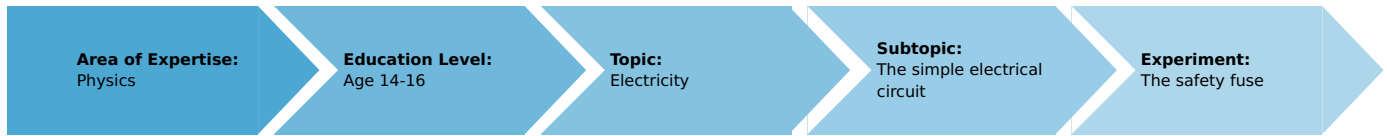


The safety fuse (Item No.: P1380700)

Curricular Relevance



Difficulty



Easy

Preparation Time



10 Minutes

Execution Time



10 Minutes

Recommended Group Size



2 Students

Additional Requirements:

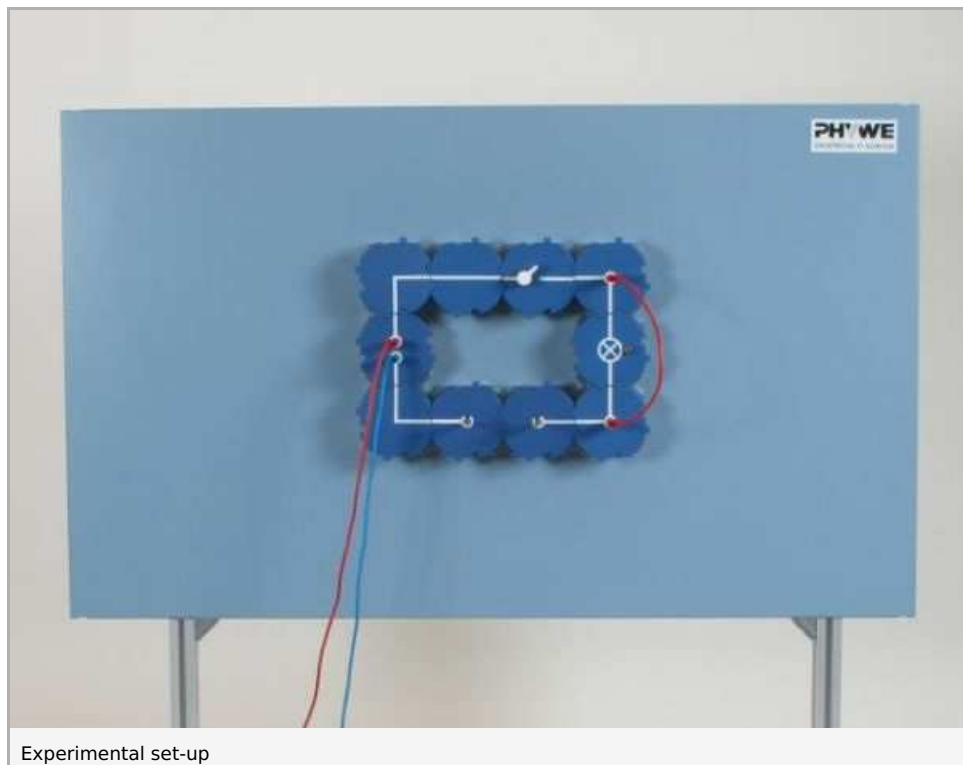
Experiment Variations:

Keywords:

Principle and equipment

Principle

This demonstration is to show how a simple safety device, the safety fuse, functions.



Equipment

Position No.	Material	Order No.	Quantity
1	PHYWE power supply, universal DC: 0...18 V, 0...5 A / AC: 2/4/6/8/10/12/15 V, 5 A	13500-93	1
2	Demo Physics board with stand	02150-00	1
3	Switch on/off, module DB	09402-01	1
4	Socket for incandescent lamp E10 ,module DB	09404-00	1
5	Connector interrupted, module DB	09401-04	1
6	Junction, module DB	09401-10	2
7	Electr.symbols f.demo-board,12pcs	02154-03	1
8	Connector, straight, module DB	09401-01	1
9	Connector, angled, module DB	09401-02	2
10	Connector, angled with socket, module DB	09401-12	2
11	Filament lamp 6 V/3 W, E10, 10 pcs.	35673-03	1
12	Connecting plug, 2 pcs.	07278-05	1
13	Iron wire, d = 0.2 mm, l = 100 m	06104-00	1
14	Connecting cord, 32 A, 1000 mm, red	07363-01	1
15	Connecting cord, 32 A, 1000 mm, blue	07363-04	1
16	Alligator clips, bare, 10 pcs	07274-03	1
17	Connecting cord, 32 A, 250 mm, red	07360-01	1

Set-up and procedure

- Connect up the circuit as shown in Fig. 1; clamp the iron wire between the crocodile clips on the connecting plugs; the switch is open.
- Switch on the power supply, set the voltage to 6 V and maximum current to 2 A.
- Close the switch and observe the lamp (1).
- Use the short connecting cable to bridge the lamp, i.e. to cause a short circuit; observe the lamp and the iron wire (2).

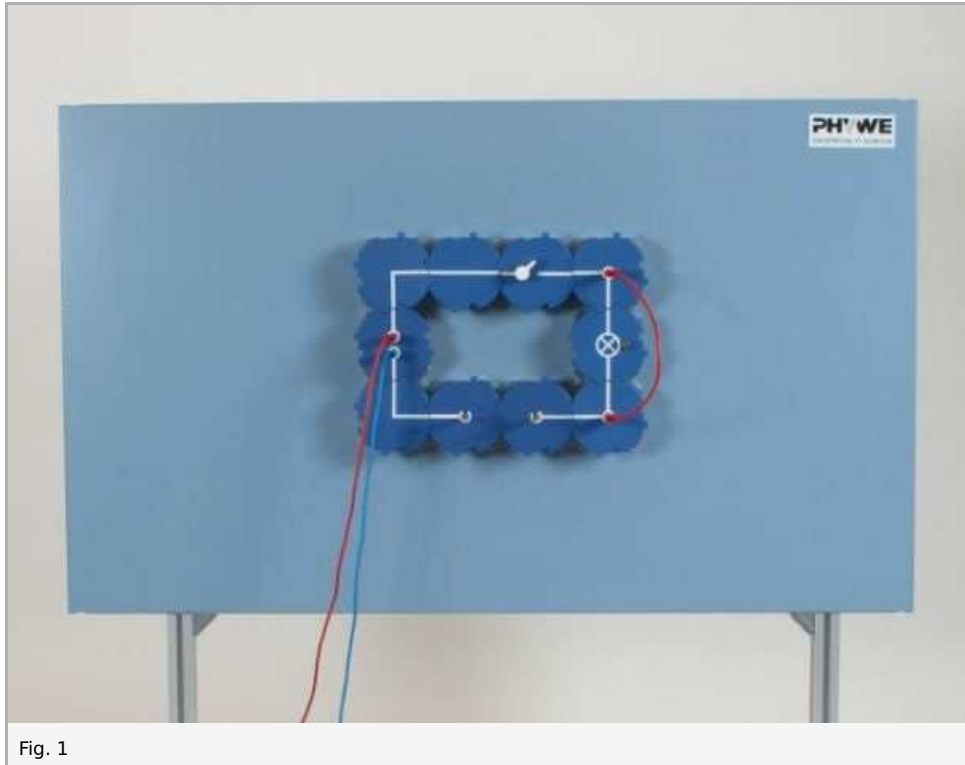


Fig. 1

Observation and evaluation

Observation

1. The lamp lights up brightly when the circuit is closed.
2. The lamp goes out as soon its connections are short circuit, and the wire melts shortly afterwards.

Evaluation

Should a short circuit occur in a circuit that contains a safety fuse, then the safety fuse breaks the circuit. In the case of the simple safety fuse, this breaking of the circuit results from the high current, which melts the wire in the fuse. Safety fuses prevent unpermissibly high currents, and so serve to protect electrical devices and equipment.

Remarks

The power supply limits the current to 2 A. The current must not be much lower if the iron wire is to melt. Even an ammeter could lower the current so much that the experiment does not succeed. Suitable safety precautions must be taken to ensure that dropping, glowing parts of the wire do not cause any damage. A piece of cardboard placed on the table or bench beneath the wire is sufficient.

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 been widely replaced by automatic cut-outs which respond to the magnetic effect of the electrical current (in the case of short circuits) and on the change in form of a bimetallic strip on heating (on overloading).