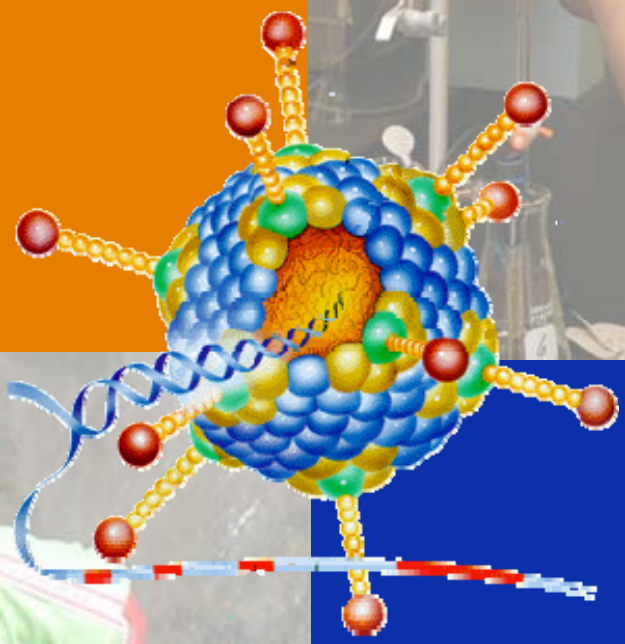
Surface Tension

Lab Book



The waterCAMPWS
Center for Advanced Materials
for Purification of Water with Systems

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Overview

Surface Tension has significant impacts on the survival as well as the processes needed for day to day existence of living beings. For example, insects such as water striders depend on the surface tension of water to move around and capture food. Most household detergents contain Sodium Docedyl Sulfate (SDS) which reduces the surface tension of water. If local water reaches a specific concentration of detergent, water striders will break the surface tension and sink. Surface tension is also essential for the transfer of energy from wind to water to create waves. Waves are necessary for rapid oxygen diffusion in lakes and seas. Understanding surface tension and what affects it is vitally important for researchers and engineers alike because new solutions for treating water have to maintain water's delicate and complex balance.

In this experiment, you will use test the surface tension of water and the effect of additives like detergent.

Materials and Equipment

Materials required for this lesson are (for each group of students):

- Beaker
- Straight pins
- Water
- Wire (24 cm. long to make a cradle for straight pin)
- Medicine-cups (to hold 1 part Joy)
- Water soluble pens
- Liquid detergent (Joy)
- Glycerin
- capillary tube
- Square wire frame (use the same wire from cradle

Procedure

1. Before beginning the experiment, develop a hypothesis about whether or not a straight pin can float on the water. Write your hypothesis and your reason for thinking so in the space below.

The Good, the Bad, the Silly…

Writing a good hypothesis is harder than you think. For example:

When it gets cold, water turns to ice.

is an acceptable hypothesis, but not very helpful, since there are many temperature of "cold" when ice wouldn't form.

A better hypothesis would be:

When the temperature reaches 32 degrees Fahrenheit and remains at that temperature, water turns to ice.

The hypothesis:

When the temperature reaches 32 degrees Fahrenheit and remains at that temperature in a room with three windows that face North on a Sunday, water turns to ice.

While this last statement may be true, it contains a lot of unnecessary detail that makes it of little practical value, since there are lots of conditions that will cause ice to form that are excluded in this hypothesis.

Part 1

2. Fill the beaker with water.
3. Take the straight pin and see if it floats when dropped vertically into the water.
4. Fish the straight pin out of the water and dry it off
5. Hold the needle horizontally, as close as possible to the surface of the water (without touching the water) and drop it.
6. Make a cradle from the wire and gently lower the wire holding the straight pin into the water.
7. Record what happens in the results section.

Part 2

8. Make a soap solution by mixing the following liquids: 1 part Joy, 21/2 parts glycerin, and 3 parts water.
9. Place this soap solution in the shallow container and make a soap film by dipping the wire frame in the solution and taking it slowly out.
10. Make a small loop of thread (diameter 3-4cm), wet it in the soap solution and lay it carefully in the soap film.
11. Once the thread loop lies in the soap film, pierce the center of the loop with a dry object (pencil or dry finger).
12. Slant the wire frame, wiggle it, and observe the perfect thread circle move and travel throughout the whole frame.

Part 3

13. Hold a capillary tube at a forty-five degree angle and put the tip in drop of water.
14. Repeat this process with soapy water.
15. Record what happens in the results section on the next page.

Results

1. What happened when you dropped the straight pin vertically?

2. What happened when you dropped the straight pin horizontally?

3. Describe what happened when you put the capillary tube into the droplet of pure water.

4. Compare this to what happened when you put the capillary tube into the drop of soapy water.

Analysis

1. In your own words, define surface tension.

2. Why is it not possible to float the needle on the water when it is dropped vertically? How about horizontally?

3. What property of the water keeps the straight pin afloat?

4. Why does the thread circle move through out the wire frame? What properties must the wire frame have to cause the thread to move?

5. Why does the water move up the capillary tube?

6. Give an example of surface tension in nature.

7. What is one thing that you learned while doing this lab? Is this a new concept or idea, or did it refine one you already have? If it is a new idea, how can you relate this idea to things you already know about water? If it is a refinement, how did you concept change? Be specific.