# Easy STEAM Experiments “Electrolysis Cell”

Nr./Art. 762360

**IMPORTANT – PLEASE READ INSTRUCTIONS CAREFULLY AND KEEP FOR FUTURE REFERENCE.**

Easy STEAM experiments – for school and at home
Applicable from grade level 4
The materials in the experiment box enable you to carry out various experiments on electrolysis in individual or group work.

**Package contents:**

1 kit for electrolysis cell
2 one-way taps
3 syringe with Luer-Lock tip
2 crocodile clips
1 battery (9 volt)
1 piece of tube
1 solar motor
1 propeller
2 test tubes

**Additional materials required:**

100 ml of water, soda, teaspoon, safety goggles, tea light, matches and wooden skewers, sharp knife and scissors

**Warning notice for a safe and correct method of use:**

- “Notice: Educational material – adult supervision is required.”
- Please retain this information for future reference.

**Notes for disposal:**

Used batteries are not to be disposed of with household waste. Consumers are legally obligated to return batteries to the appropriate collecting points. They can also be taken to any place where they are sold.

**Guarantee:**

In addition to the legal guarantee (and without reducing it) you receive 2 years of total guarantee. In case of guarantee, contact place of purchase.

**Maintenance and cleaning:**

Rinse the materials after the experiments. The materials must be allowed to dry completely before packing!

**Core learning goals:**

- Learn about electrolysis as a separation process of chemical compounds.
- Understand and describe the structure and functioning of an electrolysis cell.
- The electrolysis of water produces hydrogen and oxygen. The pupils can describe the smouldering chip and oxyhydrogen gas sample as detection methods for gases.

**Extended learning goals:**

- Understand anode (oxidation) and cathode (reduction) reaction. Set up the reaction equation of the redox reaction.
- Describe how the galvanic cell (fuel cell) works.
- Deal with the problems of hydrogen technology.

**Before you start:**

- Procure the additional materials needed.
- Prepare the experiments as described below.
- Have all materials and a cloth to wipe up ready.

## Preparation for the experiments

Electrolysis cell

1. Strip the ends of the cables with a sharp knife, bend them as shown and push them between the piece of tubing and the graphite electrodes.


2. Dissolve 1 tsp soda in 100 ml water in the measuring beaker. Place the prepared graphite electrodes in the beaker. They must not touch each other.

3. Pull the plungers out of two syringes. Remove the caps from the two one-way taps and screw them onto the syringes. Open the tap.

4. Cut off about 5 cm of the tube and put it over the tip of the third syringe.

Betzold

## 1 What's bubbling?



**This is how it works:**

1. Connect one crocodile clip each to the ends of the copper cables and the poles of the battery. Make sure that you connect the poles correctly.
2. What do you observe?
   Can you observe the same thing on both graphite electrodes?
3. Research which gases rise at the negative pole and at the positive pole, what the process is called and explain what happens.

Don't forget to disconnect the battery again!

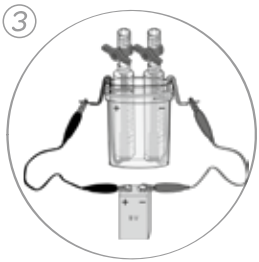

Electrolysis is a separation process of compounds. In the electrolysis of water, an electric current splits water into hydrogen and oxygen. Hydrogen rises at the negative pole (cathode). Oxygen rises at the positive pole (anode).

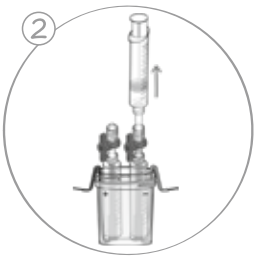
## 2 Structure of the electrolysis cell



1. When setting up the electrolysis cell, make sure that the battery is not connected.
   Place the syringes over the electrodes, the taps are open.


2. With the third syringe, draw the remaining air out of the two syringe barrels one after the other until they are completely filled with soda water. Close each of the taps.



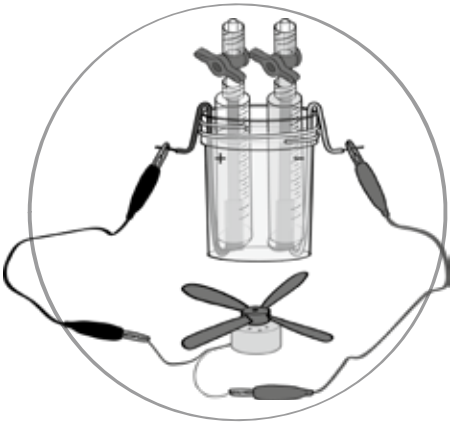




3. Now connect the battery again. What happens? After a while, pay attention to the ratios of the gas quantities!

**You can observe that:**
The syringes fill with gases. Twice as much gas is produced at the positive pole (anode) as at the negative pole (cathode).

## 3 Where does the electricity come from?

Electrolysis cell

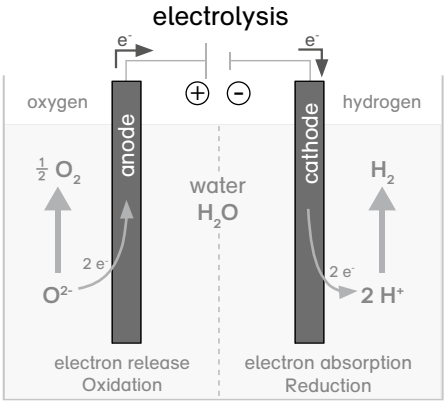


1. Put the propeller on the solar motor. Disconnect the battery from the electrolysis cell and connect one crocodile clip to each end of the solar motor cable. What happens? Did you connect the propeller correctly? Swap the poles if necessary.
2. Pay attention to how long the engine runs.
3. Connect the electrolysis cell to the battery again. Watch the amount of gas! Test how long the propeller runs. Can you see a connection?
4. Find out what happens during this process!

If you connect a consumer (solar motor with propeller) to the electrolysis cell, the propeller will turn. The electrolysis cell becomes a power supplier and emits electricity. The hydrogen reacts with oxygen, releasing energy in the process.

## 4 What happens during electrolysis?

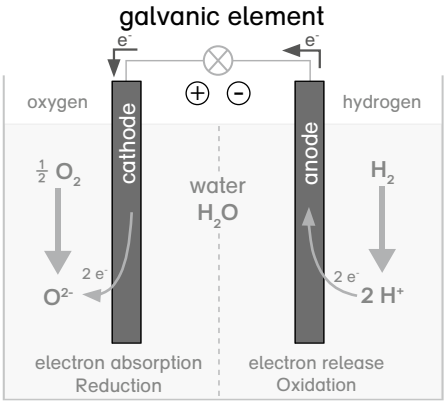
Electrolysis cell




There is a shortage of electrons at the anode and an excess of electrons at the cathode. Under high energy demand, the process is forced.

electrical energy → chemical energy

$2\ H_2O$ + **energy** → $2\ H_2 + O_2$




The reverse reaction of electrolysis takes place in the so-called galvanic element. This reaction is voluntary.

chemical energy → electrical energy

$2\ H_2 + O_2$ → $2\ H_2O$ + **energy**

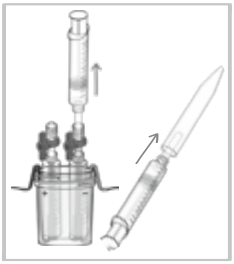
# Easy STEAM Experiments “Electrolysis Cell”

Nr./Art. 762360

**IMPORTANT – PLEASE READ INSTRUCTIONS CAREFULLY AND KEEP FOR FUTURE REFERENCE.**

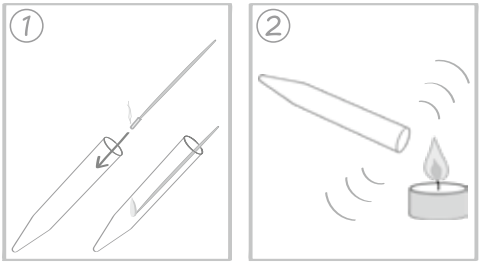
## 5 How do we detect the gases?

Electrolysis cell



**This is how you prepare the samples:**

Use the syringe to draw out 6 ml of the gas produced from one of the electrodes. Pour into a test tube and close with the thumb.




**This is how you conduct the experiments:**

1. Conduct the glowing splint test with the gas from the anode. Hold a wooden skewer, which has been blown out after lighting, in the tube. What do you see?
   The wooden skewer glows. This is how you detect oxygen ($O_2$).
2. Carry out the oxyhydrogen test with the gas from the cathode. Wear ear protection and open your mouth, but do not be frightened about what happens next. Hold the opening of the tube to the flame of a tea light. What happens?
   A soft fizzing sound is heard when the gas is ignited. This means that pure hydrogen ($H_2$) is present.

   Repeat the oxyhydrogen test with a gas mixture. Take 4 ml hydrogen and 2 ml oxygen. What happens? A bang sounds when the gas mixture ignites. An oxyhydrogen gas is a mixture of hydrogen and oxygen. The bang is particularly violent with a mixture in the ratio of 2 : 1.



**D**
Arnulf Betzold GmbH
Ferdinand-Porsche-Str. 6
73479 Ellwangen

Telefon: +49 7961 90 00 0
Telefax: +49 7961 90 00 50
E-Mail: service@betzold.de
www.betzold.de

**AT**
Arnulf Betzold GmbH
Seebühel 1
6233 Kramsach/Tirol

Telefon: +43 5337 644 50
Telefax: +43 5337 644 59
E-Mail: service@betzold.at
www.betzold.at

**CH**
Betzold Lernmedien GmbH
Winkelriedstrasse 82
8203 Schaffhausen

Telefon: +41 52 644 80 90
Telefax: +41 52 644 80 95
E-Mail: service@betzold.ch
www.betzold.ch

Betzold