

The safety fuse (Item No.: P1372200)

Curricular Relevance



Difficulty



Easy

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

Damaged leads or defective electrical equipment can lead to short-circuits. The actual piece of electrical equipment - or more accurately, its resistance - are hereby circumvented. The result is an inadmissibly high current, which can cause a fire to break out because of the resulting excessive heating up of current-carrying parts. In this experiment, students should learn the principle on which the simplest and oldest safety device, the safety fuse, functions.

Notes on setup and procedure

Suitable safety precautions must be taken so that glowing parts of the melted wire which drop down do not cause damage. A small piece of cardboard which is positioned underneath the wire is sufficient.

Remarks

To show that it is dangerous to "patch up" a safety fuse, the experiment can be extended as follows:

"Patch up" the safety fuse with a wire of larger diameter and connect it in series with a thinner wire on which, for example, a piece of carbon paper is hung. When the circuit is shorted, the fuse wire does not melt, but the (suitably dimensioned) connecting wire gets so hot that the carbon paper catches fire.

Safety fuses can also break the circuit when no short-circuit occurs, i.e. when the circuit is highly overloaded by having too many pieces of equipment connected. Safety fuses have nowadays widely been replaced by automatic cut-outs which rely on the magnetic effect of the electrical current (in the case of short-circuits) and on the change of form in a bimetallic strip (on overloading).

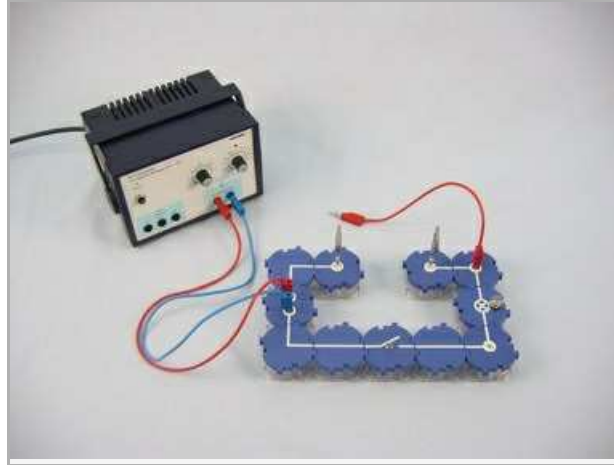
The safety fuse (Item No.: P1372200)

Task and equipment

Task

How can electrical appliances be protected from catching fire when a short-circuit occurs?

Set up a circuit containing a model of a safety fuse and use it to examine the function of an electric fuse.



Equipment



Position No.	Material	Order No.	Quantity
1	Straight connector module, SB	05601-01	2
2	Angled connector module, SB	05601-02	2
3	Interrupted connector module, SB	05601-04	1
4	Junction module, SB	05601-10	2
5	Angled connector module with socket, SB	05601-12	2
6	On-off switch module, SB	05602-01	1
7	Socket module for incandescent lamp E10, SB	05604-00	1
8	Alligator clips, bare, 10 pcs	07274-03	(2)
9	Connecting plug, 2 pcs.	07278-05	1
10	Connecting cord, 32 A, 250 mm, red	07360-01	1
11	Connecting cord, 32 A, 500 mm, blue	07361-04	1
12	Connecting cord, 32 A, 500 mm, red	07361-01	1
13	Filament lamp 6 V/3 W, E10, 10 pcs.	35673-03	(1)
14	Iron wire, d = 0.2 mm, l = 100 m	06104-00	40 mm
15	PHYWE power supply DC: 0...12 V, 2 A / AC: 6 V, 12 V, 5 A	13505-93	1

Set-up and procedure

Set-up

Set up the circuit as shown in Fig. 1. Clamp the wire with 2 crocodile clips on the two connecting plugs (Fig. 2). Open the switch.

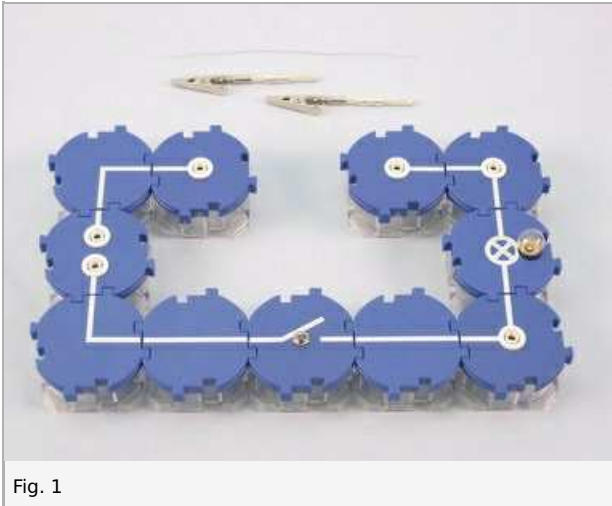


Fig. 1

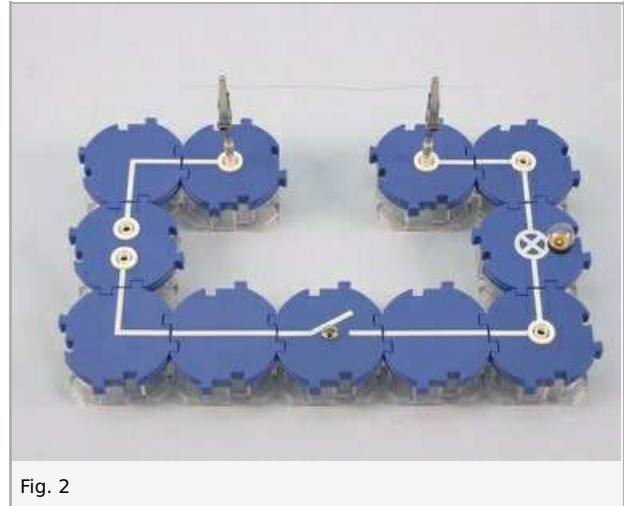


Fig. 2

Connect the power supply as shown in Fig. 3. Plug an extra wire into the upper right socket but leave its other end unconnected.

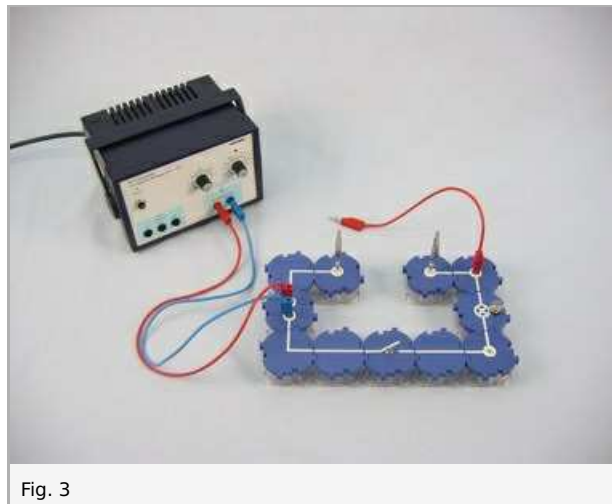


Fig. 3

Procedure

- Switch on the power supply.
- Close the switch and watch the lamp. Note what happens under "Observations" in the report.
- Use the extra connecting cord to bridge the two connections of the lamp, i.e. short-circuit them (Fig. 4) and observe what happens to the lamp and to the iron wire. Note your observations in the report.

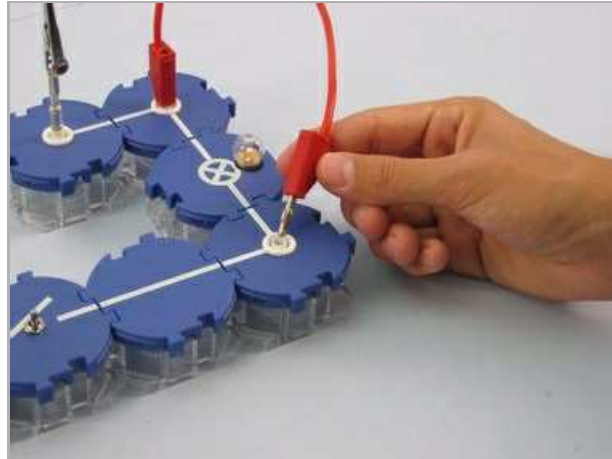


Fig. 4

- Switch off the power supply.

Report: The safety fuse

Results - Observations

Write down your observations:

- a) after the closing of the circuit
- b) after the short circuit

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Evaluation - Question 1

Why did the wire melt through? (In formulating your explanation, use the terms current and temperature.)

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Evaluation - Question 2

What do you understand under the term "short-circuit"?

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Evaluation - Question 3

In this experiment, the clamped-in wire is used as a model of an electric safety device, a safety fuse. For which purpose are safety fuses used?

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Evaluation - Question 4

Draw the circuit diagram for a circuit which is protected by a safety fuse: