Problem

Investigate what happens when a diode is connected in series with a filament lamp in a direct current circuit.

Equipment

Plug-in board	06033.00	1
On/off switch	39139.00	1
Lamp holder E10	17049.00	1
Filament lamp, 12 V/0.1 A, E10, 1 pc.	07505.03	(1)
Silicone diode 1N4007	39106.02	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, 0...12 V-, 6 V~, 12 V~	13505.93	1

Set-Up and Procedure

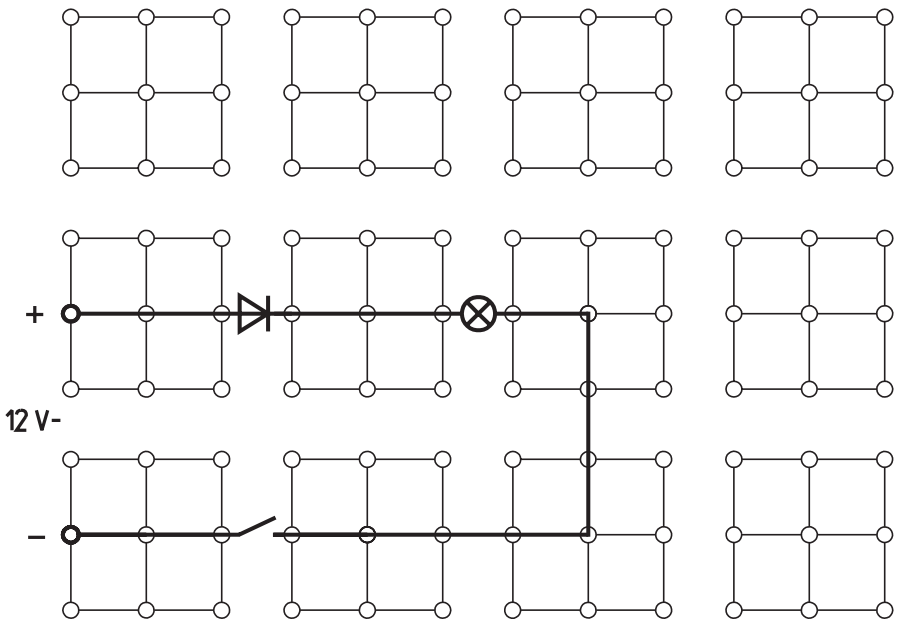
— Set up experiment as shown in Fig. 1. The on/off switch should be off. The arrow printed on the diode should be pointing in the direction of the technical current (towards negative).
— Switch on power supply unit and set direct voltage to 12 V.
— Turn switch on and observe filament lamp.
— Turn diode 180° and observe filament lamp. Note observations under (1).
— Remove one of the wire building block and add current meter to circuit. Measure current.
— If necessary, switch down to the smallest measurement range. Note current under (2).
— Switch power supply unit off.

Observations

(1)

(2)

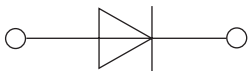
Fig. 1

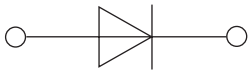


Evaluation

1. Based on your observations, answer the question posed in the header.

2. Draw in the right polarity for the following situations:

   Diode is connected in forward direction: 

   Diode is connected in reverse direction: 

3. How can these diode characteristics be applied in practice?

(How do diodes function in direct current circuits?)

The student should see that a diode functions like an electrical valve. Depending on the nature of the course, the instructor should decide whether to explain this characteristic using a model of the internal electrical conductivity process in the components or just to establish this characteristic.

Notes on Set-Up and Procedure

It is not necessary to measure the current to see that the diode functions as a valve. The filament lamp indicates electrical current in and of itself, and there is no evidence of cutoff current under these experimental conditions.

Observations

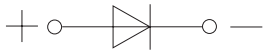
(1) The filament lights up at first. It does not light up when the diode is plugged into the circuit with reverse polarity.

(2) No current flows with reverse polarity (with the arrow pointing towards positive).

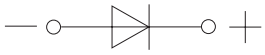
Evaluation

1. The diode only lets current flow through in one direction (when the arrow printed on it points towards negative).

2. Diode connected in forward direction:



Diode connected in reverse direction:



3. Diodes can be used to rectify alternating currents.

Notes

Semiconductor diodes behave the way they do because a barrier layer is formed between the p-conducting and the n-conducting silicone. Floating electrons from the n-area diffuse into the p-area and electron holes from the p-area diffuse into the n-area. The resulting recombination depletes the barrier layer of floating charge carriers.

If the diode is plugged in pointing in the forward direction, the barrier layer is neutralized with a flood of floating charge carriers. In the reverse direction, the barrier layer expands, and the diode blocks the flow of current.

Even if the diode is plugged in pointing in the reverse direction, there is a minimal flow of current, referred to as reverse current. This current is so small that even the current meter used in this experiment can not measure it.

T	EEP 12.1	Diodes as Electrical Valves	PHYWE

(How do diodes function in direct current circuits?)

Room for notes