Conductors and non-conductors (Item No.: P1371900)

Curricular Relevance

Area of Expertise: Physik
Education Level: Klasse 7-10
Topic: Elektrizitätslehre
Subtopic: Der einfache elektrische Stromkreis
Experiment: Leiter und Nichtleiter

Difficulty	Preparation Time	Execution Time	Recommended Group Size
Easy	10 Minutes	10 Minutes	2 Students

Additional Requirements:

Experiment Variations:

Keywords:

Task and equipment

Information for teachers

Additional information

The students know from experience at home, for example, that the wires for electrical connections are covered with a layer of insulating material to protect people using the electrical devices from the danger of touching "live" parts. With this as the basis, metallic and non-metallic materials are to be connected in a simple circuit and their conductivity tested.

Notes on setup and procedure

The filament lamp in the circuit serves to limit the current with the solid test materials, and also allows a simple determination of whether current is flowing or not.
Because of the relative shortness and large diameter of the rods examined, the currents measured for the group of metals do not differ from each other; it is only important here to determine if a material conducts electricity or not. In the examination of the conductivity of the wetted cord, the students should not only recognise that normal tap water conducts electric current, but also be impressed by the importance of the choice of the measurement range.

Remarks

The conditions for the conductivity of liquids should not be gone into here. The only statement which can be made on the conductivity of liquids is on the special cases of tap water and salt water.
The experiment can be extended to other materials, e.g. as suggested by the students, without any great expenditure.

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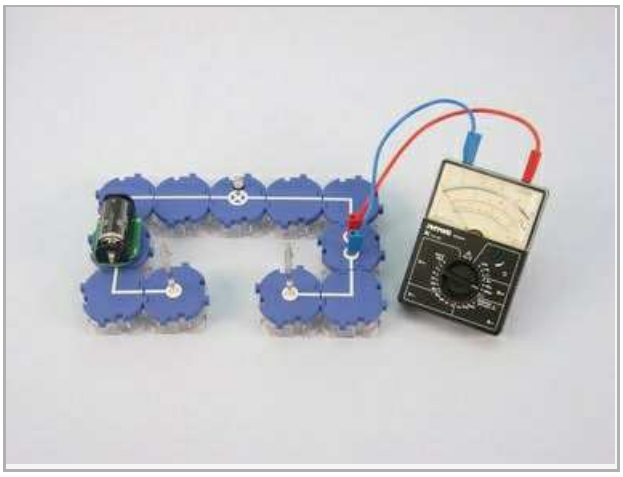
Task and equipment

Task

Which materials conduct electric current?

Investigate which materials conduct electric current.



Equipment

Position No.	Material	Order No.	Quantity
1	Straight connector module, SB	05601-01	2
2	Angled connector module, SB	05601-02	4
3	Interrupted connector module, SB	05601-04	2
4	Junction module, SB	05601-10	2
5	Socket module for incandescent lamp E10, SB	05604-00	1
6	Battery holder module (C type), SB	05605-00	1
7	Conductors/non-conductors, l = 150 mm	06107-50	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, 250 mm, blue	07360-04	1
12	Connecting cord, 32 A, 500 mm, red	07361-01	1
13	Connecting cord, 32 A, 500 mm, blue	07361-04	1
14	Battery cell, 1.5 V, baby size, type C	07922-01	1
15	Filament lamps 1.5V/0.15A,E10,10 pieces	06150-03	(1)
16	Multi-range meter, analogue	07028-01	1

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Set-up and procedure

Set-up

Set up the circuit as shown in Fig. 1 and Fig. 2, with the switch open. Fit crocodile clips to the junction sockets with the help of connecting plugs and select the 30 mA− measurement range.

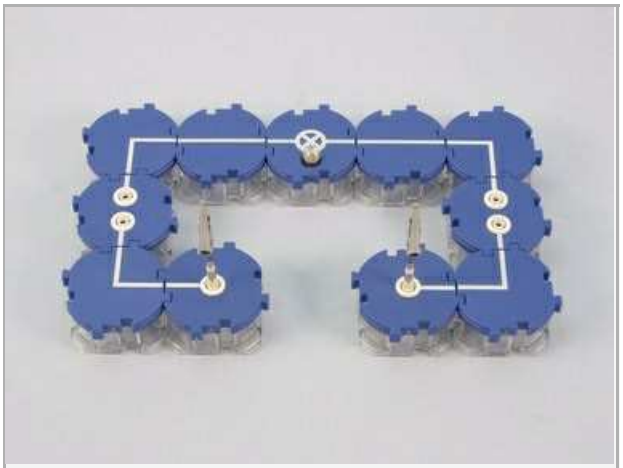

Fig. 1

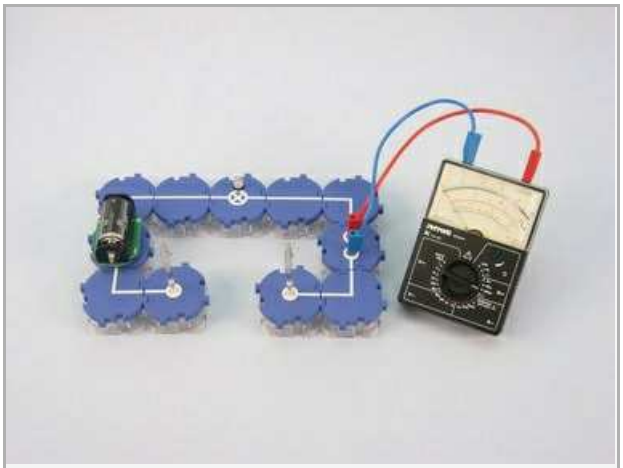

Fig. 2

Procedure

- You should have a set of materials as seen in Fig. 3. Successively clamp each of the rods from the set between the two crocodile clips (Fig. 4).

Fig. 3

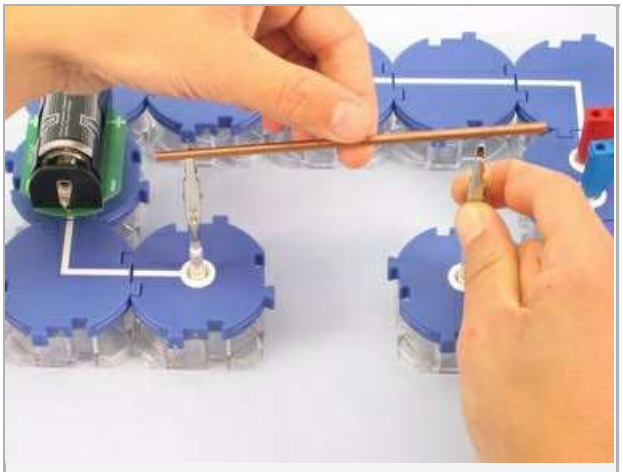

Fig. 4

- For each rod: Close the switch, observe the lamp and measure the current I. Enter the measured values in Table 1 in the report.
- Finally clamp the piece of cotton cord in position and proceed as previously, entering the measurement results in Table 1 (report).
- Remove the piece of cord, wet it thoroughly with tap water and lay it on the bench in front of the blocks.
- Connect the cord with crocodile clips and connecting cords to give a held cord length of approx. 5 cm.
- Do not change the position of the cord during the measurement.
- Observe the lamp and measure the current, whereby the measurement range is to be reduced to the 50 µA range.
- Prepare salt water (1/2 teaspoon of salt in approx. 100 ml water).
- Wet the piece of cord thoroughly with the salt water and repeat the measurement as above.
- On completing this, open the switch.

Report: Conductors and non-conductors

Results – Table 1

Enteryour results in the table.

Material	Lamp	*I* in mA
Steel	1	1 ±0
Aluminium	1	1 ±0
Copper	1	1 ±0
PVC	1	1 ±0
Glass	1	1 ±0
Carbon	1	1 ±0
Cord, dry	1	1 ±0
Cord, tap water wet	1	1 ±0
Cord, salt water wet	1	1 ±0

Evaluation – Question 1

Formulate a general statement on which materials conduct electric current (and are therefore called conductors):

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Evaluation – Question 2

Which materials do not conduct electric current (and are therefore called non-conductors or insulators)?

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Evaluation – Question 3

Think over the measurement results obtained for the conductivity of the cord. What causes the wet cord to conduct current - even though only relatively badly?

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Evaluation – Question 4

You can derive an important rule for the safe handling of electrical devices and equipment under high voltage from your answer to question 3. Formulate this rule.

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Evaluation – Question 5

Name examples of the use of insulators, in the household and technically.

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