



Exploring electrolysis



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STEM at home

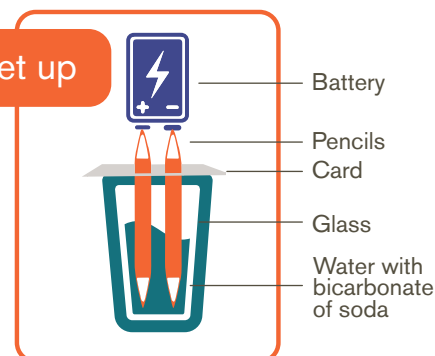
Electrolysis is one way we can break down substances. Creating a simple circuit at home can allow us to make bubbles of **hydrogen** and **oxygen** by splitting up water. A similar process is used to make **sodium hydroxide** - one of the most used ingredients in making medicines.

You will need

- A glass of water
- Two pencils and a sharpener
- A 9v battery
- 1/2 teaspoon bicarbonate of soda
- A piece of card

25 mins

Set up



Instructions

1. Sharpen the two pencils at both ends so they are approximately the same height
2. Cut out a piece of card that will sit on top of the glass
3. Stand the 9V battery in the middle of the card, with the two contact points down and mark where the two contact points touch the card
4. Poke each of the pencils through these points, so they are secured by the card and are standing apart by the same width as the contact points on the battery
5. Position the pencils by adjusting how far through the card they are. When the card is resting on the glass, the bottom of the pencils should be about 1cm from the bottom (as per the diagram)
6. Fill your glass with water to approximately 3cm deep. Add half a teaspoon of bicarbonate of soda (NaHCO_3), stir, and allow to settle - this creates an electrolyte
7. Set the card onto the rim of the glass, with the bottom of the pencils submerged in the water. The other two ends of the pencils will be sticking up in the air. Ensure no pencil ends are touching
8. Hold the 9v battery over the two pencils, as per the diagram above, touching each point of the pencil to a contact point for up to ten seconds
9. Bubbles of hydrogen (H_2) and oxygen (O_2) will now form at each pencil tip, as the water molecules in your glass have now been broken down

What do you notice?

- Q. What happens to the bubbles as you increase/decrease the pressure between the pencils and the battery?
- Q. Touch the two ends of the pencil in the water together - what happens?
- Q. What happens if you flip the battery around?

Take it further

Try this out with these different electrolytes (we used salt and water previously):

- Water and lemon juice
- Water on its own

The science in the real world

Electrolysis is a technique we use to break down substances. For it to work, whatever electrolyte you are using, needs to conduct electricity as the inside of the pencil does. You may have tried water on its own and seen that it doesn't work. By adding an ionic substance like bicarbonate of soda or lemon juice, the solution can conduct, and electrolysis can take place. The circuit you make by adding the battery causes the water molecules to break apart. Some of the hydrogen from the water is released at one of the pencil tips as bubbles, and oxygen bubbles are released at the other pencil tip. If you look closely, you'll see a different number of bubbles being formed at each pencil because we are making different gases. This splitting up of a molecule by electricity can only happen if there are free moving ions in the solution. In industry, this same method is used to make sodium hydroxide. Sodium hydroxide is essential in making medicines, so this experiment gets us close to replicating a real lab process.

Increasing the current will speed up electrolysis - that's why when you push the pencils harder against the battery you get more bubbles, as you create a better connection for current to flow. Touch the two pencil ends together and you create a short circuit, hence why you see no more bubbles. Flipping the battery will swap where the hydrogen and oxygen bubbles are formed.

