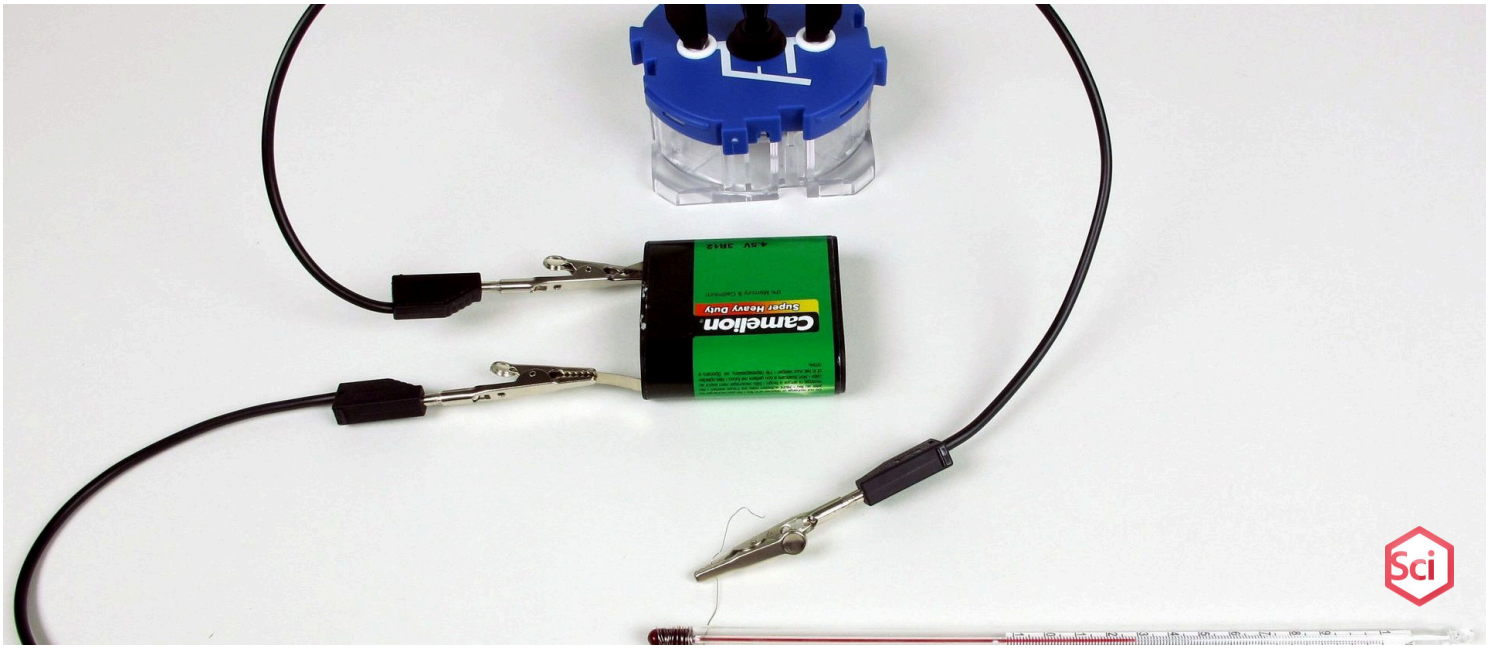
The heat effect of electric current



Nature & technology | Devices & machines in everyday use

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/608826bb6e938800032dd97d

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Teacher information

Application

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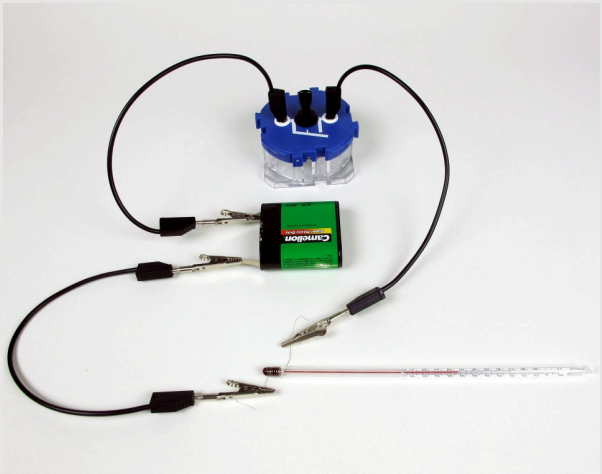

Test set-up

In this experiment, students investigate the behavior of a thin conductive wire in an electric circuit.

They observe that the wire heats up due to the current flow.

From this they conclude that electric current can be used specifically for heating, but also that heating can be an undesirable side effect of electric conductors.

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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. They know how the thermometer works and know how to handle it carefully.

Principle

In this experiment, students observe that a wire carrying an electric current heats up and observe the temperature rise on the thermometer.

Notice: It is important that the wire windings are close to the thermometer, check student setups if necessary. Also, make sure that students break the circuit again after observing the temperature rise!

Other teacher information (2/2)

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Learning objective

The students learn that a wire through which current flows heats up. They understand that this effect can be exploited, but that in some cases it also leads to undesirable losses.

Tasks

- The students build the given circuit
- To do this, they wrap the electrically conductive wire around the thermometer
- They observe the temperature as soon as current flows through the wire

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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 students break the circuit after observing the temperature rise, otherwise the battery will discharge quickly and the wire will become very hot
- The general instructions for safe experimentation in science lessons apply to this experiment.

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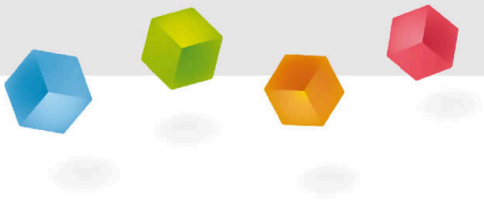

Student Information

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Motivation

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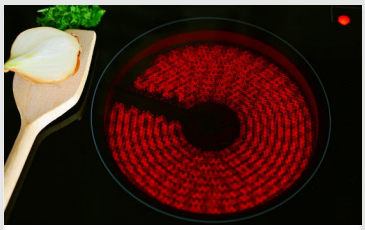
Light bulb



Stovetop

You have probably noticed that a light bulb that has been on for a while gets very hot, and the heat is actually an undesirable side effect.

However, there are many examples from everyday life where the heating of a wire is used. For example, the kettle heats with the help of a heating coil and also in the stove plate are wires that are brought to glow.

But how exactly does it work to heat a wire so strongly? We want to investigate this phenomenon in more detail in this experiment.

Tasks

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What do you suppose happens to a wire when electricity flows through it?

- No harm done.
- He's warming up.
- He's cooling off.

Temperature change of a current-carrying wire

- Wrap an electrically conductive wire around a thermometer
- Observe the temperature as soon as current flows through the wire
- 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	3
3	Alligator clip	167700	4
4	On/off switch for sciences sets	09390-07	1
5	Students thermometer, -10...+110°C, l = 230 mm	38005-10	1
6	Constantan wire, 15.6 Ohm/m, d = 0.2 mm, l = 100 m	06100-00	1

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Set-up and procedure (1/2)

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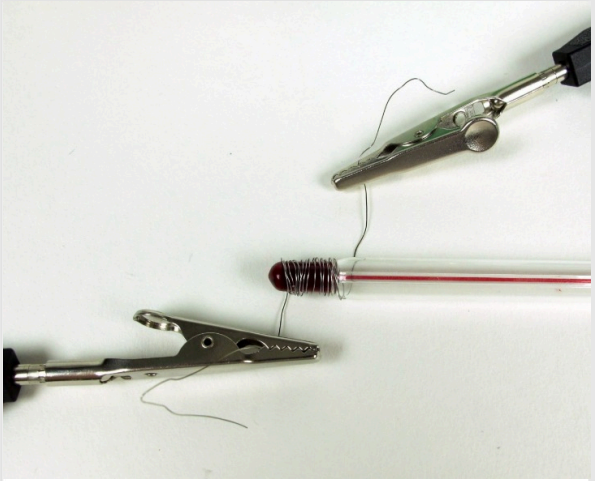

Fig. 1

First take a piece of wire about 30 cm long. Wrap the wire several times around the thermometer.

Make sure that a piece of the wire protrudes at both ends, as in Fig. 1.

Now assemble the circuit as follows:

Battery - On/Off switch - Wire - Battery

connecting each of the parts with a wire. You will need alligator clips on the poles of the battery and the ends of the wire.

Set-up and procedure (2/2)

PHYWE

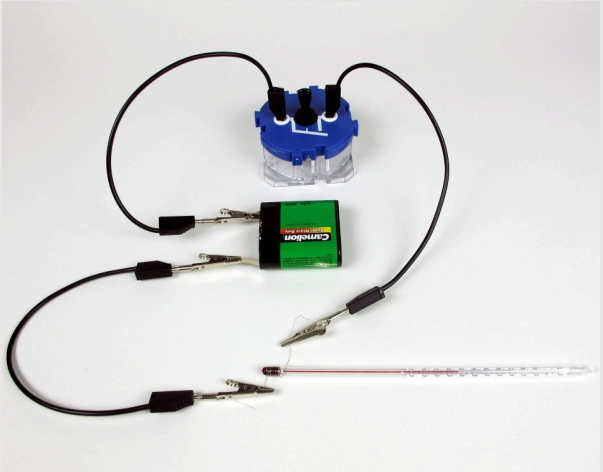

Fig. 2

Check that your set-up is correct, as shown in Fig. 2.

Procedure

- First look at what temperature the thermometer shows
- Close the switch and let current flow through the wire for 20 - 30 seconds. Observe the thermometer
- Afterwards, interrupt the circuit again, wait a certain time and observe again whether anything changes.

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Report

Task 1

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If you let current flow through a wire, it will...

- does not change its temperature.
- heat up.
- cool down.

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Task 2

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This effect is undesirable in some applications because...

2 answers are correct!

- [ ] components can be damaged by the heat.
- [ ] a hot wire conducts electricity better.
- [ ] energy is lost as a result.

Check

Task 3

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Summarize what you learned in this experiment.

A wire through which electricity flows becomes _____ over time.
If you turn off the electricity, the wire gradually becomes _____.
This effect can be used in everyday life, for example when using a _____. But it can also have negative consequences, for example because a _____ gets hot and energy is lost. Also _____ can heat up when the current flow is too strong and then conduct the current _____.

light bulb
cables
warmer
worse
stove plate
colder

Check

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Slide	Score / Total
Slide 8: current through wire	0/1
Slide 13: Wire temperature	0/2
Slide 14: Undesirable effect	0/2
Slide 15: Summary	0/6

Total 0 / 11

Solutions Repeat

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