



Task

To investigate which materials conduct electric current.

Equipment

Plug-in board	06033.00	1
On/off switch	39139.00	1
Wire building block	39120.00	1
Lamp holder E10	17049.00	1
Universal holder	39115.02	2
Conductors/nonconductors, I = 50 mm	06107.01	1
Connecting cable, 25 cm, red	07313.01	2
Connecting cable, 25 cm, blue	07313.04	2
Filament lamp, 6V/0.5 A, E10, 1 pc.	35673.03	(1)
Multi-range meter	07028.01	1
Power supply, 012 V-,6 V~, 12 V~	13505.93	1
A piece of wool cord, approx. 6 cm long		

Set-Up and Procedure

- Connect up the circuit as shown in Fig. 1, with the switch open. Select the 300 mA- measurement range.
- Set the power supply to 0 V and switch it on.
- Close the switch and adjust the power supply voltage to 2V. Leave this unchanged throughout the experiment.
- Successively clamp each of the rods contained in the conductor/nonconductor set made available to you in the universal holder, close the switch and measure the current strength I; enter the measured value in Table 1.

- When all rods have been tested, clamp the piece of wool cord in position and procede as previously.
- Remove the piece of cord, wet it with tap water, clamp it back in position and again measure the current strength; to increase the ammeter pointer swing, stepwise reduce the measurement range and finally set it to the 50 µA range, measure the current strength and note the measured value.
- Adjust the power supply to 0 and switch it off.

Observations and Measurement Results

Table 1 U = 2 V

Material	I /mA
Steel	
Aluminium	
PVC	
Glass	
Carbon	
Cord, dry	
Cord, wet	



Fig. 1





Evaluation

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

2. Which materials do not conduct electric current (and are therefore called nonconductors)?

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

b) An important rule for the safe handling of electrical devices and equipment under high voltage can be derived from your answer to question a). Formulate this rule.

4. Name examples of household and technical uses of insulating materials.



(Which materials conduct electric current?)

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. From this basis, metallic and non-metallic materials are to be connected in a simple circuit and their conductivity tested.

Notes on Set-Up and Procedure

The filament lamp in the circuit serves to limit the current. The maintenance of a constant voltage of 2 V allows the favourable 300 mA measurement range to be used.

Because of the relative shortness and large diameter of the "wires" examined, the current strengths measured for the group of metals do not differ from each other; it is only important here to determne if a material conducts electricity or not. In the examination of the conductivity of the wetted cord, the students should not only recognize that normal tap water conducts electric current, but also impressively experience how important the choice of the measurement range is.

Measurement Results

Table 1 U = 2 V

Material	I /mA
Steel	227
Aluminium	227
PVC	0
Glass	0
Carbon	224
Cord, dry	0
Cord, wet	0.02

Evaluation

- 1. Metals conduct electric current.
- 2. PVC, glass and wool do not conduct electric current.
- 3. a) The water causes the wet cord to conduct current.b) Do not handle electrical devices and equipment when they are moist.
- Insulation of wiring for connecting electrical sockets to household devices; insulation of masts for long-distance cables; plastic handles for voltage testers and screwdrivers; ...

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 case of tap water.

The 6 V lamp is recommended, because it has a lower resistance than the other lamps in the set, and so is more liable to allow changes in the current strength with the various materials to be recognized.

Pieces of shoe-laces are also suitable as cord

The experiment can be extended to other materials, e.g. as suggested by the students, without any great expenditure.





(Which materials conduct electric current?)

Room for notes