The characteristic curve of a silicon diode (Item No.: P1382500)

Curricular Relevance

Area of Expertise: Physics
Education Level: Age 14-16
Topic: Electricity
Subtopic: Basics: electronics
Experiment: The characteristic curve of a silicon diode

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

Additional Requirements:

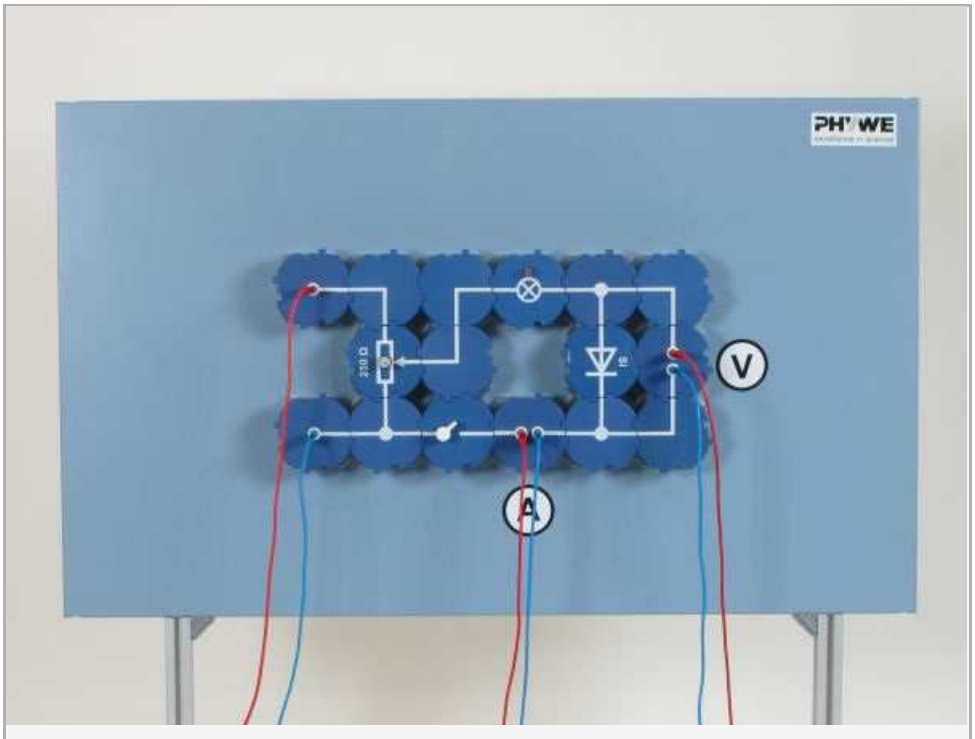
Experiment Variations:

Keywords:

Principle and equipment

Principle

The dependence of the current that flows through a silicon diode on the size and polarity of the applied voltage is to be examined.



Experimental set-up

Equipment

Position No.	Material	Order No.	Quantity
1	Multimeter ADM2, demo., analogue	13820-01	2
2	PHYWE power supply, universal DC: 0...18 V, 0...5 A / AC: 2/4/6/8/10/12/15 V, 5 A	13500-93	1
3	Demo Physics board with stand	02150-00	1
4	Potentiometer 250 Ohm, module DB	09423-25	1
5	Socket for incandescent lamp E10 ,module DB	09404-00	1
6	Connector interrupted, module DB	09401-04	2
7	Junction, module DB	09401-10	2
8	Silicon diode 1N4007,module DB	09451-00	1
9	Electr.symbols f.demo-board,12pcs	02154-03	1
10	Connector, angled, module DB	09401-02	5
11	Connector, T-shaped, module DB	09401-03	3
12	Filament lamps 12V/0.1A, E10, 10 pieces	07505-03	1
13	Connecting cord, 32 A, 1000 mm, red	07363-01	3
14	Connecting cord, 32 A, 1000 mm, blue	07363-04	3

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Set-up and procedure

- Connect up the circuit as shown in Fig. 1.
- Select the 1 V- measurement range for voltage and 100 mA- for current.
- Increase the voltage in the steps recommended in Table 1, read off the values of the current and enter them in Table 1.
- Reduce the voltage to 0 V.
- Increase the measurement range of the voltmeter to 3 V-.
- Remove the diode from the circuit, and replace it with opposite polarity.
- Increase the voltage stepwise to 3 V and enter the values of the current in the last lines of the Table.

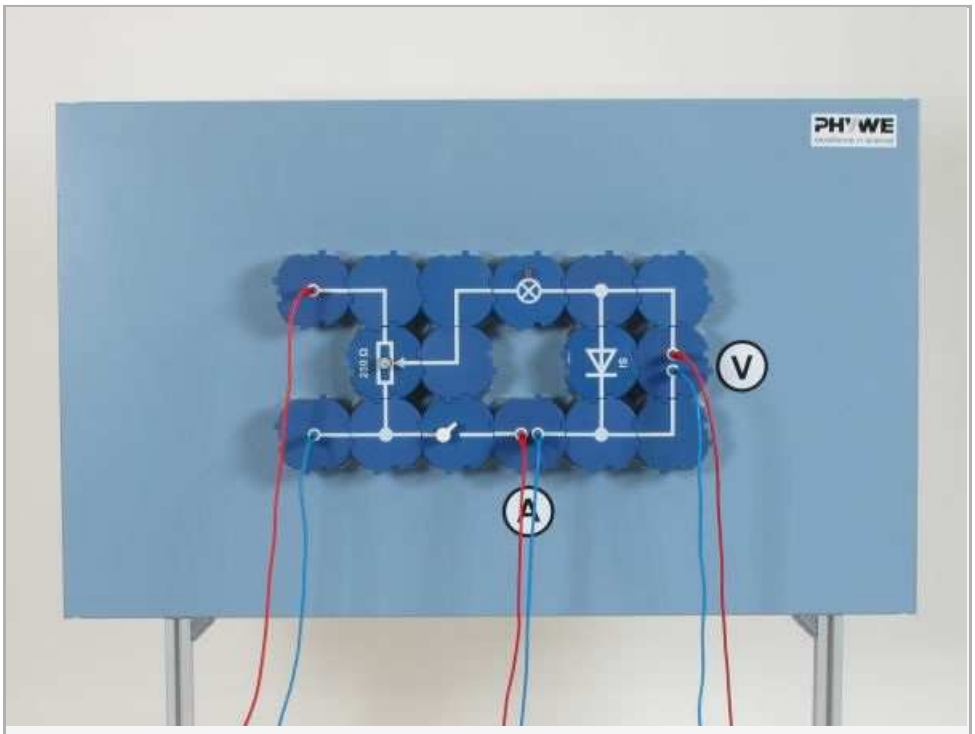

Fig. 1

Observation and evaluation

Observation

Table 1

$\frac{U_D}{V}$	$\frac{I_D}{mA}$
0.3	0
0.6	2
0.65	6
0.7	17
0.75	50
0.78	95
-1	0
-2	0
-3	0

Evaluation

The plot of the measured values in Fig. 2 shows that current does not flow through the diode until the voltage exceeds approx. 0.6 V. On increasing the voltage above this value, the curve of the flow of current rises very steeply.

The diode has the correct polarity for conducting current, and a small resistance. In the measurement example, this resistance is $R = U/I = 8.2\ \Omega$ at a voltage of 0.78 V.

After reversing polarity, no current is measurable even on increasing the voltage to 3 V.The diode exhibits a very high resistance, it is in the reverse position.

The graph of the diode current against the applied voltage is called the characteristic curve of the diode.

Even when the diode is in the current-conducting direction, current cannot flow until the electric field between the donor and acceptor ions (formed in the junction between the p-conducting and n-conducting silicon by recombination of the electrons and electron holes) is eliminated by the applied voltage.

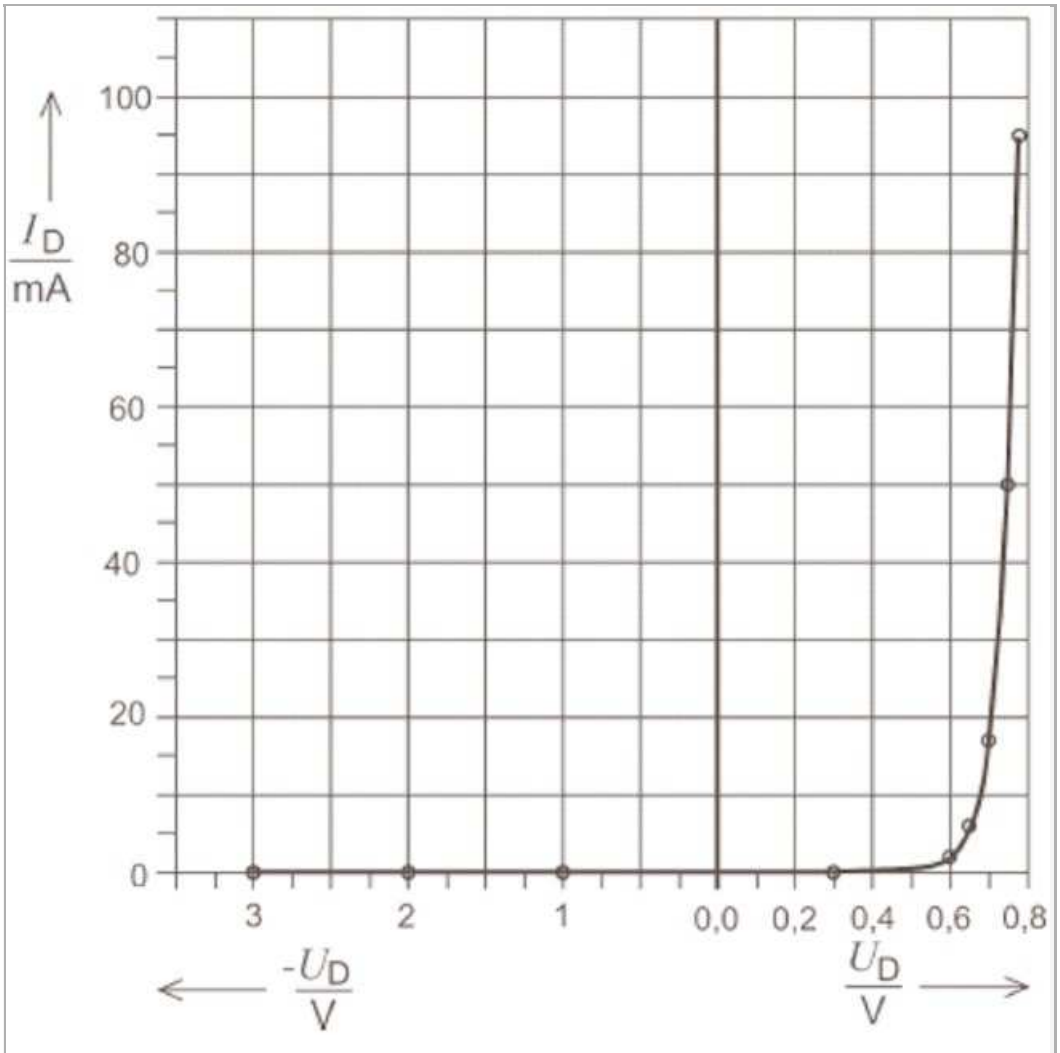

Fig. 2: The characteristic curve of a silicon diode

Remarks

The filament lamp used in the circuit limits the diode current in the current-conducting direction to the permissible limiting value, and also simultaneously makes the difference in the behaviour of the diode in the current-conducting and current-stopping directions clearly visible. The reverse current of the Si diode is not detectable with the demonstration measuring instrument. With the forward direction circuit chosen here, setting the ammeter to a higher sensitivity would only result in the registration of the current that flows through the voltmeter.

Technically, the voltages and currents of a diode are designated U_F and I_F in the forward direction, and U_R and I_R in the reverse direction.

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