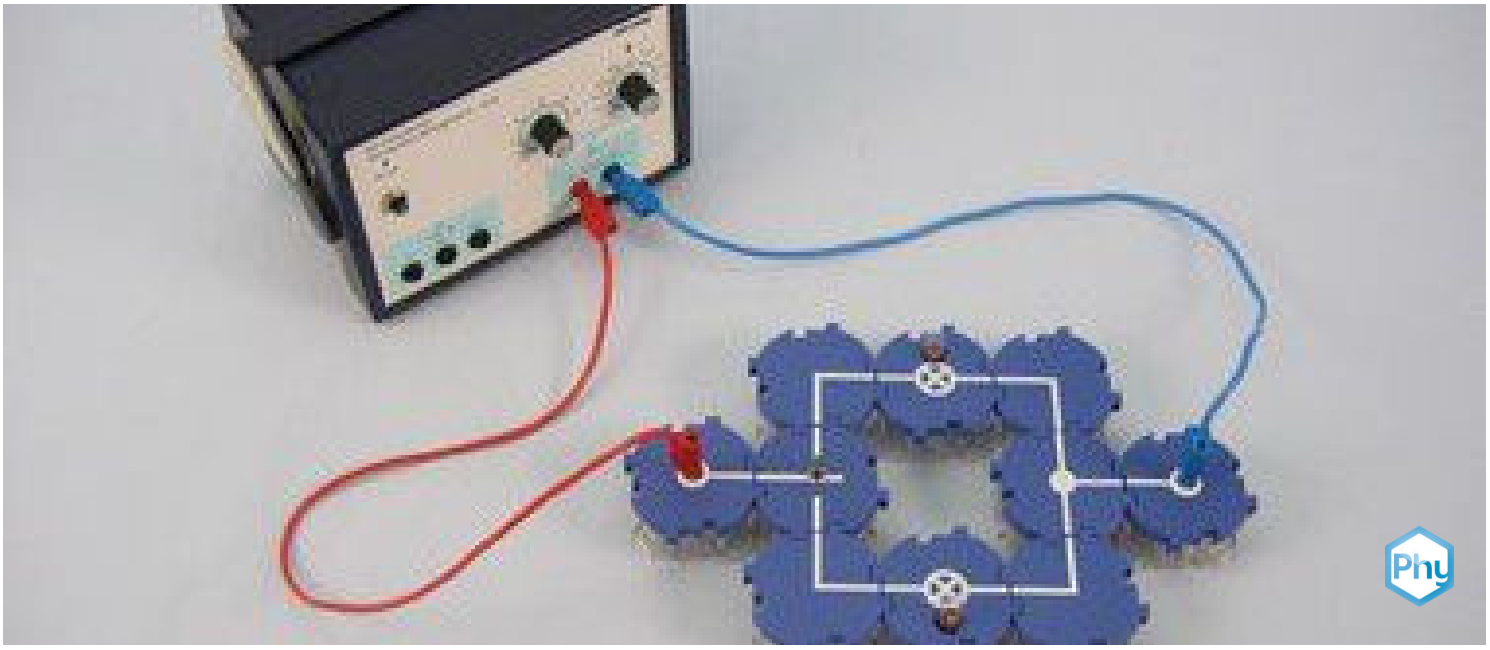
Changeover switches and alternating switches



Physics | Electricity & Magnetism | Simple circuits, resistors & capacitors

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

This content can also be found online at:

http://localhost:1337/c/5f4ea57438db8d0003265c1c

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Teacher information

Application

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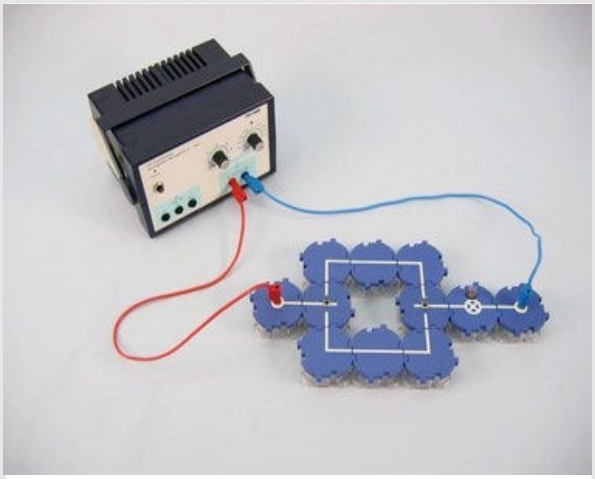

Experiment set-up

In electrical engineering there are different switches. With the help of simple on/off switches many circuits can be realized. Changeover switches used in toggle circuits are also called toggle switches because of this function.

PHYWE

Robert-Bosch-Breite 10
37079 Göttingen

Tel.: 0551 604 - 0
Fax: 0551 604 - 107

info@phywe.de
www.phywe.de

Other teacher information (1/2)

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Prior knowledge

Students should generally be familiar with light switches and know that a circuit must be closed for current to flow.

Scientific principle

The changeover switch ensures that an electrically conductive connection is made or disconnected. A switch functions according to the "all or nothing principle". Single pole changeover switches have three terminals, with the middle terminal being connected to only one of the other terminals at a time.

Other teacher information (2/2)

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Learning objective

The students should become familiar with the structure and function of changeover switches. They should also learn and understand that a cross switch can be realized when two changeover switches are installed one after the other in a circuit, just as it is installed in houses, for example, when several switches are to switch the same lamp on and off.

Tasks

In the first experiment, the students build an electric circuit with which they can switch between two consumers. In the second experiment, a corridor circuit (cross switch) with two changeover switches is constructed and examined.

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Robert-Bosch-Breite 10
37079 Göttingen

Tel.: 0551 604 - 0
Fax: 0551 604 - 107

info@phywe.de
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Safety instructions

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

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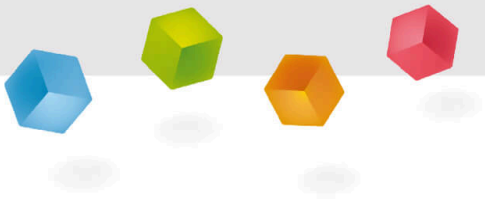

Student Information

PHYWE

Robert-Bosch-Breite 10
37079 Göttingen

Tel.: 0551 604 - 0
Fax: 0551 604 - 107

info@phywe.de
www.phywe.de

Motivation

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Light switch

Switching lights on and off using a wall switch is particularly popular with small children. But as you know, it is also part of our everyday life in later life. The position of the switch determines whether the light goes on or off.

Somewhat more sophisticated are so-called cross-circuits, as they are often used in corridors or larger rooms with several doors. Here the same light can be conveniently switched on and off with different switches.

In this experiment you learn what exactly a toggle switch is and also build up a cross / corridor circuit.

Tasks

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How do change-over/switchover circuits work?

Investigate how to switch between two electrical devices in an electric circuit and how a corridor circuit with two changeover switches is constructed.

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Robert-Bosch-Breite 10
37079 Göttingen

Tel.: 0551 604 - 0
Fax: 0551 604 - 107

info@phywe.de
www.phywe.de

Equipment

Position	Material	Item No.	Quantity
1	Straight connector module, SB	05601-01	1
2	Angled connector module, SB	05601-02	4
3	T-shaped connector module, SB	05601-03	1
4	Junction module, SB	05601-10	2
5	Change-over switch module, SB	05602-02	2
6	Socket module for incandescent lamp E10, SB	05604-00	2
7	Connecting cord, 32 A, 500 mm, red	07361-01	1
8	Connecting cord, 32 A, 500 mm, blue	07361-04	1
9	Filament lamps 12V/0.1A, E10, 10 pieces	07505-03	1
10	PHYWE Power supply, 230 V, DC: 0...12 V, 2 A / AC: 6 V, 12 V, 5 A	13506-93	1

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Tel.: 0551 604 - 0
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9	Filament lamps 12V/0.1A, E10, 10 pieces	07505-03	1
10	PHYWE Power supply, 230 V, DC: 0...12 V, 2 A / AC: 6 V, 12 V, 5 A	13506-93	1

Set-up (1/2)

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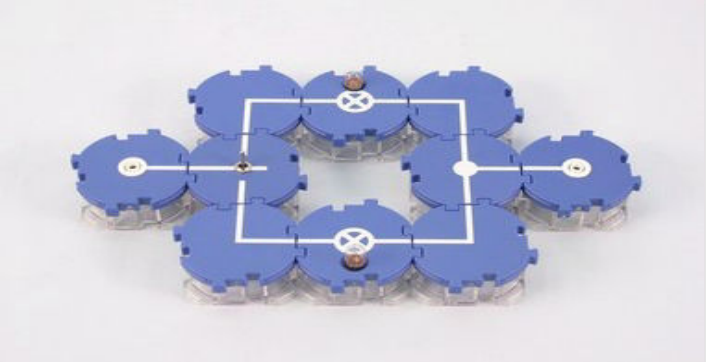
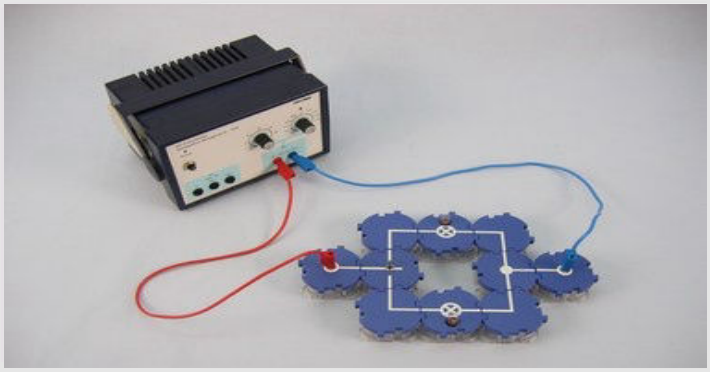
1st experimental part: Set up the experiment according to the figures.

- Screw the 12 V bulbs into the lamp sockets.
- Connect the power supply unit to the blue stones as shown.





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Robert-Bosch-Breite 10
37079 Göttingen

Tel.: 0551 604 - 0
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info@phywe.de
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Set-up (2/2)

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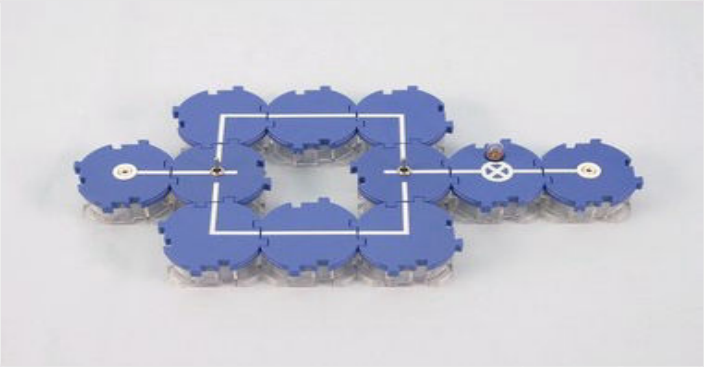
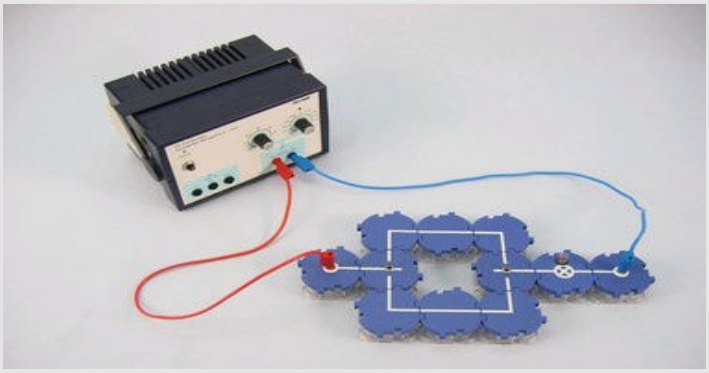
2nd experimental part: For the 2nd experimental part, change the structure according to the illustrations.

- In particular, replace the right T-shaped cable section with a second switch.
- The circuit now has only one lamp behind the second switch.





Procedure

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1. experimental part

- Set the power supply unit to 0 V / 2 A, switch it on and slowly increase the voltage to the 12 V rated voltage of the bulbs.
- Operate the change-over switch several times while observing the two bulbs.
- Set the power supply unit to 0 V and switch it off.

2. experimental part

- After the conversion to the 2nd test part, switch the power supply unit on again and slowly increase the voltage again to the 12 V nominal voltage for the bulb.
- Operate the two changeover switches several times in any order one after the other, paying attention to the bulb each time.
- Set the power supply unit to 0 V and switch it off.

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Robert-Bosch-Breite 10
37079 Göttingen

Tel.: 0551 604 - 0
Fax: 0551 604 - 107

info@phywe.de
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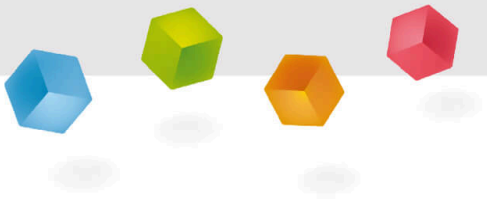

Report

Task 1

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Which of the answers fit the first attempt?

- [ ] An incandescent lamp is always off.
- [ ] The bulbs are always on or off at the same time.
- [ ] After adjusting the voltage, only one of the two bulbs is lit.
- [ ] When the changeover switch is actuated, the two bulbs light up alternately.
- [ ] The light bulbs always light up briefly at the same time each time they are switched over.

Check

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Robert-Bosch-Breite 10
37079 Göttingen

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Fax: 0551 604 - 107

info@phywe.de
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Task 2

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Which of the answers fit the second attempt?

- [ ] If the switches are in the same position the lamp is off.
- [ ] With each of the two switches, the bulb can be switched on and off as desired.
- [ ] If the switches are in the same position, the lamp lights up.
- [ ] The status of the lamp changes (On/Off) with every switching.
- [ ] The lamp can only light up when both switches are in the upper position.

Check

Task 3

PHYWE

Paste the words in the right places.

One switch has _____ connections. One of them can _____ be connected to one of the _____ other terminals by switching. So a _____ can be used to switch from one electrical device to another within a _____.

circuit
alternately
three
switch
two

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

Task 4

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Paste the words in the right places.

The main _____ of a _____ is that the same _____ can be switched on and off as desired with a second _____. The _____ of the respective other _____ does not matter.

cross-circuit
advantage
switch
consumer
switch
switch position

Check

Task 5

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Where are cross-circuits typically installed?

- [ ] Staircase and corridor lighting
- [ ] Electric toothbrushes and shavers
- [ ] Large rooms with several doors
- [ ] For protection of kitchen appliances

Check

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