

SOAP-POWERED BOAT

SCIENCE EXPERIMENT

For Grades 2–6

MAKE A SMALL BOAT MOVE ACROSS THE WATER
USING THE POWER OF CHEMISTRY

SUPPLIES:



**Boat template
(provided at the end)**



Liquid detergent



**Clean milk carton
or Styrofoam**



**Container of water
(like a sink, bathtub, bowl,
or casserole dish)**



Pepper



**Eye dropper, or something
that can drip a small amount of liquid**



Scissors

SOAP-POWERED BOAT

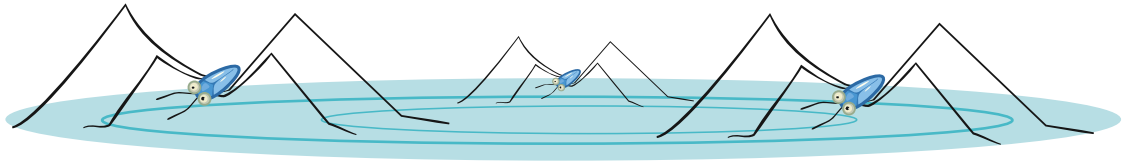
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BIG IDEAS

This experiment demonstrates the surface tension of household liquids.



Surface tension is caused by liquid molecules bonding to one another. It is a property of liquids that allows them to resist an external force. This is how some insects, like water striders or mosquitos, can sit or walk on the surface of a lake without falling through. When the leg pushes down on the water, it can't break the surface tension of the water; the water tries to recover its flatness and pushes the insect upward.

Soap reduces the surface tension of the water around it. This is because soap molecules are not attracted to water the way other water molecules are. Part of the soap wants to bond with the water while the other part of the soap wants to push the water away.

Differences in surface tension can also be used as a source of power. By placing soap in a small notch cut from the back of a simple boat, the boat moves across the surface of the water because the soap can only disperse backwards. This makes the surface tension greater at the front of the boat than at the back, which pulls the boat forward. The boat moves by being pulled forward by water molecules (not by being pushed by soap molecules).

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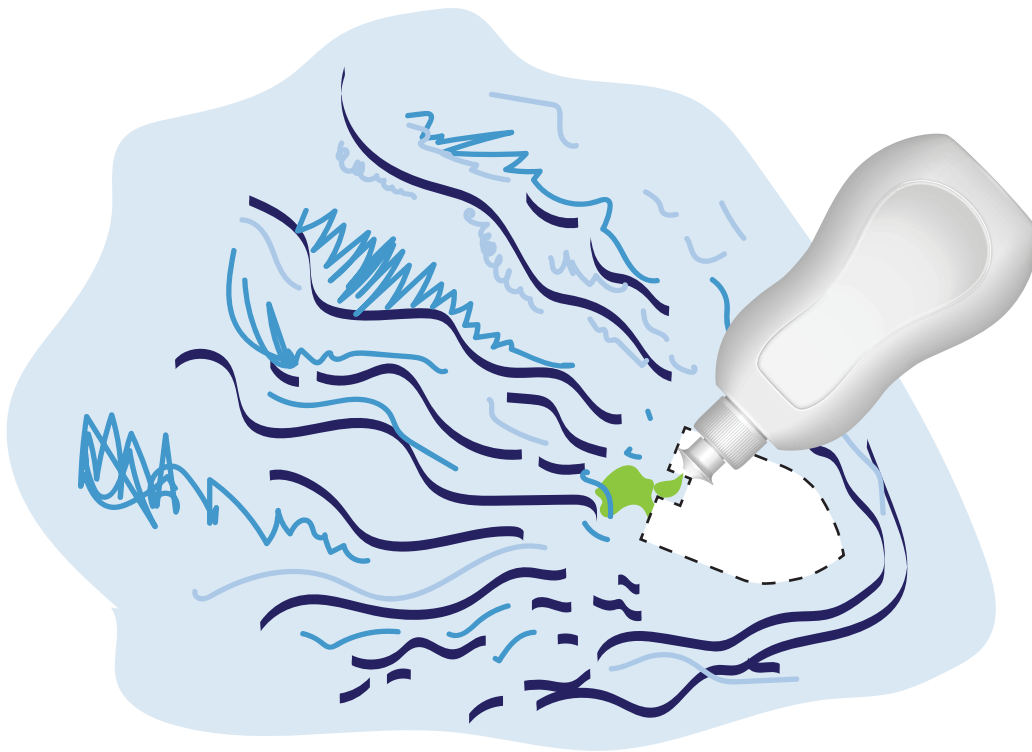
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The **Marangoni effect** is also acting upon the boat. This effect describes how a liquid with a high surface tension pulls more strongly on the surrounding liquid than a liquid with a low surface tension. Your detergent molecules reduced the water surface tension behind the boat, causing the water (and the boat) to move forwards.

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1. Using the boat template provided, cut out a simple boat from a clean milk carton or Styrofoam.
2. Cut a small notch at the back of the boat, in the middle of the rear edge.
3. Fill a sink, bathtub, large bowl, or casserole dish with water.
4. Sprinkle pepper on the water so you will see the water move more clearly.
5. Place the boat near the edge of the container of water.
6. With an eyedropper or similar tool, drop a small amount of detergent in the notch at the end of the boat. What happens? (The boat should move forward.)



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TRY MAKING A HYPOTHESIS:

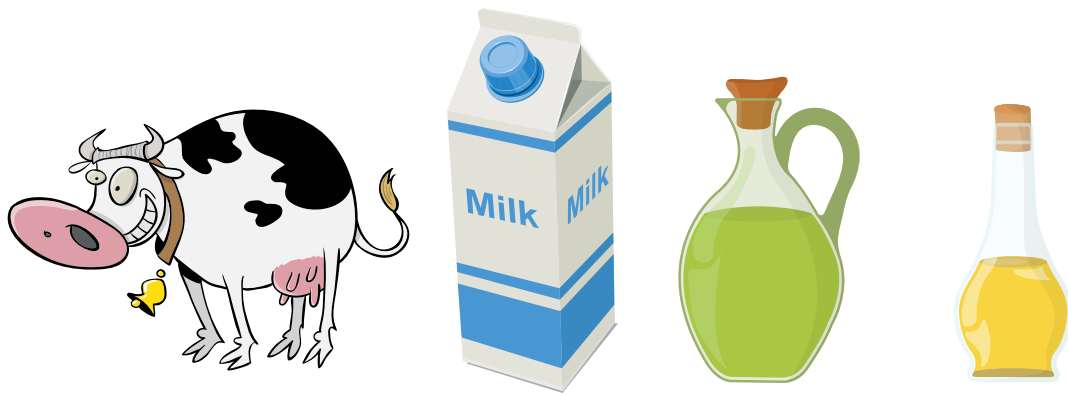
Develop a hypothesis for further experimentation using the following prompt:

"If [we do this], then [this] will happen."

i.e.: If we put too much soap at the back of the boat, it will sink.

FURTHER EXPERIMENTATION

1. Try this with different kinds of liquids (i.e. milk, canola oil, vinegar). Does the boat still move forward?



2. Try cutting out different shapes of boats. Does the size of the boat affect its ability to move? You will need to use fresh clean water and a fresh clean container.
3. Try it with lots more soap.



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