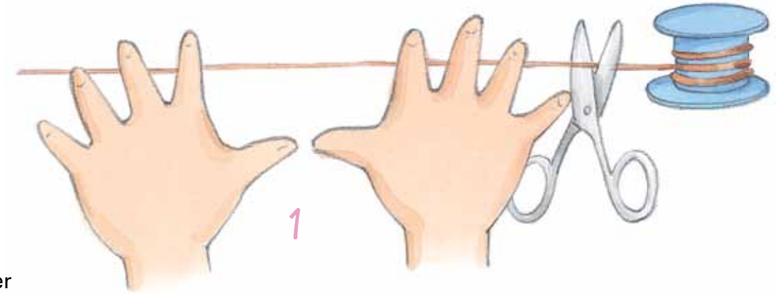
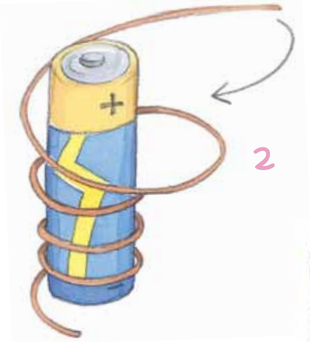
The simplest motor in the world

You will need:

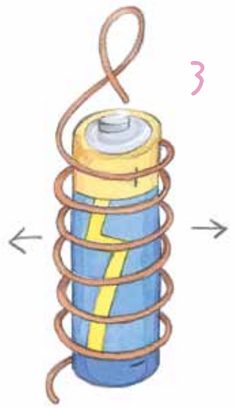
- Scissors
- A disc-shaped magnet
- A 1.5 V battery
- A reel of copper wire



1 Cut a length of copper wire about two palms long, more or less 35 cm. Cut it firmly, as it's a bit hard. There!



2 Roll the piece of copper around the battery, forming a spiral. It will end up like a hair ringlet! How artistic; it looks like a modern art sculpture!



3 Bend one end of the copper wire toward the positive end of the battery (you know, it has a + sign). Without changing the shape of the copper, open the spiral slightly so that the copper will be able to turn… in other words, make it a bit larger.

4 Set the spiral aside and now place the magnet on the negative end of the battery (the end with the – sign). You will see that it sticks there. Click!

5 Now place the spiral of copper wire around the battery and connect both terminals, one tip on the positive pole and the other on the negative pole, but touching the side of the magnet.

Why does it happen?

An **electric motor is a machine that transforms electrical energy into mechanical energy**, that is, into movement. In this experiment, you have just built the simplest possible electric motor! When the copper wire touches the magnet, you close the circuit and an electrical current passes through it. Given that it is found inside a magnetic field (which is what the magnet produces), a force is generated that makes the wire spin around the magnet. Thus, you have converted the electric energy provided by the battery into mechanical energy, which makes the copper wire move and spin!

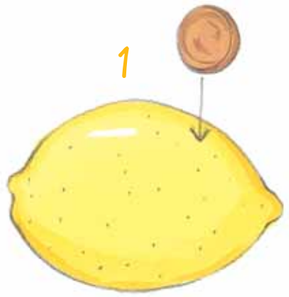
6 Try it out!
Place the battery standing up on a table with the copper wire connected. You will see that it starts to spin endlessly! Wow! What a fun scientific dizzy spell!

The citrus connection

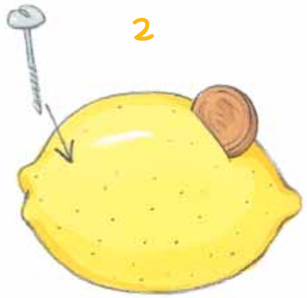
You will need:

- A couple of lemons
- Two galvanized zinc screws
- Two copper 5-cent coins
- Scissors
- Conductor cables (copper)
- A low intensity LED (we use 2V)

1 Hold the lemons at both ends and stick one of the copper 5-cent coins into it; stick the coin in firmly about half way.

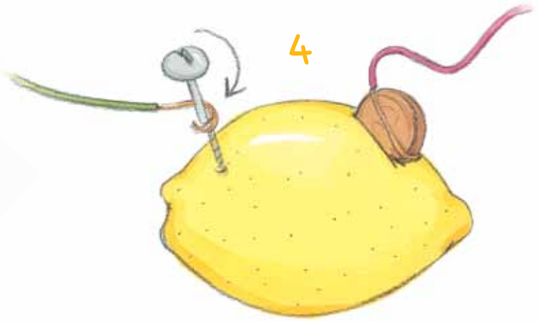


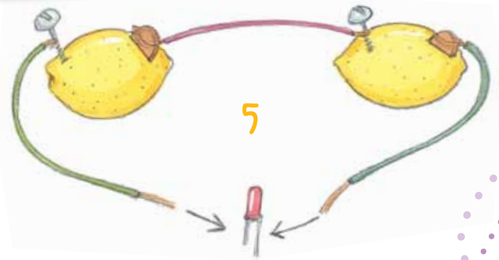
2 In the same upper half of the lemon where you stuck the coin, stick the screw, but in the opposite side, that is, one in front of the other. Oh, the poor lemon!



3 With the help of the scissors, very carefully strip the end of the wire, removing its plastic cover. It would be better to ask an adult or an older brother or sister to help you, because it's quite a complicated step. Do the same thing with the other wire, to make two. That's it, well stripped!

4 Connect a cable to the screw, rolling the stripped end of the cable around it. And connect the other cable to the coin; it's best to make a U-shape and check that it stays well attached to the coin.





5 Now take the other lemon and stick the corresponding coin and screw into it. Connect the end of the wire leaving the first screw to the coin in the second lemon and the coin in the first lemon to the screw in the second one. Cut this last wire in half and strip the ends as shown in the drawing: You're going to connect it to an LED.

Why does it happen?

You connected two **different metals** to these "guinea pig" lemons: **A galvanized screw made of zinc and a coin made of copper, which forms electrodes.** Zinc is a metal that gives electrons (the anode) and copper on the other hand, receives them (the cathode). At the other end, the lemon juice enables the electrons to pass from one metal to the other, creating a very small electrical current. Both lemons must be connected for the LED to work. You would need more than 5,000 lemons to light up a light bulb in one of the lamps in the house, but that would be impossible! You can try doing the same thing with different fruit and vegetables: Potatoes, apples…

6 Try it out!

Lastly, connect the end of each cable to the LED rods. You cannot connect it any other way, because the LED only works in one way! So, the largest rod of the LED goes with the cable leaving the coin and the short rod goes with the cable leaving the screw. You'll see that as soon as you connect them, the LED lights up! Wow! But to see it better, you can switch off the lights.

Let's make an electromagnet

You will need:
- A 9V battery
- A spoon
- Conductor cable
- Paper clips
- Plasticine
- A tool for cutting Plasticine

1 Cut a small piece of Plasticine to serve as a base to place the battery. A piece the size of 2 or 3 fingers will be enough. It works very well, because it holds the battery perfectly and it's a clean system that is easy to model!

2 Fix the battery to the Plasticine well. To do so, sink the bottom of the battery into the middle of the Plasticine... but just a little! With the leftover piece of Plasticine, make a kind of "L" to make the lid over the top of the battery. You have to be careful with all the details, hey?

3 Now take the spoon and the conductor cable with the two ends stripped and roll the cable around the handle of the spoon. But don't roll it round entirely! The two ends must stick out, as if the spoon had two antennae!

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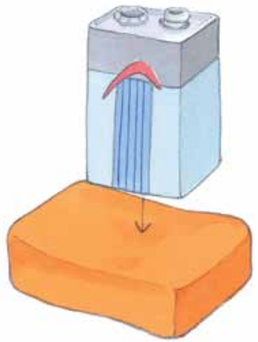

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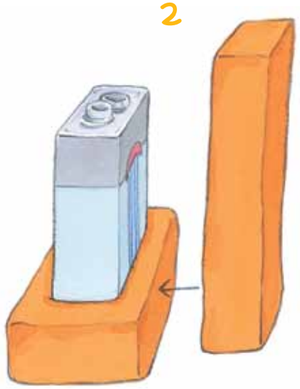

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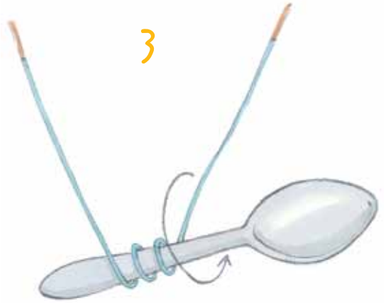

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4 Connect the two ends of the cable to the poles of the battery (the two little bumps at the top of the battery).

5 Lastly, close the top with another piece of Plasticine, so that the cables cannot come loose.

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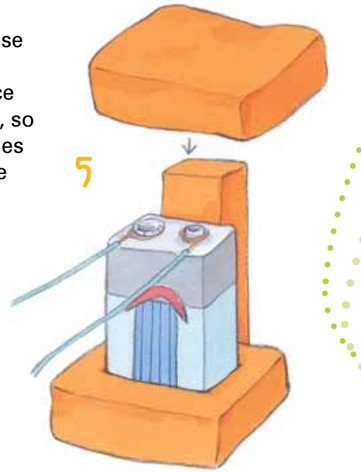
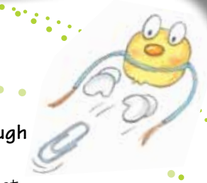


Why does it happen?



When you roll the cable around the spoon, you make a coil through which you make the electrical current circulate when you connect the two ends of the cable to the battery. The movement of electrons through the coil also generates a magnetic field, which magnetizes the spoon that is positioned right in the middle of the coil. So, **it magnetizes it, converting it into a magnet!** Now, the spoon is capable of attracting small metallic objects! Be careful not to try attracting large objects, because the attraction force of the spoon is very limited!

6 Try it out!

And finally, for the spectacular step: Bring the end of the spoon close to a paper clip and pick it up! It looks like spoon magic, but it's an electromagnet you've made yourself! You can even make a chain of paperclips!

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