

Galvanic cells



Physics

Electricity & Magnetism

Electric current & its effects



Difficulty level

medium



Group size

2



Preparation time

10 minutes



Execution time

10 minutes

This content can also be found online at:

<http://localhost:1337/c/5f4eba0a38db8d0003265c9d>



PHYWE



Galvanic element

Motivation and tasks

PHYWE



Commercially
available batteries

The functional principle of a commercial battery is that of a galvanic cell. Such a cell can be easily reproduced at home.

A galvanic cell consists of two different metals (electrodes) connected by an electrolyte. As positive metal ions from the surface of the electrodes pass into the electrolyte and freely moving electrons remain on the electrodes, a voltage is created between the electrodes.

1. Build your own battery from materials found in the household.
2. Show that a voltage is actually generated by your battery.

Equipment

Position	Material	Item No.	Quantity
1	Trough, grooved, w/o lid	34568-01	1
2	Copper electrode, 76 mm x 40 mm	45212-00	2
3	Zinc electrode, 76 mm x 40 mm	45214-00	1
4	Lead electrode, 76 mm x 40 mm	45215-00	1
5	Iron electrode, 76 x 40 mm	45216-00	1
6	Alligator clips, bare, 10 pcs	07274-03	1
7	Connecting cord, 32 A, 500 mm, red	07361-01	1
8	Connecting cord, 32 A, 500 mm, blue	07361-04	1
9	Emery paper, medium	01605-00	1
10	Analog multimeter, 600V AC/DC, 10A AC/DC, 2 M Ω , overload protection	07021-11	1

Set-up (1/2)

PHYWE



Materials for battery construction

- Cut slices from the blotting paper and aluminium foil in the size of the coins (one per coin).
- Additionally cut out a larger aluminium surface as a base plate.
- Prepare the vinegar in a container.
- Then dip the blotting paper in the vinegar. It is best to use tweezers.

Set-up (2/2)

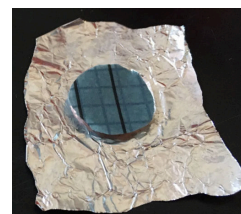
1. Place one of the coins on the large piece of aluminium foil.
 2. Place a sheet of aluminium foil on top.
 3. Then place a slice of blotting paper soaked in vinegar on top.
 4. Then put on another coin and repeat steps (2) to (4) until you reach the last coin.
- Always stack in the order aluminium foil as first electrode, then blotting paper with vinegar as electrolyte and then copper as second electrode. Such a unit is called a mono-cell.



(1.) and (4.)



(2.)



(3.)

Procedure (1/2)

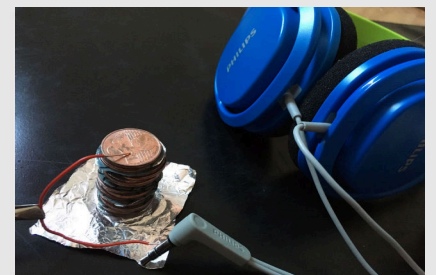
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Take a standard 1.5V battery and connect one end, also called the pole, to the audio connector on the headphones. Use the copper wire. Now touch the other end of the battery to the second contact of the audio connector by pressing it onto the base aluminum foil.

- Then what do you hear?

The crackling you hear is caused by the voltage of the battery in the headphones. Now try the same with your homemade battery.

- Can you hear anything again?
- Does that sound something like this?

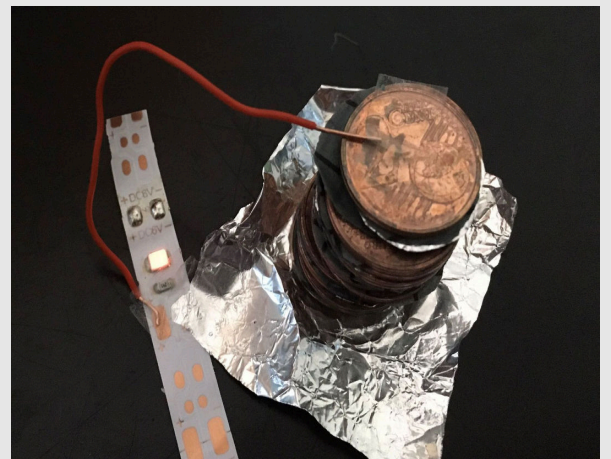


Procedure (2/2)

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As an alternative to headphones, you can also use the self-built battery to power an LED. Since the direction of the current is important, you can determine which is the plus and which the minus pole of your battery. Pay attention to the + and - symbol on your LED lamp.

- Is the coin end (top) or the aluminium foil base end (bottom) your minus pole?



Operating an LED with the self-built battery

Task 1

PHYWE

Assign the matching words to the gaps.

When two contacts of a are connected to a headphone, we hear a crackling sound the moment the circuit is closed. So the headphones can be used as a simple for an electrical voltage. When we connect our homemade battery we also hear a crackling sound. So our homemade battery also generates a .

battery

measuring device

voltage

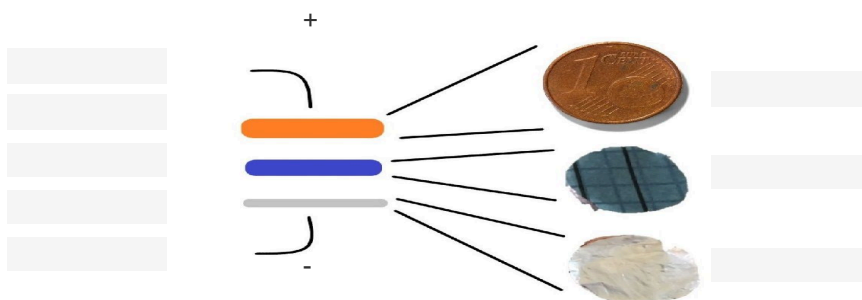
☒ Check

Task 2

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Structure of the self-built battery

- Electrolyte
- Aluminium foil
- Electrode
- Electrode
- Copper Coin
- Cathode (+)
- anode (-)
- Blotting paper with vinegar

☒ Check

Task 3

PHYWE

Assign the matching words to the gaps.

Our self-made battery consists of two different . These are called in the battery. The vinegar in the blotting paper between them serves as in the battery. With such an arrangement one speaks of a . The depends on the metals used. This property of metals is called standard potential. The more different this value is in the metals, the higher the voltage of the cell.

electrolyte

voltage

electrodes

metals

galvanic cell

☒ Check

Task 4

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How can the voltage of a galvanic element be increased?

- ☐ Use the same material on both electrodes
- ☐ Connecting several cells in series
- ☐ Parallel connection of several cells
- ☐ Use electrode metals with very different standard potentials

☒ Check

Slide	Score / Total
Slide 8: Measuring" the voltage with the headphones	0/3
Slide 9: Structure of the self-built battery	0/8
Slide 10: Measuring" the voltage with the headphones	0/5
Slide 11: Functionality of a galvanic element	0/2

Total amount



Solutions



Repeat