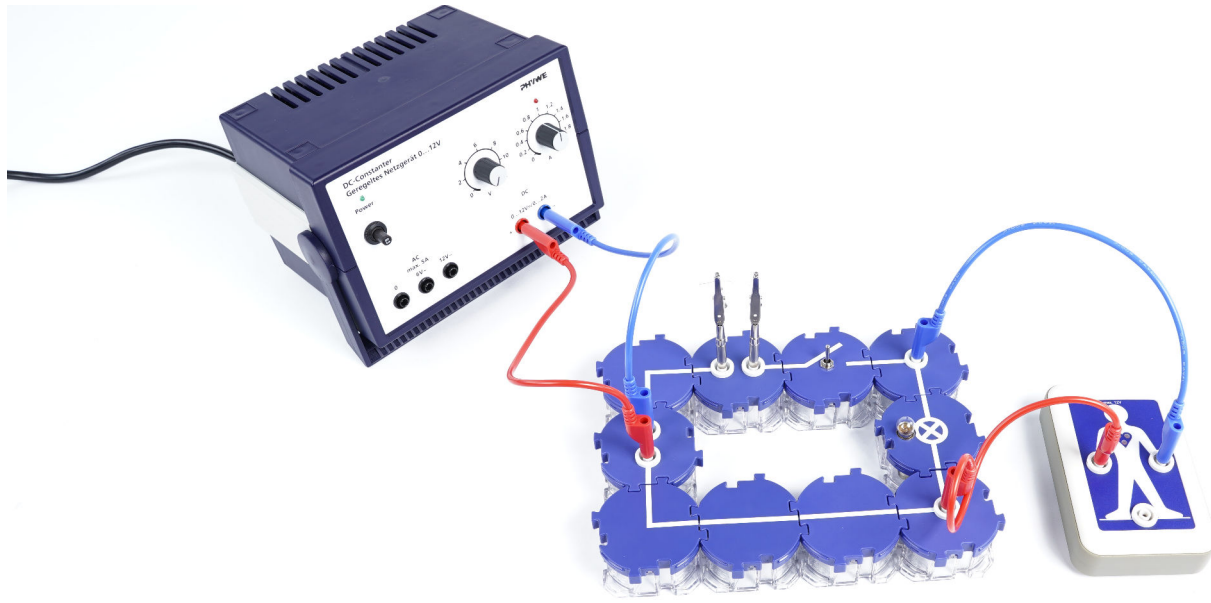


Earthing of the power supply line



The pupils should use the experiment to recognise the dangers of electric current.

Physics

Electricity & Magnetism

Use of electrical energy, energy supply



Difficulty level

medium



Group size

2



Preparation time

10 minutes



Execution time

10 minutes

This content can also be found online at:



<https://www.curriculab.de/c/681b223906b7f30002f9f9bc>

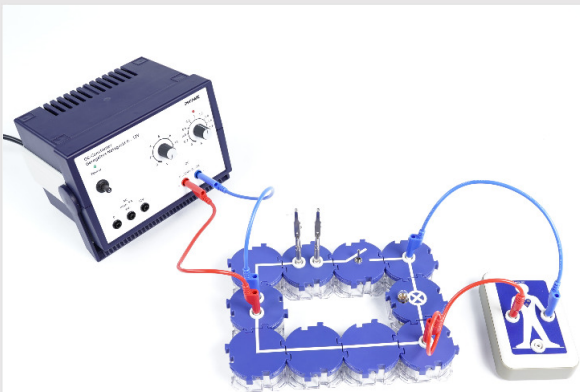
PHYWE



Teacher information

Application

PHYWE



Experimental setup

Improper use of electrical household appliances can be fatal - usually due to carelessness or ignorance. A model person is used to illustrate which contacts in the electrical circuit are life-threatening.

In a household, the power supply is provided via a live L conductor and an earthed N conductor. The latter ensures a fixed potential to earth, but also harbors dangers: A circuit can be completed via the earth. The experiment shows when such dangers arise due to the earthing of the N conductor and how they can be avoided.

Other teacher information (1/2)

PHYWE

Prior knowledge



No prior knowledge is required.

Principle



The dangers of electric current are analysed.

Other teacher information (2/2)

PHYWE

Learning objective



The students should use the experiment to recognise the dangers of electric current.

Tasks



Set up a circuit with a fuse, switch and light bulb. In a power supply network, there is an L conductor and an earthed N conductor. Use the model man to investigate the dangers posed by electric current and the earthing of the neutral conductor.

Safety information

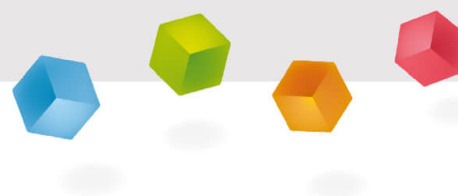
PHYWE



- The general instructions for safe experimentation in science lessons apply to this experiment.

PHYWE

Student information



Motivation

PHYWE

Improper use of electrical household appliances can be fatal - usually due to carelessness or ignorance. A model person is used to illustrate which contacts in the electrical circuit are life-threatening.

In a household, the power supply is provided via a live L conductor and an earthed N conductor. The latter ensures a fixed potential to earth, but also harbors dangers: A circuit can be completed via the earth. The experiment shows when such dangers arise due to the earthing of the N conductor and how they can be avoided.



Electric current can be fatal.

Equipment

Position	Material	Item No.	Quantity
1	Straight connector module, SB	05601-01	4
2	Angled connector module, SB	05601-02	2
3	T-shaped connector module, SB	05601-03	1
4	Interrupted connector module with sockets, SB	05601-04	2
5	Junction module, SB	05601-10	2
6	Straight connector module with socket, SB	05601-11	1
7	Angled connector module with socket, SB	05601-12	2
8	On-off switch module, SB	05602-01	1
9	Socket module for incandescent lamp E10, SB	05604-00	1
10	Resistor module 10 kOhm, SB	05615-10	1
11	Resistor module 47 kOhm, SB	05615-47	1
12	Model person for electrical safety	05680-00	1
13	Alligator clips, bare, 10 pcs	07274-03	1
14	Connecting plug, 2 pcs.	07278-05	1
15	Connecting cord, 32 A, 250 mm, red	07360-01	1
16	Connecting cord, 32 A, 250 mm, blue	07360-04	2
17	Connecting cord, 32 A, 500 mm, red	07361-01	1
18	Connecting cord, 32 A, 500 mm, blue	07361-04	2
19	Filament lamps 12V/0.1A, E10, 10 pieces	07505-03	1
20	Iron wire, d = 0.2 mm, l = 100 m	06104-00	1
21	PHYWE Power supply, 230 V,DC: 0...12 V, 2 A / AC: 6 V, 12 V, 5 A	13506-93	1

Setup (1/2)

PHYWE

1st attempt

In this configuration, the upper cable corresponds to the L conductor and the lower cable to the N conductor.

- Set up the experiment as shown in Fig. 1 and Fig. 2. Clamp the iron wire (fuse) with the help of crocodile clips on double plugs, whereby the crocodile clips must not touch each other.
- Insert the bulb holder so that the holder thread is connected to the upper cable.
- Connect one hand of the model man to the bottom corner of the circuit.
- Connect the other hand to the upper corner of the circuit or touch the lamp socket.

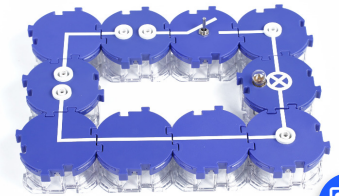


Fig. 1

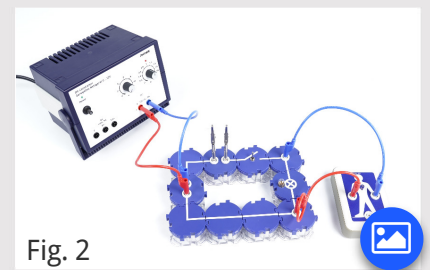


Fig. 2

Procedure (1/2)

PHYWE

1st attempt

- Apply a voltage of $U = 12\text{ V}$.
- Close the switch.
- Observe the model person and note the observations in the protocol.
- Also note the changes in the iron wire.

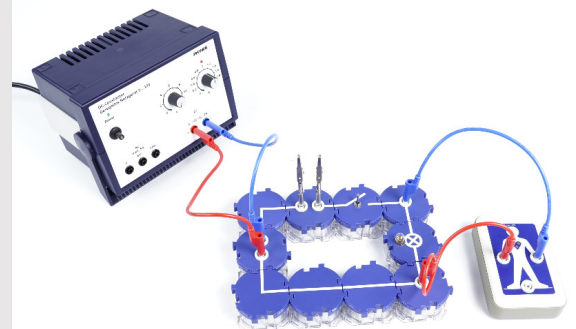


Fig. 5

Setup (2/2)

PHYWE

2nd attempt

The upper cable corresponds to the L conductor and the lower cable to the N conductor. The N conductor is earthed. This is realised by module cables downwards and a connecting cable.

- Modify the experiment as shown in Fig. 3 and Fig. 4 (with "Earth line").
- Connect one hand to the upper corner of the circuit or touch the lamp socket.

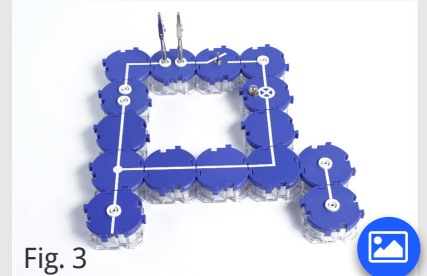


Fig. 3

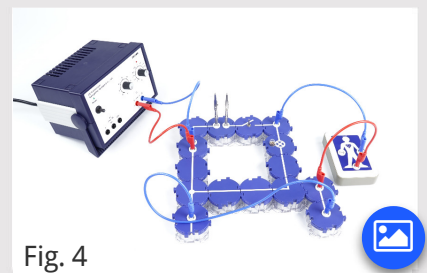


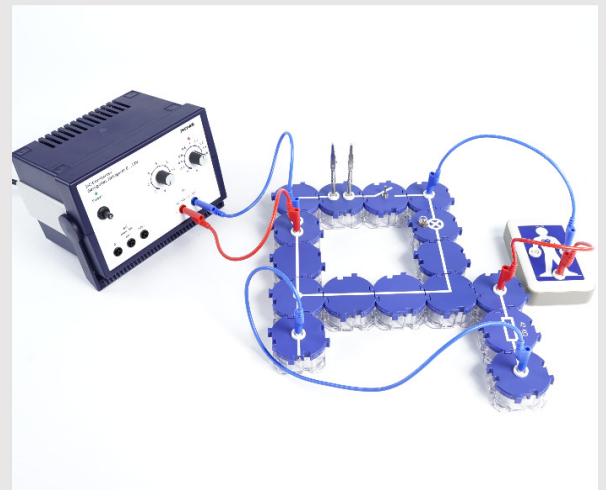
Fig. 4

Procedure (2/2)

PHYWE

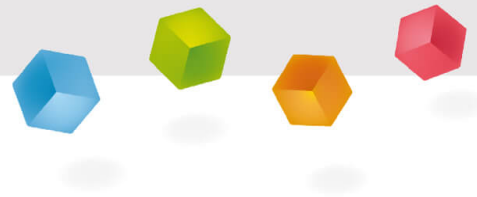
2nd attempt

- Close the switch.
- Note your observations in the protocol.
- With the switch open, insert resistors into the earth line and connect the feet of the model man to earth, first via 47 k Ω and then via 10 k Ω . (see illustration)
- Make a note of the observation in the protocol..



Experimental setup with resistor

PHYWE



Report

Observation (1/2)

PHYWE

Make a note of your observation:

a) Model man, b) Iron wire

Observation (2/2)

PHYWE

Note down your observations on the second part of the experiment:

a) without resistor, b) with $47\text{ k}\Omega$ resistor, c) with $10\text{ k}\Omega$ resistor

Task (1/3)

PHYWE

Why do the diodes in the model man light up in the first attempt?

The circuit inside the model man is closed.

The circuit inside the model man is open.

The circuit inside the model man is earthed.

What needs to be considered when connecting lampholders?

Care must be taken not to touch the N conductor.

Take care not to touch the L ladder.

Nothing needs to be observed.

Task (2/3)**PHYWE**

Why do the diodes in the model man light up brightly if there is initially no resistance between the feet and the earth wire?

Task (3/3)**PHYWE**

What is the significance of the resistor in the second experiment? Name practical applications.

Slide

Score / Total

Slide 16: Multiple tasks

0/2

Total score



Show solutions



Repeat



Export text