The diode as rectifier (Item No.: P1373800)

Curricular Relevance

Area of Expertise: Physik
Education Level: Klasse 10-13
Topic: Elektrizitätslehre
Subtopic: Elektronik
Experiment: Die Diode als Gleichrichter

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

Additional Requirements:

Experiment Variations:

Keywords:

Task and equipment

Information for teachers

Additional information

It can be assumed that the students know about the valve action of a diode and also have a knowledge of the basic properties of alternating currents (constant change in magnitude and periodical change in the direction of the current). They can therefore predict the essentials of the action a diode will have in an alternating circuit.

Notes on setup and procedure

The experiment is designed so that, further to the rectifying action of the diode, the students also recognise that the diode has a resistance in the forward direction – even though a relatively small one – and that, before using the multi range meter, its measurement range must be carefully selected, and also the type of current must be taken into account, in order to avoid it being damaged.

Remarks

We can add to evaluation point 2 that the ammeter cannot follow the rapid oscillation of the alternating current because of the time lag of its response, and therefore cannot indicate the flow of a current in the direct current measurement range. A direct current of greatest possible smoothness is required for many technical applications. Capacitors can be used to smooth the pulsed direct current supplied by diodes.

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Task and equipment

Task

How can alternating current be converted to direct current?

Examine the effect of a diode in an alternating 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	13505-93	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; select the 300 mA⎓ measurement range.

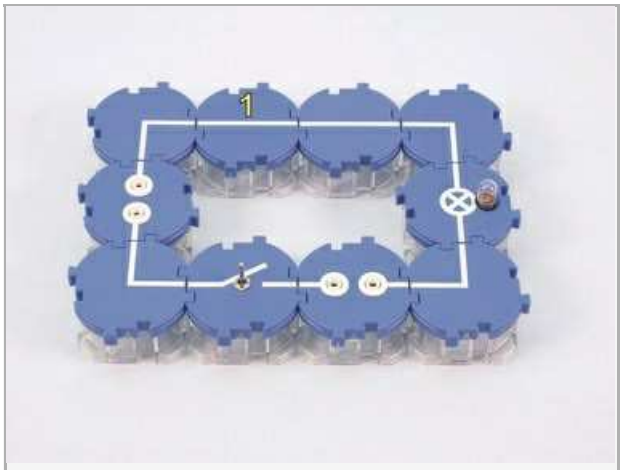

Fig. 1

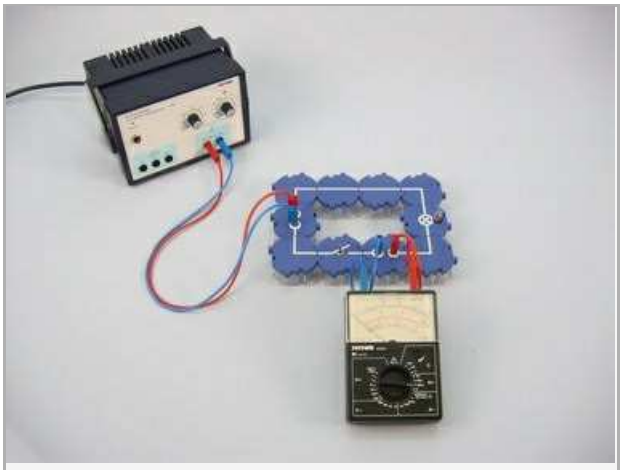

Fig. 2

Procedure

- Switch on the power supply and set it first to 12 V− direct voltage.
- Close the circuit; measure the current and note the value under Result - Observations 1.
- Replace connector module 1 (see Fig. 1) with the diode in the forward direction (arrow points to negative terminal) as shown in Fig. 3 and Fig. 4; measure and note the current under Result - Observations 1.

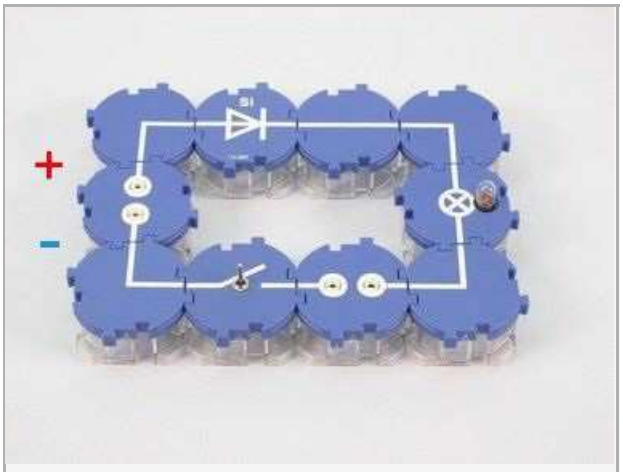

Fig. 3


Fig. 4

- Replace the diode with the connector module, apply 12 V~ alternating voltage but do not yet change the measurement range for the current.
- Close the circuit, observe the lamp and measure the current; note what you observe under Result - Observations 2.

- Set the multi range meter to the 300 mA~ measurement range; measure and note the current Result - Observations 3.

- Set the 300 mA- measurement range; again replace connector module 1 with the diode, measure and note the current under Result - Observations 4.

- Open the switch, reverse the polarity of the ammeter, turn the diode through 180° (Fig. 5), close the switch, measure the current and note the value of it Result - Observations 5.
- Switch off the power supply.


Fig. 5

Report: The diode as rectifier

Result - Observations 1

I = ...mA (without a diode in direct current circuit)

I = ...mA (with a diode in direct current circuit)

Result - Observations 2

Note your observations and the current.

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Result - Observations 3

I = ...mA (without a diode in alternating current)

Result - Observations 4

I = ...mA (with a diode in alternating current)

Result - Observations 5

Note the current and your observations.

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Evaluation - Question 1

Why is the current somewhat smaller when the diode is included - in the forward direction - in the direct current circuit (cf. Observations 1)?

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Evaluation - Question 2

Which conclusion on working with the multi range meter you must draw from Observations 2?

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Evaluation - Question 3

Explain why the current noted under Observations 4 is only half of that noted under Observation 3. Why is it in fact even a little less than half of the value measured in Observations 3?

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Evaluation - Question 4

How can alternating current be converted to direct current?

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Evaluation - Question 5

Name examples of the necessity to convert an alternating current to a direct current.

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