River & Rowing Museum
Henley on Thames

Surface Tension Experiments


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Have you ever watched a pond skater darting across its pond? Or noticed how the rain forms droplets on your windows on a rainy day? Why doesn't it spread out evenly all over the glass? It's because of something called **surface tension.**

Surface tension can help explain why rain falls in droplets, why plants can draw up water from the earth and channel it up to their leaves. And why some mini-beasts can walk on the surface of a stream without sinking to the bottom!

So what is surface tension? Let's investigate!

1. Can I make a paperclip float on water?

What you will need:

- A glass or beaker of water
- A few paperclips
- Washing up liquid (just a drop needed)

What to do:

- Fill your beaker with water then pick up a paperclip. Will the paperclip float or sink when you drop it into water? Have a go. Were you right?

- The paperclip is denser than water so it will sink.

- Now see if you can use surface tension to float your paperclip. Bend up an end of your paperclip to form a handle so you can hold it and very gently lay it flat on the surface of the water. This is quite tricky and might take a few goes, but the pictures will help you.

- How is the water surface behaving? Surface tension works like the surface of a trampoline or an elastic 'skin'.

- Carefully add a drop of washing up liquid to the water. What happened to the paper clip? Can you suggest why?

- Read on for the science behind surface tension.

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2. How many water droplets can you fit onto a penny?

What you will need:

- A glass or beaker of water
- A penny that has been washed and dried
- A medicine dropper if available but not essential
- Washing up liquid (just a few drops)
- Paper towel

What to do:

- Place your clean dry penny on a flat surface.
- Dip a finger into the beaker of water (or use a medicine dropper to draw up some water) and then hold it just above the penny so that your finger is pointing downwards towards the surface of the penny – but make sure it does not touch.
- Can you see a water droplet forming at your fingertip?
- Let this water droplet fall onto the penny. Does it spread evenly over the penny or does it form a shape on the surface of the penny? What sort of shape does your droplet look most like – a cube? A pyramid? A sphere?
- Now you've had a think about the size and shape of your first droplet make a prediction – how many drops of water do you think you can fit onto the surface of your penny?
- Start testing your prediction by adding water droplets slowly and carefully, one by one and watching your first droplet grow bigger. Was your prediction close?
- Dry the penny and write down how many drops you were able to add before the water spilled over. You might like to try this a few times and make a note of the average number of water droplets that will sit on your penny.
- Now add a little washing-up liquid to your beaker of water and repeat your experiment. Can you fit as many soapy water droplets on your penny?
- Repeat your experiment using other liquids, for example milk and juice. Does changing the liquid change the number of drops that will fit on your penny?

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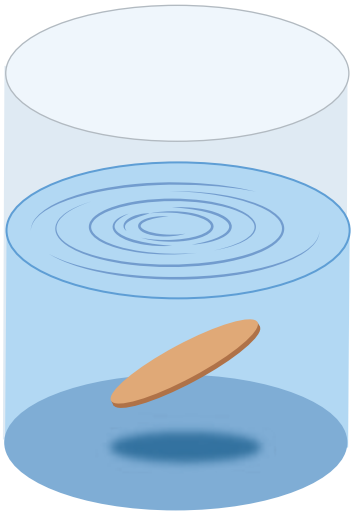

3. How many pennies or pebbles can you add to a beaker of water without the water overflowing?

What you will need:

- A glass or beaker of water
- Pennies or small stones
- A medicine dropper if available but not essential
- Washing up liquid (just a few drops)
- Paper towel or a cloth

What to do:

- Fill your beaker with water and place it on a flat surface. Have a cloth or paper towel ready to clear up any spills.
- Predict how many pennies or small stones you will be able to add before the water begins to trickle over the rim of the beaker.
- Now gently add your pennies or whatever you are using and watch the water surface closely. Does it rise higher than the rim of the glass (you might have to kneel down so that your eyes are at the same level as the water surface to see this)? What shape does the water surface make?
- The reason that the water can rise above the rim of the beaker without trickling over is surface tension. You could draw your beaker of water and record the shape. How accurate was your prediction?

The Science of Surface Tension

The beaker of water holds many tiny water molecules. These water molecules behave like tiny magnets. Because of the different atoms that make up a water molecule (two hydrogen atoms and one oxygen atom), part of the molecule has a slightly positive charge and part has a slightly negative charge. The positive part of one water molecule attracts the negative part of another water molecule, just like the opposite poles of a magnet.

A molecule of water in the middle of the beaker, or in the middle of a water droplet, is pulled evenly in all directions by all the other molecules around it. But a water molecule on the surface has no water above it, only air. Water molecules are attracted much more strongly to other water molecules than to air molecules.

This means that water molecules on the surface of the beaker or the surface of the droplet are pulled mostly inwards. This makes the water surface behave as if it were covered in a stretched elastic 'skin'. In water this 'skin' is strong so we say that water has a high surface tension. In other liquids, like vinegar and alcohol, the 'skin' is weak. These liquids have a lower surface tension.

The washing-up liquid makes the water molecules at the surface pull towards each other less strongly; it reduces the surface tension. Because adding soap makes the water molecules 'stick together less', the paperclip in the first experiment sinks and the water droplet in the second experiment becomes weaker and spills over the penny sooner.