Super Science Connections: A Needle "Floats"

Can a needle float on water?

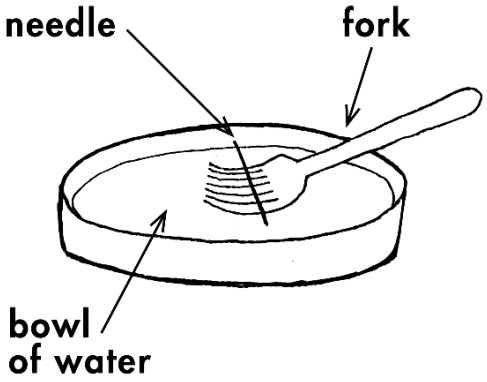
This activity is intended for children entering grades K-4 in the next school year. To carry it out safely there must be a responsible older person to prepare materials, read directions aloud, and supervise the activity. This could be a parent, guardian, or older sibling. The activity involves a needle, so care must be taken that younger children do not hurt themselves. The supervisor should consult the science background information on the next to last page before leading children through the activity.

Materials

- A small cup of water (3 inches or 7 cm in diameter)
- Sewing needle
- Fork
- Toothpick
- Dish soap (Dawn™ is excellent)

Directions

1. Lay the needle across the tines of a fork.
2. Carefully lower the fork into the water, keeping the needle as nearly horizontal as possible. The needle should remain on the surface of the water, "floating".
3. Carefully slide the fork out from under the needle and out of the water. Make as few waves as possible.



This activity is courtesy of ICE, the Institute for Chemical Education at UW-Madison's Chemistry Department. It is adapted for use at home from A Needle Floats in the Super Science Connections Section 4: Surface Tension activities offered by ICE at this link:
http://ice.chem.wisc.edu/sites/ice.chem.wisc.edu/files/images/Publications/SSC/SSC_Surface.pdf

Troubleshooting

If the needle keeps sinking, try using a brand new needle, a thinner needle, or cleaning the needle surface with fine steel wool. Make sure the fork is not magnetized by trying to lift up the needle in air with the fork. If the fork attracts the needle, the fork will drag the needle through the water surface instead of letting it "float".

Here is an alternative technique for lowering the needle into the water in a cup with a smaller diameter:

- Lay the needle across the tines of the fork.
- Carefully lower the fork toward the water, bracing the needle against the sides of the cup. Gradually lower the fork and then slowly pull the fork away from the edge of the cup, as illustrated by the images below (viewed from left to right).




Discussion/Extension

1. Try to get the needle to remain on the surface of the water without using the fork. Can you do it?
2. If you put the needle in the water point first, can you get it to "float"? If not, why?
3. Dip a toothpick into a small cup of dish soap. Touch the soap-covered tip of the toothpick into the cup of water and stir gently with the toothpick to ensure that some of the soap goes into the water. Try to get the needle to remain on the surface of the water again. Can you?
4. Empty the water with dish soap, rinse the cup thoroughly, and refill the cup with water. "Float" the needle again. Take a clean toothpick and repeatedly touch the water surface gently with the point of the toothpick. Don't stir. Does the needle stay on the surface? (This is a control experiment to ensure that the toothpick does not make waves that would sink the needle.) Now coat the tip of the toothpick with dish soap and gently touch the tip to the water surface. What happens?

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Discussion/Extension Answers:

1. The answer will vary depending on who is trying this, and the technique used.
2. No, you cannot get it to float because the point of the needle easily punctures the water surface and the surface tension is not strong enough to support the needle. When the needle is horizontal the area of needle in contact with the water surface is much bigger and the needle does not break through the surface. (You can prick your finger with the point of the needle, but not with the side.) It is the force of the surface tension that makes the needle "float" on top of the water.
3. Adding soap to the water reduces the surface tension of the water. The surface tension is no longer strong enough to "float" the needle.
4. When the needle is already "floating", reducing the surface tension with dish soap reduces the force holding the needle up, so the needle sinks.

Science Background

The needle is more dense than the water, and would be expected to sink. However, the surface of the water can support the needle because of the force of surface tension.

Surface tension involves attractions between water molecules and acts to minimize the surface area of the water. Think of the water surface as similar to a rubber balloon stretched from the sides of the container. The stretched balloon will have to stretch more if you put something heavy on its surface. The balloon tries to minimize the stretching, holding the heavy object up. But if the object is too heavy it will puncture the balloon and fall.

You can think of the surface tension as a "skin" on the water. When the needle is sideways on the surface it can't break through the surface; the water can support the needle and keep it "floating". If you put the needle into the water point first, the point punctures the surface "skin" and then the needle sinks.

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Connection

Find out about the insect called a *pond skater*. How does this insect use surface tension?

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