KS3 Worksheet

Walking Water

S4 Science Club

What are we learning?

Water is “sticky”, it sticks to itself and to other things.

Think about getting your hand wet. The water doesn’t just brush off, it sticks to your hand, until it dries and evaporates.

The stickiness of water allows plants to suck up water from the soil and is why a fountain pens don’t leak ink.

Specific forces are at work to make water sticky, they are called **cohesion** and **adhesion.**

Cohesion in water

Water molecules stick to each other using a force called **cohesion.**

Let’s watch cohesion in action.

Take a glass and fill it with water, in the sink, to the very top.

Next, slowly add a few more drops.

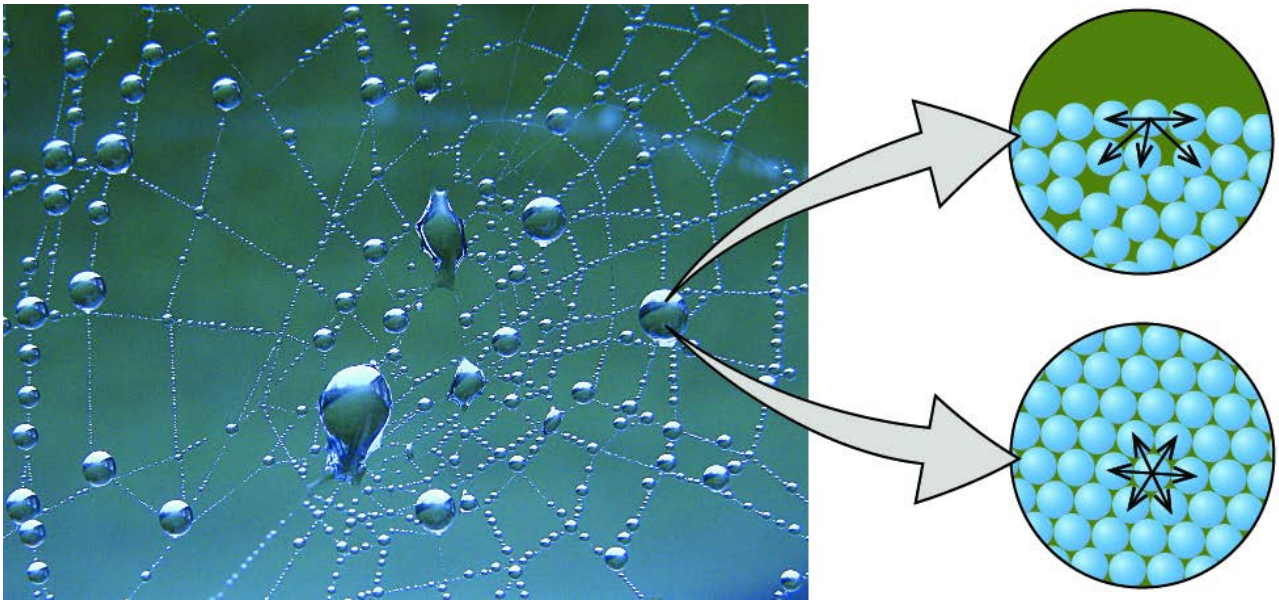
Describe what happens before the water overflows.

What you are witnessing is called s**urface tension** and it happens because of water molecules' tendency to stick to one another. **Cohesion** refers to the attraction of molecules to other molecules of the same type. Water molecules have strong cohesion because of their ability to form hydrogen bonds with other water molecules.

Cohesive forces cause **surface tension,** which is the tendency of water surfaces to resist rupture. If you place something light, but heavier than water (such as a penny), on the surface of a glass of water, it will not sink.

The water molecules at the surface, where the water meets the air, have to form all 4 of their cohesive hydrogen bonds with the molecules below them or next to them, because there is only air above them, this means the surface molecules form stronger bonds with their neighbours, creating surface tension.

The **cohesion** formed by the **hydrogen bonding** means water has **high surface tension.**



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When cohesion occurs in a narrow tube the force allows water to climb up the tube. This is called capillary action and is how plants get water from the soil and why the bottom of your jeans gets wet all the way up your shins when you walk in the rain!

Adhesion in water

Water molecules also stick to other molecules that are not water. This force is called adhesion.

Adhesion occurs when the forces of attraction between water and another molecules is stronger than the cohesion between water molecules.

Notes & Doodles

Walking water

Capillary Action in Water Molecules

You will be exploring capillary action, a type of cohesion, further by making water ‘walk’ between glasses.

This experiment can get messy so make sure you get an adult’s permission before you start.

You will need:

- 6 glasses or beakers
- 6 sheets of kitchen roll
- Water
- Food colouring – red, yellow and blue

Instructions

1. Add a few drops of red food colouring to one glass and add water so the glass is half full
2. Repeat for the yellow and blue food colouring
3. You should now have 3 glasses of coloured water and 3 empty glasses
4. Arrange the glasses in a circle alternating the full and empty glasses.
5. You should end up with a ring of glasses alternating full and empty.
6. Take a sheet of kitchen roll and fold into thirds lengthways.
7. Repeat for the other 5 sheets
8. Put the end of one sheet into one glass and the other end in the glass next to it to make ‘snakes’ of kitchen paper joining the glasses.
9. Repeat until there is a complete circle of glasses joined by paper towels like the picture below.

Walking water

Questions

Use the information above and your experiment to answer these questions about adhesion and cohesion. You can use the new words box below to help.

Draw or write about your experiment. What happened? How long did the change take?

Fill in the gaps to complete the sentences about what happened in your experiment.

The water is drawn up the paper towel because of _____ _____ and _____. The water is drawn through small gaps in the paper towel, this is called _____.

What is the difference between cohesion and adhesion?

What type of bonding causes cohesion?

Why does water form droplets?

New words and concepts

Cohesion – **Cohesion** is the force of attraction between molecules of the same type. Water molecules have strong cohesive forces because of their ability to form **hydrogen bonds** with one another.

Adhesion – **Water** molecules also stick to other molecules that are not water. This force is called **adhesion.**

Adhesion occurs when the forces of attraction between water and another molecules is stronger than the cohesion between water molecules.

Surface tension – surface tension is the tendency of water surfaces to resist rupture. Surface tension is a strong cohesion. Surface tension happens because water molecules at the surface, where the water meets the air, can only form cohesive **hydrogen bonds** with the molecules below them or next to them because there is only air above them. This means the surface molecules form stronger bonds with their neighbours, creating surface tension.

Capillary action – capillary action is not a force it is a process, it is the process of water moving within a confined space or a material due to the forces of **cohesion, adhesion** and **surface tension.** Capillary action allows plants to 'suck' water up from the soil in narrow tubes called xylem vessels.

Notes & Doodles

My Science Ideas

What science ideas or questions has this video and worksheet given you?

Walking water

Teacher Feedback