Series and parallel connection of bulbs

Nature & technology > Devices & machines in everyday use

Difficulty level	Group size	Preparation time	Execution time
medium	2	10 minutes	10 minutes

This content can also be found online at:

http://localhost:1337/c/6088238c6e938800032dd955

PHYWE
Robert-Bosch-Breite 10
37079 Göttingen
Tel.: 0551 604 - 0
Fax: 0551 604 - 107
info@phywe.de
www.phywe.de

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Teacher information

Application

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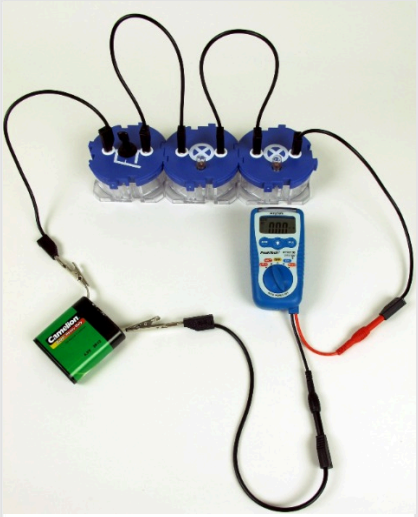

Test set-up

In this experiment, the students investigate the behaviour of two incandescent lamps in an electric circuit when connected in series and in parallel.

They find that in series connection all loads must be intact, while in parallel connection if one load fails the others are not affected.

From this they conclude that the design of a circuit has a significant influence on the behaviour of the loads and that both circuits have different advantages and disadvantages depending on the application.

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Robert-Bosch-Breite 10
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Other teacher information (1/2)

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Previous knowledge

The students are familiar with the principle of the electric circuit and can draw and implement circuit diagrams. The students know the current as a physical quantity and can measure it independently with the multimeter in the circuit.

Principle

The students independently learn the behaviour of the two circuits in the event of the failure of a consumer. If necessary, the current measurements can be omitted, which should show that a much higher current flows in the parallel circuit. This allows the brighter glow of the light bulbs to be explained clearly.

Notice: However, Ohm's law, which would fully describe the observed phenomenon, will not be discussed here.

Other teacher information (2/2)

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Learning objective

The students learn the basic difference between series and parallel connection. They understand why, in contrast to the series circuit, the other load still lights up in the event of failure of one load in the parallel circuit.

Tasks

- The students build a series and then a parallel circuit from two incandescent lamps
- They each observe the brightness of the lamps and measure the flowing current
- You remove one of the lamps from the circuit and observe what happens

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info@phywe.de
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Safety instructions

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- The use of the battery means that there is no electrical hazard from the set-up. Nevertheless, the use of the on/off switch makes sense, as it is not assumed that the students can assess the danger.
- Make sure that the students always break the circuit when making changes to the experimental set-up.
- The general instructions for safe experimentation in science lessons apply to this experiment.

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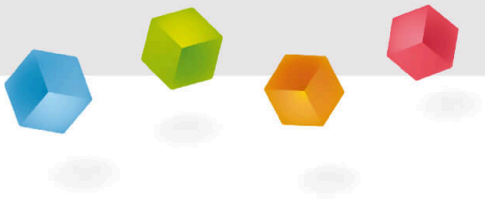

Student Information

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Motivation

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Fairy lights

Multiple socket

From your everyday life you know many electrical devices that you plug into the socket so that they are supplied with electricity. However, the circuit up to the socket, but also in the devices themselves, often differs. Have you ever wondered how exactly this works?

For example, you can plug many devices into a multi-outlet, and if you unplug one of them, the others will still be powered.

However, many fairy lights go out completely if a single light bulb breaks.

What the difference is between these two examples and what this means in everyday life is what we want to investigate in this experiment.

Tasks

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You have a series and a parallel circuit with two lamps each. Now one of the two lamps is broken, in which circuit does the other lamp continue to shine?

Series connection

Parallel connection

What are the differences between series and parallel connection?

- Set up two incandescent lamps in series. Observe the brightness of the lamps and the current flowing. Remove one of the lamps from the circuit and observe what happens.
- Set up two incandescent lamps in parallel. Make the same observations
- Go to the report and answer there the questions about the experiment

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Equipment

Position	Material	Item No.	Quantity
1	Flat battery, 4.5 V	07496-01	1
2	Connecting cord, 32 A, 250 mm, black	07360-05	6
3	Alligator clip	167700	2
4	Lamp holder, E10, with sockets	09390-06	2
5	Lamp 4 V/0,04 A,E 10 socket	06154-00	2
6	On/off switch for sciences sets	09390-07	1
7	Digital student multimeter AmpSafe, 600V AC/DC, 200mA AC/DC, 20 MΩ, electronic overload protection	07127-00	1

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Set-up

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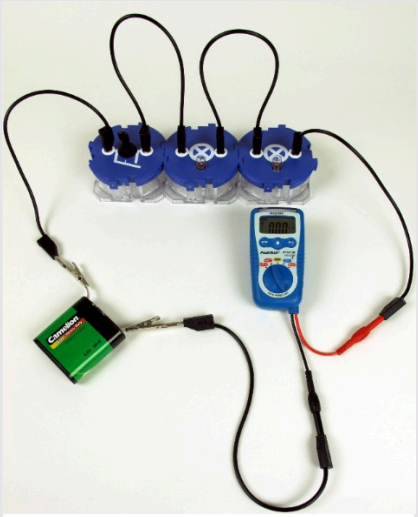

Fig. 1

First build the series circuit as shown in Fig. 1.

Assemble the circuit in the following order:

Battery - On/Off switch - Lamp holder - Lamp holder - Ammeter - Battery

- You can plug the cables directly into the blue blocks and the current meter.
- Clamp a crocodile clip to each pole of the battery, then you can plug the cable in there.

Turn the two bulbs into the lamp sockets.

Procedure (1/2)

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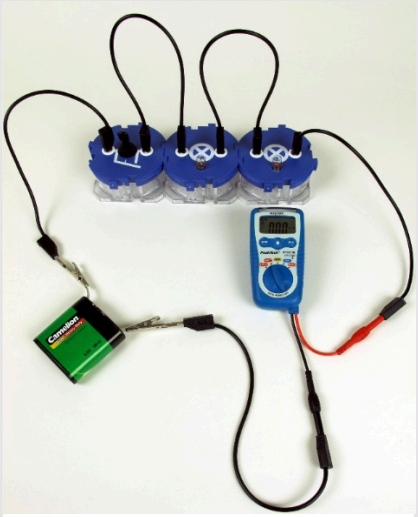

Fig. 1

To take measurements, turn on the ammeter by turning the switch to "mA". Press the "Mode" button until the screen displays "DC".

Task 1

- Observe the bulbs and measure the current with the meter
- Carefully unscrew a bulb
- Observe the light bulb in the circuit
- Write down your observations on a piece of paper.

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Procedure (2/2)

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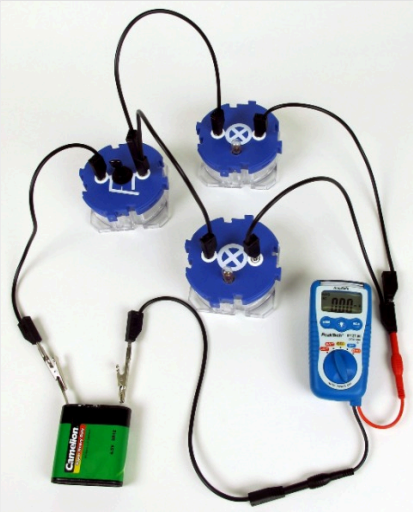

Fig. 2

Set up the parallel circuit as shown in Fig. 2. At the on/off switch and at the ammeter you have to plug the cables of the two lamp sockets into each other.

Task 2

- Observe the bulbs and measure the current with the meter
- Carefully unscrew a bulb
- Observe the light bulb in the circuit
- Write down your observations on a piece of paper.

Switch the current meter off again (turn the switch to "OFF").

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Report

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Robert-Bosch-Breite 10
37079 Göttingen

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Fax: 0551 604 - 107

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Task 1

The lamps in the series connection have ... than the lamps in the parallel circuit.

- fainter
- stronger
- equally bright

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Task 2

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An example of a series connection from everyday life is...

- the multiple socket.
- the fairy lights.

Task 3

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Summarize what you learned in this experiment.

The measured current is _____ in the parallel circuit, so the bulbs shine _____.
In the series circuit, the current is _____ and the bulbs shine _____.
If a lamp is removed, in a _____ circuit the second bulb goes out, in the _____ circuit it remains lit unchanged.

larger | series | brighter | parallel | smaller | darker

Check

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