

Year 6 science

Why is water sticky?

Australian Curriculum links: Year 6 Science

Changes to materials can be reversible or irreversible (ACSSU095)

Water is fundamental to life on Earth. The water cycle is a popular topic for teaching a range of science concepts. However, giving students a deeper understanding of some of the underlying concepts can be challenging.

In this lesson sequence, students use a range of hands-on activities to explore what water is and how it behaves as it changes from ice to liquid water to water vapour. They gain a clear mental picture of water molecules. Learning about how these molecules behave when water is heated and cooled can help them to understand how the water cycle works. These mental pictures will also be a useful foundation for further learning in chemistry.

Fog and clouds can be used as a precursor to this activity: it introduces the topic of condensation in the context of the water cycle.

Equipment

For the class

- [The water cycle](#) poster
- [Matter and evaporation](#) learning object (Scootle)
- five-cent coin
- eye dropper or pipette
- water
- paper towel
- small cup of water
- predict-observe-explain student worksheet (Resource 1)
- diagram of water molecule (Resource 2)
- diagram of a water molecule with charges (Resource 3)
- 'How are water molecules arranged?' (Resource 4)
- additional materials for making model water molecules (plasticine or fuzzy balls)



For each pair of students

- two balls of plasticine of different colours or two larger fuzzy balls of the same colour and four smaller fuzzy balls of a different colour
- small piece of Blu-Tack
- diagram of a water molecule with charges (resource 3)

Lesson steps

1. Display 'The water cycle' poster on the electronic whiteboard or screen. Ask students to share what they already know about the water cycle. Explain that water has some amazing properties. Conduct the following short experiments or activities to observe the different properties of water.

How many drops of water can you fit on a five cent coin?

2. Using the predict-observe-explain student worksheet (Resource 1), students predict how many water drops fit on a five cent coin and what the water drops will look like on the coin.
3. Using the eye dropper or pipette, slowly drop water onto the coin, counting each drop. Count every drop.
4. Students record the number of drops then fill in the other parts of the worksheet as they conduct the experiment.
5. Examples of student initiated questions include:
 - Does the side of the coin make a difference?
 - Does the height that the dropper is held above the coin make a difference?
 - Does the placement of the drops make a difference?

What is water made of?

6. Discuss the results, observations and questions raised from the previous experiment. Ask students to speculate why we could describe water as 'sticky'.
7. Ask students what they think water is made of.
8. Explain that it took scientists many hundreds of years to discover what the matter around us (including water) is made of. They concluded that water is made of molecules. Display a diagram of a water molecule (Resource 2). Explain that water is made of billions of tiny, tiny, tiny particles called molecules. We can't see water molecules directly even with powerful microscopes so scientists use models and diagrams, like the one in Resource 2, to understand what molecules look like. As in the diagram, water is made up of two atoms of hydrogen attached to one side of an oxygen atom.
9. Using plasticine, fuzzy balls, other art materials or Blu-Tack, students work in pairs to make a model of a water molecule.
10. Ask students to evaluate their own model by identifying the aspects of the model that might be like a real water molecule and what aspects might be unlike a real water molecule. Students should keep their models on their desks for the next activity.

Why is water sticky?

11. Explain to students that scientists also worked out why water is 'sticky' (see the note below). One end of the water molecule has a slight negative charge and the other end



has a slight positive charge. Display the diagram of a water molecule to show the charges (Resource 3).

12. Working in pairs, ask students to use their models to predict how the charged water molecules might align when they are close to each other. Students should be able to predict that the negative end of one molecule will align with the positive end of the other molecule or vice versa.

Note: This explanation is dependent on the students' prior experience with the concepts of electrical charge. If the students are unsure about the basics of electrostatic charges, ask them to rub a balloon in their hair and hold it near a wall. Explain that rubbing the balloon on their hair caused a build-up of negative charges and that holding the balloon against the wall causes a build-up of positive charge on the surface of the wall. So the balloon sticks to the wall.

How are water molecules arranged in ice?

13. Explain that water molecules are constantly moving. Temperature determines at what speed they move and if water molecules form a solid, liquid or gas.
14. Ask students to speculate how water molecules might be arranged when frozen in ice. Students work in groups of four to arrange their plasticine or fuzzy ball models. If you have time, students could make additional plasticine or fuzzy ball models to replicate more water molecules.

What do the water molecules do when the ice melts?

15. Ask students what they think will happen if the ice cube is heated further.
16. As a class, watch Experiment 1 in the 'Matter and evaporation' learning object. This experiment simulates what happens when ice is heated from -10°C to -1°C . The simulation initially asks the students if the ice will melt when heated to -1°C .
17. Play the simulation through a number of times to allow students to watch the different elements on the screen. For instance, on first viewing you might focus student attention on the ice cube. Does it melt? On the next viewing, you might focus their attention on how the water molecules are arranged in the ice and then how the motion of the water molecules change as the ice is heated. Ask students to complete Part A of 'How are water molecules arranged?' (resource 4).
18. Ask students what they think will happen if the ice cube is heated further. As a class, watch Experiment 2 in the 'Matter and evaporation' learning object. Students complete Part B of 'How are water molecules arranged?' (resource 4).

What happens to water molecules when liquid water evaporates to form water vapour?

19. Ask students what they think will happen in the liquid water is heated to higher and higher temperatures.
20. As a class, watch Experiment 3 of the 'Matter and evaporation' learning object. Students complete Part C of 'How are water molecules arranged?' (Resource 4).
21. To conclude, as a class, students use their model water molecules to simulate what the water molecules do as they form ice, liquid and gas.

Resource 1 Predict-observe-explain student worksheet

❖ How many drops of water fit on a five cent coin?

» My predictions

I predict that _____ drops will fit on a five cent coin

I predict that that the coin and the water drop will look like this.

» My observations

a) The water on the coin was shaped like

b) I also observed _____

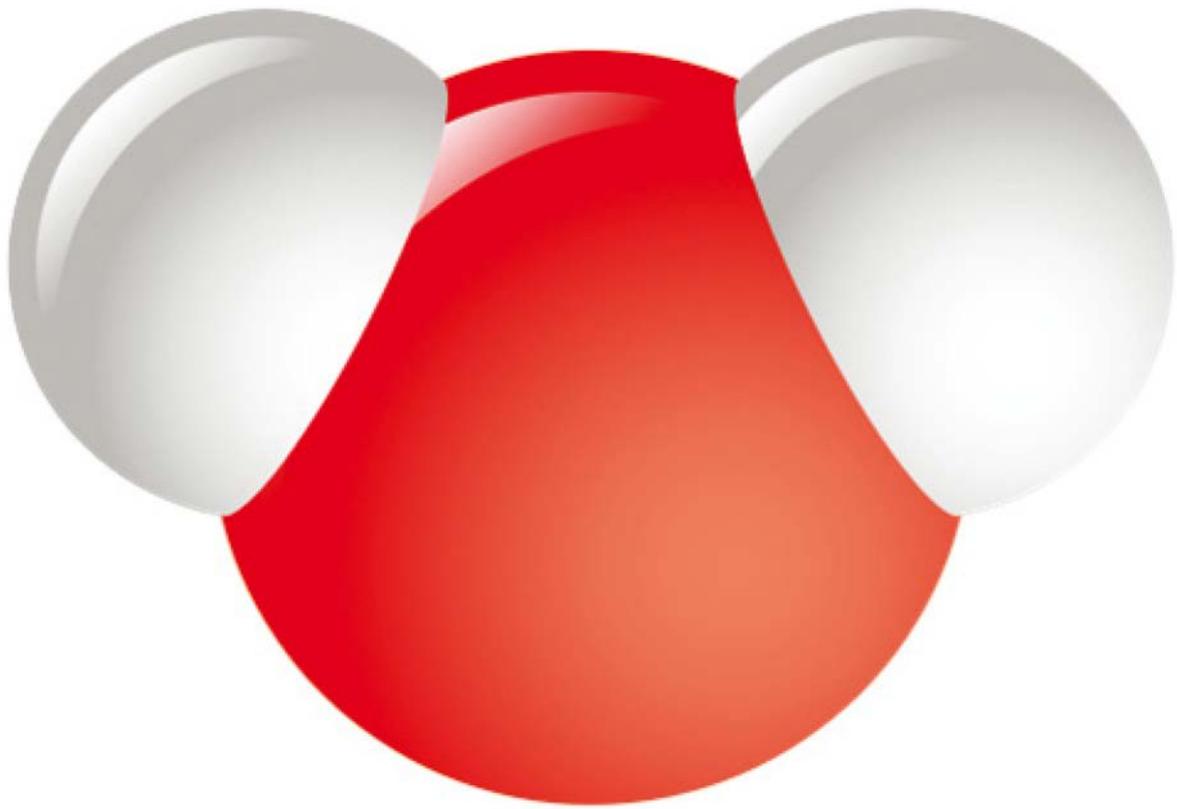
c) Some questions we asked while we did this activity were: _____

My explanation

The water drop took this shape because _____

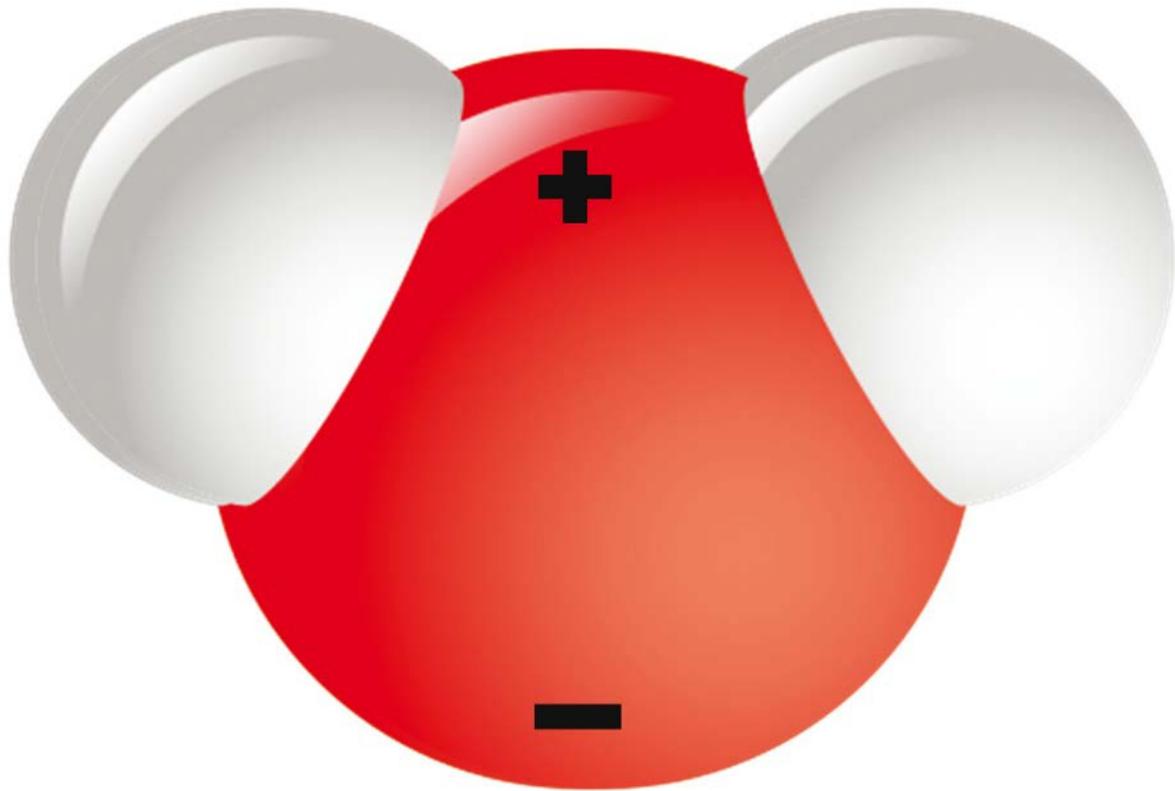
Resource 2

Water molecule diagram



Resource 3

Water molecule diagram with charge



Resource 4 How are water molecules arranged?

...❖ How are water molecules arranged in ice, liquid water and water vapour?

Part A Experiment 1—Solid water (ice)	
Draw a labelled diagram to show how water molecules are arranged in ice.	Explain in your own words how water molecules are arranged in ice.
Part B Experiment 2—Liquid water	
Draw a labelled diagram to show how water molecules are arranged in liquid water.	Explain in your own words how water molecules behave when they are in a liquid form.
Part C Experiment 3—Water vapour	
Draw a labelled diagram to show how water molecules are arranged in water vapour.	Explain in your own words how water molecules behave when they are in a water vapour.