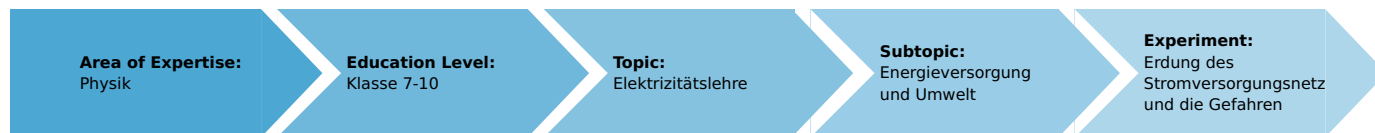


Earthing the power supply network and the dangers associated with it

(Item No.: P1377300)

Curricular Relevance



Difficulty



Intermediate

Preparation Time



10 Minutes

Execution Time



10 Minutes

Recommended Group Size



2 Students

Additional Requirements:

Experiment Variations:

Keywords:

Task and equipment

Information for teachers

Additional information

Fatal accidents can occur when electrical appliances are handled in a household. Most of such accidents result from careless behaviour or lack of knowledge. The person model is to be used to demonstrate which parts of an electric circuit are extremely dangerous to touch.

Power is supplied to a household via an L-lead connected to the supply voltage and an earthed N-lead. The earthing of the N-lead is necessary to produce a steady potential against earth (important when lightning strikes or insulation is faulty). The earthing of the N-lead is associated with dangers, however, as an electric circuit can then be closed to earth. This experiment demonstrates when there is danger because of the earthing of the N-lead and how such danger can be avoided

Notes on setup

In this setup, the upper lead represents the L-lead and the lower lead the N-lead. The earthing of the N-lead, through which current flows in the second and third parts of the experiment, is achieved with connecting building blocks downwards and a connecting cord. It may be necessary for you to repeat this to the students.
Only iron wire of $d = 2 \text{ mm}$ is to be clamped in as a safety fuse model!

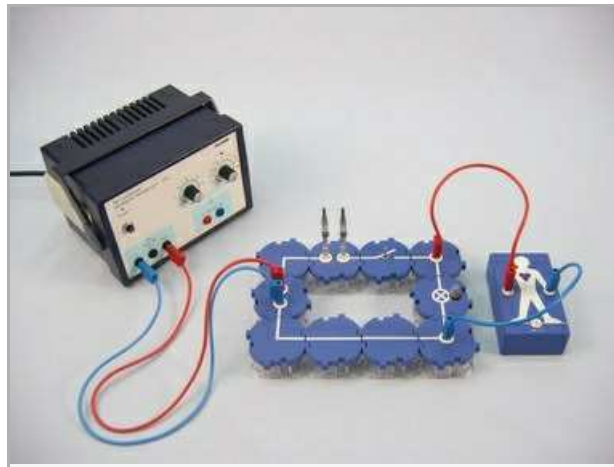
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Task and equipment

Task

Which dangers are associated with electric current?

Set up an electric circuit with a safety fuse, switch and filament lamp. In a power supply network there is an L-lead and an earthed N-lead. Use the person model to examine the dangers which are associated with electric current and with the earthing of the N-lead.



Equipment



Position No.	Material	Order 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, 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, SB	05680-00	1
13	Alligator clips, bare, 10 pcs	07274-03	(2)
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	07505-03	(1)
20	Iron wire, d = 0.2 mm, l = 100 m	06104-00	50 mm
21	PHYWE power supply DC: 0...12 V, 2 A / AC: 6 V, 12 V, 5 A	13506-93	1

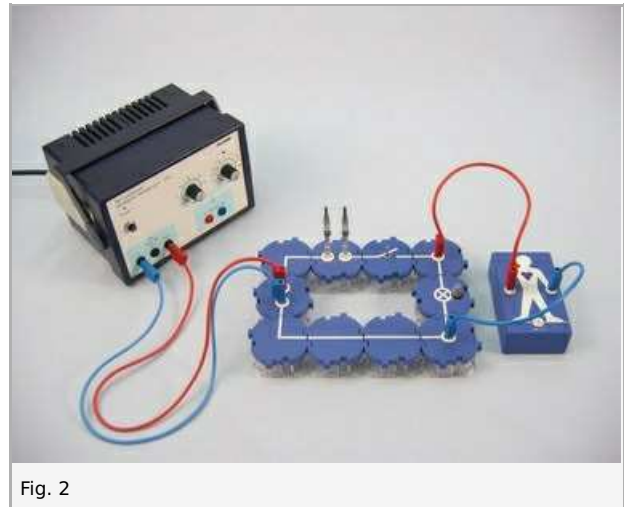
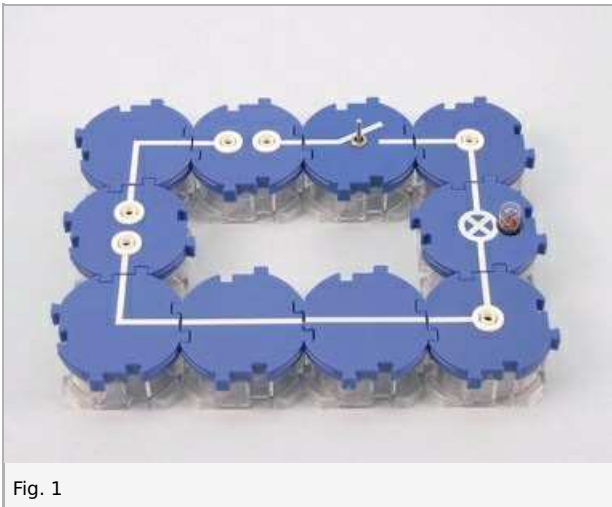
Set-up and procedure

Set-up

First experiment

In this setup, the upper lead represents the L-lead and the lower lead the N-lead.

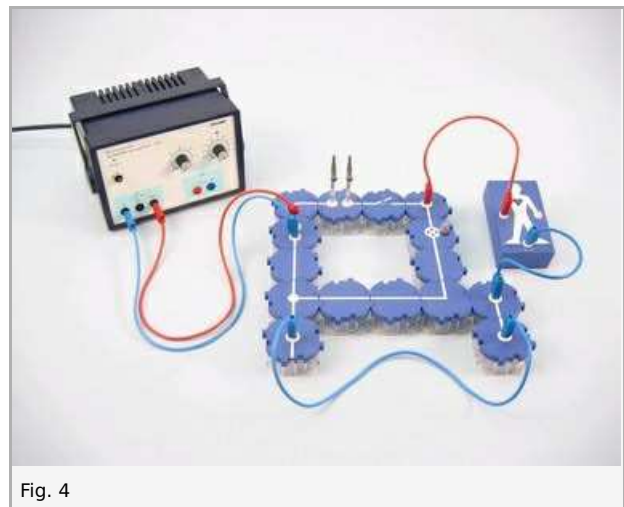
- Set up the experiment as shown in Fig. 1 and Fig. 2. Use crocodile clips to clamp the iron wire (safety fuse) across the double plugs. The crocodile clips must not touch each other.
- Insert the lamp socket so that the socket thread is connected to the upper lead.
- Connect one hand of the person model to the lower corner of the electric circuit.
- Connect the other hand with the upper corner of the electric circuit or contact the lamp socket.



Second experiment

The upper lead represents the L-lead and the lower lead the N-lead. The N-lead is earthed. Achieve this with connecting building blocks downwards and a connecting cord.

- Change the experiment acc. to Fig. 3 and Fig. 4 (with "earth lead").
- Connect one hand of the person model with the upper corner of the electric circuit or contact the lamp socket.



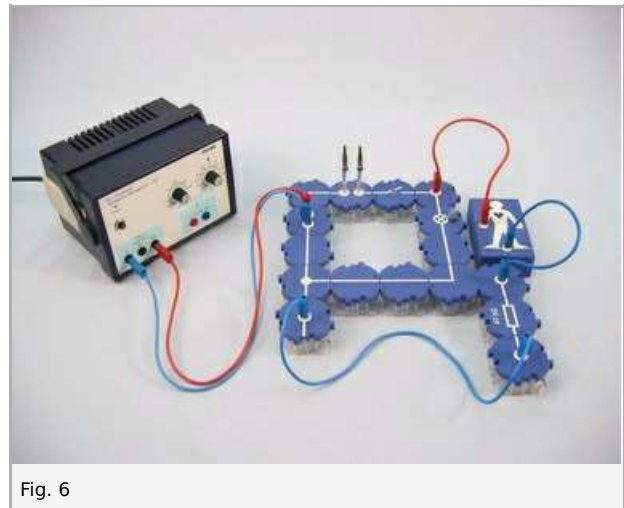
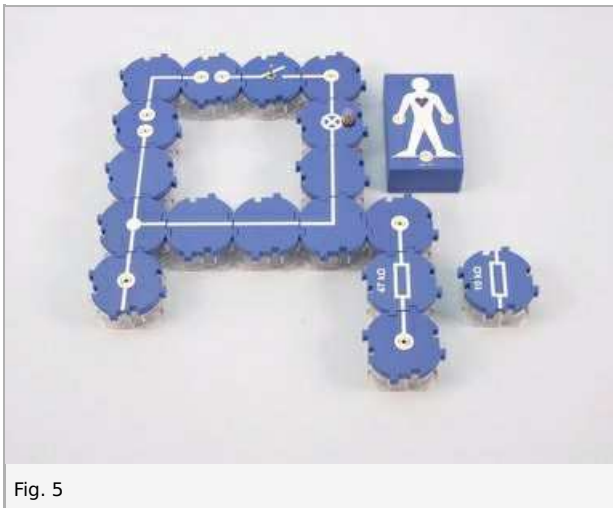
Procedure

First experiment

- Close the switch.
- Observe the person model and note your observation in the report.
- Record any change in the iron wire.

Second experiment

- Close the switch.
- Record your observations in the report.
- Change the experiment acc. to Fig. 5 and Fig. 6. Connect the socket on the foot of the person model to the earth lead, first across $47\text{ k}\Omega$, then across $10\text{ k}\Omega$.
- Connect one hand with the upper corner of the electric circuit or contact the lamp socket.
- Record your observations in the report.



Report: Earthing the power supply network and the dangers associated with it

Result - Observations 1

Note down your observations during the first part of the experiment.

- a) person model
- b) iron wire

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Result - Observations 2

Note down your observations during the second part of the experiment.

- a) without resistor
- b) with 47 kΩ resistor
- c) with 10 kΩ resistor

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Evaluation - Question 1

Why did the diodes in the person model light up in the first experiment?

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Evaluation - Question 2

What is to be kept in mind when connecting lamp sockets?

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Evaluation - Question 3

Why did the diodes in the person model light up brightly, although there was first no resistance between the feet and the earth lead?

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Evaluation - Question 4

What was the importance of the resistance in the second experiment? Name practical applications.

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