

LIGHT FROM SALT WATER

A battery is actually a box full of energy. This is handy because then you always have electricity when you want it. Wherever you are. In a dark, creepy forest or simply if you want to read in the dark in bed.

With this exhibit, you are going to make a battery yourself that can make a lamp light up. The only things you need are beakers of salt water, electrical wires and aluminum foil.

WHAT DO YOU NEED?

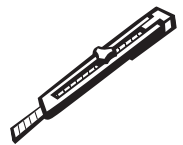
Materials:

- Very thin electrical wire with a copper core (3 meters)
- Aluminum foil
- Transparent plastic beakers
- 1.6 volt LED lamp
- Foamboard, 65 centimeters long and 30 centimeters wide
- Plank
- Water
- Salt
- Vinegar
- Adhesive tape
- Nails



Tools:

- Pencil
- Ruler
- Compasses
- Marker
- Scissors
- Snappy knife
- Stripping pliers
- Wood saw
- Hammer
- Sandpaper
- Water jug



BUILDING PLAN

Before he starts building, a builder of exhibits first makes a building plan of the exhibit. That's what you are going to do too. A building plan shows how something is made and how big it will be.

First look at the photo and the drawings under 'How are you going to make it?' This will give you an idea of what the exhibit will look like and how it should be constructed.

Tips: 1. You can read the text accompanying the drawings already. 2. If the materials for your exhibit are already available, it's a good idea to have a look at them too.



Under *'What do you need?'* you can see all the materials and tools that you need. But the list of materials does not show exactly how much of them you will need. You will know that only when you have decided how big the exhibit will be. So first decide with your pal how big the exhibit should be and how you are going to draw it.

Discuss your plan with your **teacher**.

Now use a pencil and ruler to make a building plan in your **workbook**. You both make your own building plan in your workbooks, but you do it in the same way. You make the drawing to scale 1:2. This means that one centimeter in the drawing is really two centimeters in real life. So if your real exhibit is forty centimeters high, it is twenty centimeters high in the drawing. Write the real measurements next to the different parts. Also show where the holes must be in the beaker holder in your building plan. For this, use the description under *'How are you going to make it?'*

You are going to show the building plan to the rest of your class. Tell them how you plan to build the exhibit. Ask the other children and the teacher what they think of the building plan. Maybe they have an idea to make it even better.

Show your improved building plan to the **teacher**. When he or she has approved your drawing, you can start making the list of materials together.

LIST OF MATERIALS

The building plan is ready, so you now know the size of all the materials and you can count how many of each part you need. Make the list of materials in your **workbook** and give the list to your **teacher**. Ask him or her where you can get these things. Then you can really start building!

HOW ARE YOU GOING TO MAKE IT?

To build an exhibit together you have to discuss a lot and make agreements. How are you going to tackle it? Who does what?

Divide up the different tasks as fairly as possible.

Try to work together as much as possible, so that you both get some experience of building.

If you come across a difficult word, look it up in a dictionary.

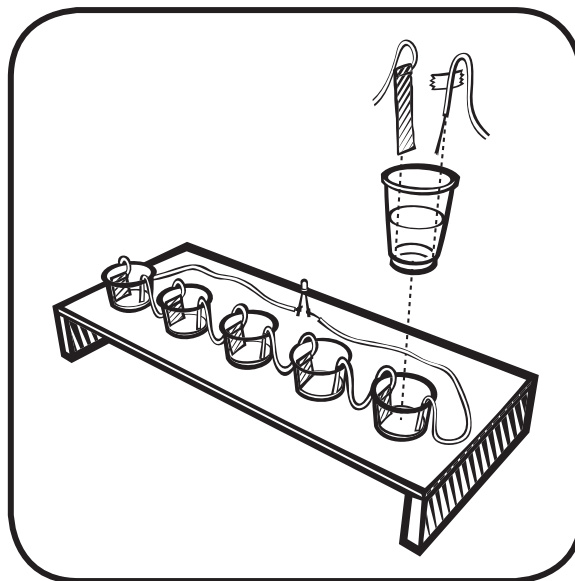
1.

Cut 4 pieces of electrical wire measuring 25 centimeters with the cutting part of the pliers.

2.
With the stripping pliers, remove about 4 centimeters of the plastic covering at both ends of the wire.
You call these the electrical wire strips. Do this for all four wires. Be careful that you adjust the stripping pliers well, as the wires are very thin.
3.
Measure the height of the plastic beakers. Cut 5 pieces of aluminum foil 6 centimeters wide. The length is the number of centimeters of the beaker that you have just measured.
4.
Lay one end of the stripped electrical wire on a corner of the aluminum foil and fold a small piece of foil over it. Press this down firmly. The foil must completely touch the wire. Now fold the foil in half lengthways and press it down firmly. Fix it in place with adhesive tape. Take a good look at the picture to see how you should fold the foil!
5.
Repeat step four for all the electrical wires. Spread the copper wires at the ends out a bit so that you get a sort of brush.
6.
Now you are going to make a holder for the beakers. Take a beaker. Use a marker to draw a line halfway up the beaker. Then cut the beaker through the middle. Now you can measure the diameter of the middle of the beaker. This will be the diameter of the holes that you are going to make. Use compasses to draw 5 circles with this diameter on the foamboard. Make sure 5 centimeters of space is left between the circles and the edge of the foamboard. Also leave 5 centimeters of space between the circles.
7.
Cut the holes out with a snappy knife. Be careful when doing this. Always keep the fingers of your other hand **BEHIND** the knife so that you don't cut your fingers.
8.
Now make the feet for the beaker holder. Use a wood saw to saw two blocks of wood from a plank. The blocks are the same width as the foamboard and are 8 centimeters high. Hammer them under the ends of the foamboard.
9.
Insert the beakers into the holes so that they are steady. Take one electrical wire with the aluminum foil attached. Hang the aluminum foil in the first beaker with the foil on the side of the next beaker.
Hang the wire in the second beaker and fix it to the top of the beaker with adhesive tape. The wire comes just above the bottom.
You repeat this until you have arrived at the fifth beaker. Have a good look at the drawing to see how to do this.
Check that the foil is hanging well in the beaker. If it is not, you can also stick it down.
The wire that is in the foil should not come into contact with the water. Check whether all the wires are still in the foil.

10. Cut 2 electrical wires measuring 50 cm. Using the stripping pliers, strip off about 4 centimeters of the plastic covering from either end. At the end of one of the wires, fix the last piece of aluminum foil as in step four. Hang this in the fifth beaker. Attach the other end to one of the feet (this is called a 'contact') of the LED lamp.

11. Attach the second wire to the other contact of the LED lamp. Hang the other end of the wire in the first beaker. Again, stick the wire firmly to the inside with adhesive tape. Now check that there is a stripped wire and a piece of aluminum foil in all of the beakers. Also make sure that the wire and the foil do not touch each other in the beakers.



12. Pour a liter of hot water into a water can and add two dessert spoons of salt. Stir it well so that the salt is dissolved.
13. Fill each beaker half full with the salt water solution. Make sure that the copper wires are in the water.

HOW DOES IT WORK?

The exhibit is ready. You have nothing more to do if it works. Is the lamp lit? If not, check that the LED lamp is connected well. Have you put the wires in the beakers correctly?

If the lamp is still not lit even though everything is connected correctly, try this: turn round the contacts to the LED lamp (the current can only flow in one direction). If the lamp is still not lit, add a half teaspoon of vinegar to each beaker. Stir it well. Make sure that the wires and the foil are still where they should be. Is it working now?

Tip: to see whether the lamp is lit, you must sometimes look straight into the lamp. If you still can't see it well, you can take the battery to a dark room. Or you can put a cover made of black cardboard around the LED lamp.

WHAT DO YOU SEE HAPPENING?

You are now going to look for the science behind the exhibit. This exhibit is about electricity and batteries. Do the research below. Write the answers in your **workbook** under 'Research report 1'.

1.
Does your battery also work if you use four beakers instead of five? Try this out. Take the fifth beaker out of the row. Hang the long wire that runs to the LED lamp in the fourth beaker.
2.
And what happens if there are three beakers, or two or one? Try this out.

WHAT'S THE ANSWER?

You are now going to find information about electricity and batteries. You can look for information in the school media library, the library or the Internet. Go to www.sciencecenteropschool.nl and then to 'primary school pupils' and click on 'links'. Under the title of your exhibit, you will find a number of websites with background information.

Answer the questions below and write the answers in your **workbook** under 'Research report 2'.

Operation / science:

What is electricity? What is an electric circuit? What is a battery?

Invention:

Who invented the battery?

Application:

Make a list of all the equipment in your home that works on batteries. Why are there batteries in this equipment?

Let your **teacher** read your answers.