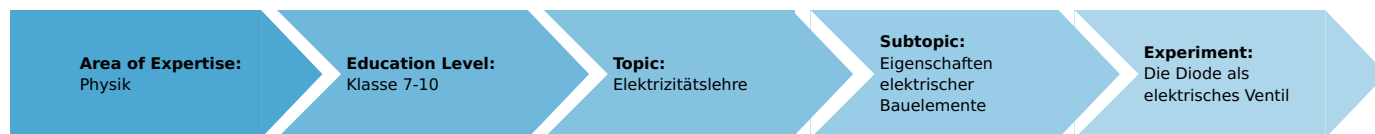


The diode as electrical valve (Item No.: P1373700)

Curricular Relevance



Difficulty



Intermediate

Preparation Time



10 Minutes

Execution Time



10 Minutes

Recommended Group Size



2 Students

Additional Requirements:

Experiment Variations:

Keywords:

Task and equipment

Information for teachers

Additional information

The students should recognise that a diode acts as an electrical valve. The teacher has to decide, according to the situation, whether an explanation is to be given for this action with the help of a model of the electrical processes within the components, or if this action is merely to be established.

Notes on setup and procedure

The measurement of current is not necessary for the recognition of the valve effect, because the lamp shows when current flows anyway, and, under the given experimental conditions, no inverse current can be detected.

Remarks

The behaviour of a semiconductor diode can be explained by the formation of a barrier layer between the p-conducting and n-conducting silicon. Free 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 free moving charge carriers.

If the diode is connected pointing in the forward direction, the barrier layer is neutralised by a flood of free moving charge carriers. In the reverse direction, the barrier layer widens out, and the diode blocks the flow of current.

Even if the diode is connected pointing to the reverse direction, there is still a minimal flow of current, referred to as reverse current. This is so small with the diode used in this experiment, however, that even the ammeter used in this experiment cannot measure it.

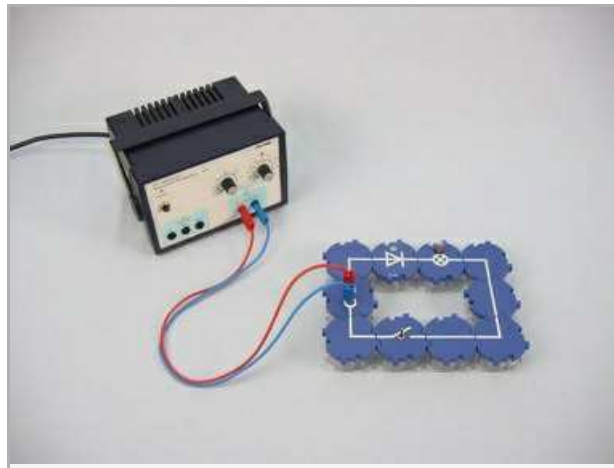
The diode as electrical valve (Item No.: P1373700)

Task and equipment

Task

How does a diode function in a direct current circuit?

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



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	On-off switch module, SB	05602-01	1
5	Socket module for incandescent lamp E10, SB	05604-00	1
6	Silicon-diode module 1N4007, SB	05651-00	1
7	Connecting cord, 32 A, 250 mm, red	07360-01	1
8	Connecting cord, 32 A, 250 mm, blue	07360-04	1
9	Connecting cord, 32 A, 500 mm, red	07361-01	1
10	Connecting cord, 32 A, 500 mm, blue	07361-04	1
11	Filament lamps 12V/0.1A, E10, 10	07505-03	1 piece
12	Multi-range meter, analogue	07028-01	1
13	PHYWE power supply DC: 0...12 V, 2 A / AC: 6 V, 12 V, 5 A	13506-93	1

Set-up and procedure

Set-up

Set up the circuit as shown in Fig. 1 and Fig. 2, with the switch open, and the tip of the diode in the printed symbol pointing in the technical direction of flow of current (towards negative).

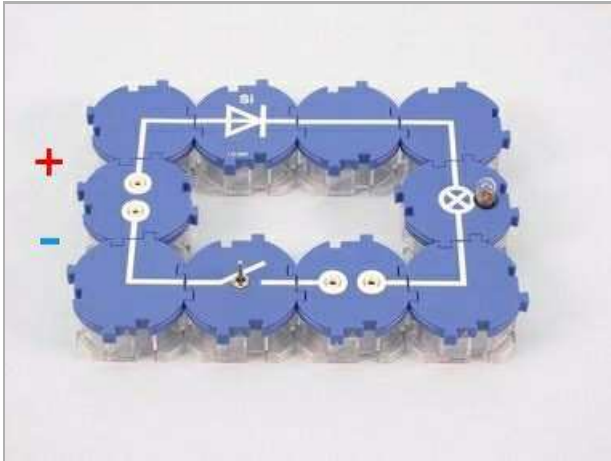


Fig. 1

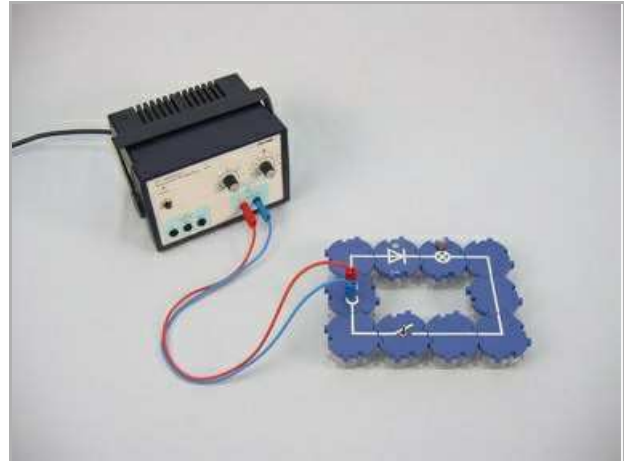
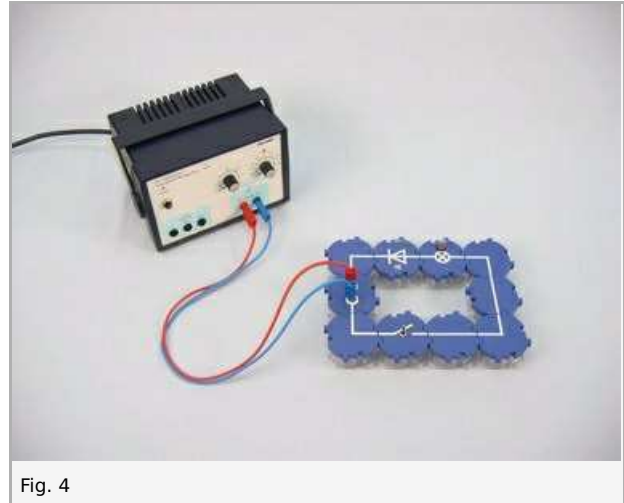
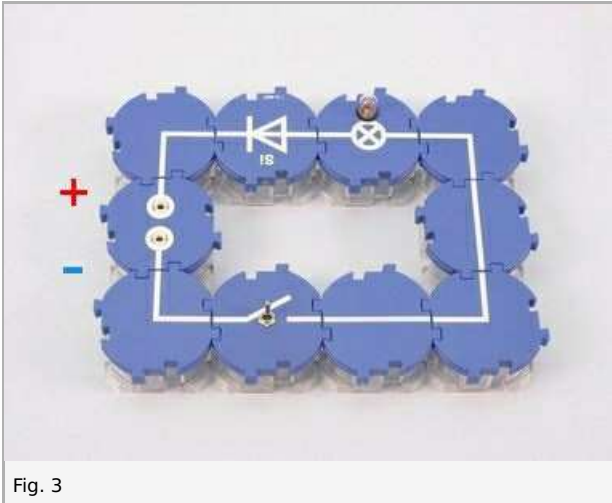


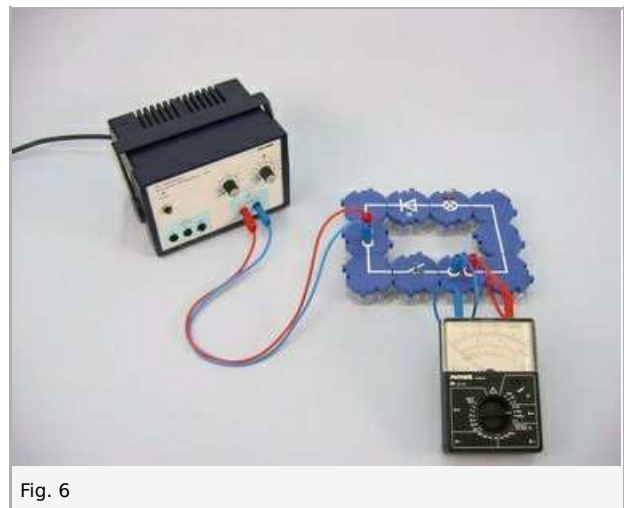
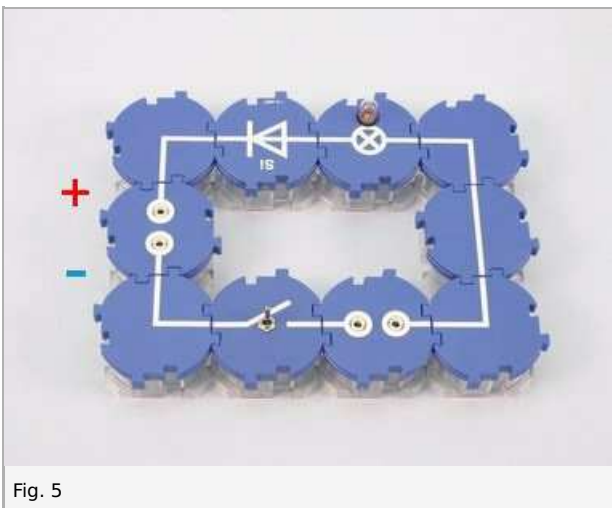
Fig. 2

Procedure

- Switch on the power supply and set it to 12 V direct voltage.
- Close the switch and observe the filament lamp.
- Turn the diode through 180° and observe the filament lamp (Fig. 3 and Fig. 4). Note your observations under Result - Observations 1.



- Remove one of the connector modules from the circuit and replace it with an ammeter (Fig. 5 and Fig. 6); measure the current.
- If necessary, switch down to the smallest measurement range; note the current Result - Observations 2.
- Switch off the power supply.



Report: The diode as electrical valve

Result - Observations 1

Note your observations.

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Result - Observations 2

Note your observations.

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Evaluation - Question 1

How does a diode function in a direct current circuit? Use your observations for your answer.

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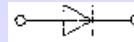
Evaluation - Question 2

Note the correct polarity in the following cases:

The diode is switched in the forward direction:



The diode is switched in the reverse direction:



Evaluation - Question 3

How could the properties of a diode be used in practice?

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