

OVERVIEW

In this activity, students add food coloring to milk, observe, and then add a drop of liquid soap. The soap reduces the surface tension of the milk and the dye immediately moves freely through the liquid, creating rainbow patterns and designs.

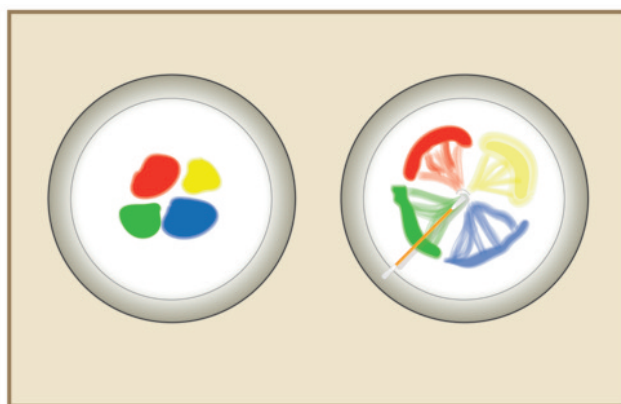
Inquiry Questions: What are some properties of liquids? What is surface tension, and what causes surface tension to change as new materials are added?

MATERIALS

- ✓ Whole milk
- ✓ Dawn® Ultra dishwashing liquid
- ✓ Food coloring
- ✓ Cotton swab
- ✓ Waterproof plate or bowl

PROCEDURE

1. Pour enough milk into the plate or bowl to cover the bottom.
2. Add several drops of food coloring (however many colors you want!) near the center of the milk. Record your observations.
3. Dip a cotton swab in the Dawn® Ultra dishwashing liquid, then touch it to the center of the milk near the food coloring. Record your observations.
4. Move the swab to different areas of the milk to see different patterns emerge. Now hold the cotton swab in one place. Record your observations.
5. Repeat the procedure, but this time, instead of dipping the cotton swab in soap, dip it in water.



EXPLANATION

What's Happening in this Activity?

Liquids are a state of matter that has definite volume but no defined shape. Milk is a liquid mixture composed mostly of water, but also contains vitamins, minerals, fats, and proteins. One property of liquids is **surface tension**, which is the attraction of particles at the surface of a liquid. This strong attraction creates an invisible film that makes moving an object through the surface of a liquid more difficult than moving an object that is already submerged. Because of surface tension, liquids keep a low surface area (think of water beads or droplets). Water has very high surface tension due to the strong hydrogen bonds between water molecules. In this experiment the food dyes do not spread or move throughout the surface of the milk due to surface tension.

A **surfactant** is a substance that has the ability to reduce the surface tension of a liquid. Liquid dish soap is an example of a surfactant, and when it is added to the milk the surface tension is reduced. As the surface tension decreases, the butterfat and protein particles in the milk can move more freely and easily, allowing the dyes move with them.

CHEMISTRY IN ACTION 🌐

Real-World Applications

- Surfactants – such as liquid dish soap, detergents, fabric softeners, and shampoo – are used as cleaners because of their ability to break up fats and oils. One side of a surfactant particle attracts fats and oils, while the other side attracts water. This interaction allows water to mix with fats and oils and wash them away.
- Surface tension in water can be seen all around us: water beading into droplets, insects that seem to be walking on water, and the ability of water to sit slightly above the rim of a cup without it spilling over. The strong attraction of water molecules on the surface makes all of these experiences possible!
- There are many ingredients that go into dishwashing soaps and liquids, such as fragrances, lathering agents to create bubbles, and conditioners to protect the skin. To create effective dishwashing liquids, chemists and scientists must find the perfect balance of ingredients.



What Does a Career in Chemistry Look Like?

Check out the profiles below to learn more about how scientists use their knowledge of chemistry to make a difference in our lives!

Tell us about your job as a scientist!

My job as a Products Researcher is to act as a translator between consumers and marketing and Research & Development teams at P&G.

Products Researchers use their backgrounds in chemistry and engineering to convert what consumers say they want into language other scientists and engineers use to make new or better products! We also use our deep technical knowledge of how our products work to create claims that help consumers make good choices.



Tell us about a cool project that you're working on and how you use science in your career!

I work in a group at P&G where I am developing the technology that will go into haircare products five or ten years from today! On a typical work day, I will spend some time in the lab to do experiments, analyze data, discuss findings and results with collaborators, and plan the next steps.

What motivated me to pursue a career in chemistry is the scientific curiosity that drives and pushes me to explore new bounds and create better products for the future.

