis for evidence that meet the goals of the investigation.
  - ◇ Collect data to produce data to serve as the basis for evidence to answer scientific questions or test design solutions under a range of conditions.

Analyzing and Interpreting Data

- Grade 3-5
  - ◇ Analyze and interpret data to make sense of phenomena, using logical reasoning, mathematics, and/or computation.
  - ◇ Analyze data to refine a problem statement or the design of a proposed object, tool, or process.
- Middle School
  - ◇ Analyze and interpret data to provide evidence for phenomena.
  - ◇ Analyze and interpret data to determine similarities and differences in findings.