



Surface Tension

Suggested Curriculum links (Grade 5)

Physical Science: Light

- 300-10 identify properties such as texture, hardness, colour, buoyancy, and solubility that allow materials to be distinguished from one another

Materials

- Water
- Cups
- Quarters
- Sewing needle
- Tissue
- Washing tub
- Oil
- Soap
- Paper
- Scissors

Overview

Cohesion and surface tension are two major properties of liquids. Using water your student will explore the phenomena of these properties, the strength of surface tension, surface tension between liquids and how to reduce surface tension.

Objectives

- To investigate the property of cohesion of liquids.
- To investigate the property of surface tension of liquids.

Background

The attraction of liquid molecules to each other is a phenomenon called cohesion. Cohesion forces cause droplets of water on a surface to have a domelike shape. It looks like there is a thinly stretched film surrounding the droplet that is always trying to contract. This phenomenon is called surface tension.

In the centre of a droplet, the water molecules cohere (are attracted to) water molecules on all sides. Water molecules at the surface do not have water molecules on all sides so they cohere more strongly to the molecules next to them.

The surface tension of water can be very strong. The water strider is an insect common to Newfoundland ponds. They “skate” along the surface of the water due to surface tension. They are held up by the attraction of the water molecules at the surface. This is different from objects that float. Floating objects break the surface tension and are held afloat by the cohesion of water molecules below the surface.

When a droplet of oil is placed in water, it remains in a bubble form separated from the water. This is due to the cohesive forces and tension forces within each liquid. Soap breaks the surface tension of liquids, reducing the attraction between the water molecules.

Procedure



At the Fluvarium

Join us for *What's the Matter with Water?* Water! One of the simplest, most common types of matter on earth, yet often taken for granted and misunderstood. *What's the Matter with Water?* takes Grade 5 students on a journey of discovery to investigate this so-called ordinary material. Outside we consider water's volume and mass, and the affect temperature has on these properties. Indoors, having viewed up close our giant water molecule, students enter our Aqua lab and examine the 'solution' to water's solubility. Down at the Fluvarium level, the class takes a water sample and tests it for dissolved oxygen, a water quality parameter necessary for a trout's survival. Hands on and curriculum relevant, this program is sure to 'matter' to all who partake!

1. *Review and demonstrate surface tension and cohesion.*

Discuss how surface tension and cohesion are properties of liquids. Ask the students for examples from their lives of surface tension (ie. Water droplets and beads on a car). Demonstrate how water molecules are attracted to each other. In groups have the students put droplets of water close together on a laminated sheet of paper. Have the students predict what will happen if they join the droplets together with a toothpick. Have them try it and report their observations. Due to the cohesive forces it should form a single larger droplet.

Demonstrate to the students the phenomenon of water tension. Carefully fill a cup to the rim with water. Add quarters to the water till the surface of the water bulges in a dome-like shape. Use the narrow edge first to minimize disruption of the surface tension. The water is able to bulge and not flow out of the cup due to surface tension.

2. *Investigate the strength of surface tension.*

Ask the students if they have ever seen a water strider. Discuss how the water strider skates on the surface tension of the water. The surface tension can also hold up paperclips or needles. Have the students place a sewing needle on a piece of tissue and lay it all on the surface of the water. The tissue should soak with water and eventually sink while the needle should remain at the surface due to surface tension.

3. *Investigate the interaction between two liquids.*

Investigate cohesion and tension between two liquids. Ask the students add a drop of oil to water in a clear cup. Have the students describe what they see. Discuss the phenomenon with the class.

4. *Investigate how surface tension can change.*

In the cup with oil and water have the students add a drop of soap and report what happens. The soap reduces the attraction of the liquid molecules to each other, lowering the surface tension. (Instead they become attracted to the soap molecules).

Ask the students to cut out the paper water striders. Tell them that they will be placing their water striders on in the middle of a tub of water. Have them draw setup including the position of the water strider. Tell



them that they will be placing a drop of soap behind the water strider. Have them predict where the water strider is going to move. In their groups, ask the students to add the detergent behind the water strider and record their results. (The water molecules behind the water strider become less attracted to each other. The cohesive forces on the other sides of the paper water strider pull it forward). Have each group report their results on the board and discuss.

Extensions

- Go to a pond and observe/catch water striders. Alternatively set up an aquarium for water striders in the classroom.
- Have the students test various objects to see whether they float or are held up by surface tension.

Resources

Websites

The Exploratorium: Sticky water

http://www.exploratorium.edu/ronh/bubbles/sticky_water.html

Information on cohesion and surface tension.

Video

Richard Hammond's Invisible Worlds - Water Strider

<http://www.youtube.com/watch?v=RphuMEUY3Og>

Video about how water striders move and surface tension.



Paper Water Striders

