



Problem

Investigate how a circuit with a filament lamp responds to various resistors.

Equipment

Plug-in board	06033.00	1
Lamp holder E10	17049.00	1
Filament lamp, 12 V/0.1 A, E10, 1 pc.	07505.03	(1)
Resistor, 47 Ω	39104.62	1
Resistor, 100 Ω	39104.63	1
Resistor, 470 Ω	39104.15	1
Wire building block	39120.00	2
Connecting cables, 25 cm, red	07360.01	1
Connecting cables, 25 cm, blue	07360.04	1
Connecting cables, 50 cm, red	07361.01	1
Connecting cables, 50 cm, blue	07361.04	1
Multi-range meter	07028.01	1
Power supply, 012 V-, 6 V~, 12 V~	13505.93	1

Set-Up and Procedure

First experiment

 Set up experiment as shown in Fig. 1 with two wire building blocks.

- Set direct voltage to 12 V and switch power supply unit on.
- Observe brightness of filament lamp and note.
- Remove one wire building block and replace successively with 47 Ω , 100 Ω , and 470 Ω resistors. For each separate resistor, observe the brightness of the filament lamp and compare with original brightness.
- Enter observations in Table 1.
- Switch off power supply unit.

Second Experiment

- Change experiment set-up to correspond with Fig. 2.
- Set measurement range to 300 mA-.
- Switch on power supply unit.
- Measure current and enter value in Table 2.
- Remove a wire building block and, again, replace successively with 47 Ω , 100 Ω , and 470 Ω resistors. Measure the respective current and enter values in Table 2.
- Switch off power supply unit.

Fig. 1











Observations and Measurement Results Table 1

Resistance value of resistor in Ω	Filament lamp shines
_	
47	
100	
470	

Table 2

Resistance value of resistor in Ω	Current I /mA
_	
47	
100	
470	



Example 27 kQ±10%=red-violet-orange-silver

Fig. 3

Evaluation

1. Summarize the observations you made in Experiment 1.

2. What conclusion can you draw from these observations? (Answer the question posed in the header.)

 The word "resistor" is used to designate an electrical component. The word "resistance" is used to designate the characteristic of an electrical conductor to obstruct current. Explain the source of resistance in metallic conductors.

 A closer look at the resistor components used in these experiments reveals colored rings. These rings are used to designate the resistance value of the component in Ω (Ohm) accordingly (Fig. 3): Using these internationally recognized color codes, try to decipher the resistance value of the resistor components used.





(What effect do resistors have on a circuit?)

The student should recognize that resistors influence the current in a circuit. A greater resistance value in Ω means less current.

In the first experiment, the brightness of a filament lamp both demonstrates the flow of a current and roughly indicates the intensity of the current in the circuit.

The second experiment is primarily useful for practicing the set up and operation of a simple circuit and measuring current. The students should also practice setting the device to various measurement ranges.

Notes on Set-Up and Procedure

Since the students must first learn how to operate the multi-range meter safely, make sure to tell them in the second experiment that the meter must be correctly poled and that they should not set a low measurement range until they are sure that the display does not exceed the full scale of the indicator.

Observations and Measurement Results

Table 1

Resistance value of resistor in Ω	Filament lamp shines
_	brightly
47	less brightly
100	weakly
470	not at all

Table 2

Resistance value of resistor in Ω	Current I /mA
	101
47	80
100	63
470	22.6

Evaluation

- 1. The greater the resistance in Ω , the less brightly the filament lamp shines. When the 470 Ω resistor is in place, the lamp does not shine at all.
- 2. The resistance of the resistor components obstruct the electrical current. The greater the resistance value in Ω , the more the current is obstructed.
- 3. There are free electrons in a metallic conductor. These free electrons move randomly in the metal lattice. When voltage is connected to one end of the conductor, the electrons move towards the plus pole. The unit cubes, oscillating in a steady position, more or less obstruct these electrons considerably. This obstruction is the electrical resistance.
- 4. See example in Fig. 3.

Notes

Students should only be advised of the system for marking resistance values with colored rings or points in accordance with an internationally accepted code for their own information. Knowing how to decipher the code is not essential.





(What effect do resistors have on a circuit?)

Room for notes