Influence of illumination level on voltage and current intensity of a solar cell

Task and equipment

Information for teachers

Additional information

The solar cell plays an important role in the development of alternative, non fossil fuels energy sources. It converts light energy directly into electric energy.
The pupils examine whether the distance of the light source affects the generated voltage and current intensity of a solar cell. The essential result of this experiment is that the voltage remains relatively constant, whereas the current intensity strongly decreases when the distance of the light source increases. Since the generated current intensity does not only depend on the distance, but also on the angle to the light source, the measured current intensities can vary.

Notes on the Setup and Procedure

In order to measure a voltage of 0.5 V, a measurement range of 20 V is used in this experiment, so that the students can take note of only two decimal places. In this manner it can be made more clear that the measurement values of the voltage remain nearly constant.

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Task

How does the solar cell behave when the light of the sun decreases?

In this experiment the lighting changes in accordance to the distance of the solar cell to the light source. The current intensity and voltage of the solar cell will also be measured.

Student's Sheet

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Equipment

Position No.	Material	Order No.	Quantity
1	Angled connector module, SB	05601-02	4
2	Straight connector module, SB	05601-01	2
3	Interrupted connector module, SB	05601-04	2
4	Holder for solar cell 2.5 x5 cm, with plugs	06752-12	1
5	Solar cell 2.5 x5 cm, with plugs	06752-11	1
6	Connecting cord, 32 A, 250 mm, blue	07360-04	1
7	Connecting cord, 32 A, 250 mm, red	07360-01	1
8	Mount for halogen lamp with reflector	05781-00	1
8	Halogen lamp with reflector, 12V / 20W	05780-00	1
9	Beaker, low form, plastic, 100 ml	36011-01	1
10	Support base, variable	02001-00	1
11	DMM with NiCr-Ni thermo couple	07122-00	1
12	PHYWE power supply DC: 0...12 V, 2 A / AC: 6 V, 12 V, 5 A	13506-93	1

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Set-up and procedure

Set-up

Place the halogen lamp in one half of the tripod foot and connect it to the alternating current (AC output) of the power supply unit (12 V ~) like in fig. 1.
The power supply unit is switched off.

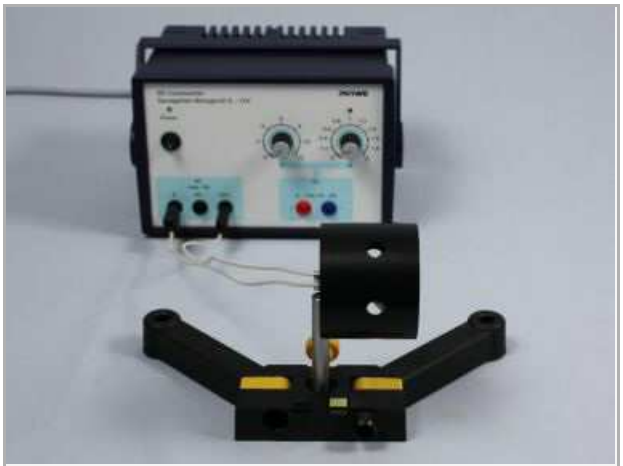

Fig. 1

Place the solar cell in its holder (fig. 2).

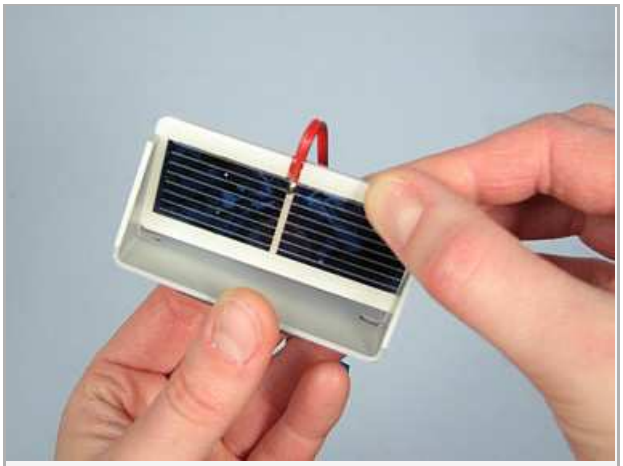

Fig. 2

Build up the electric circuit for the solar cell. Place it in front of the halogen lamp so that the tripod foot touches the middle of both front sides of the circuit elements (fig. 3).

Adjust the lamp and the modules along a line.

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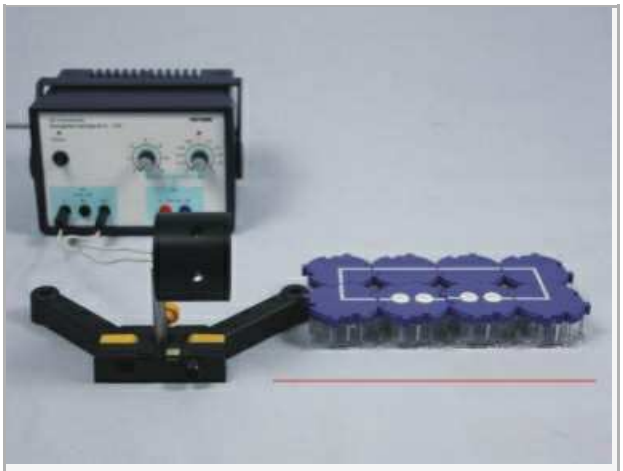

Fig. 3

Connect the solar cell to the electric circuit (fig. 4).

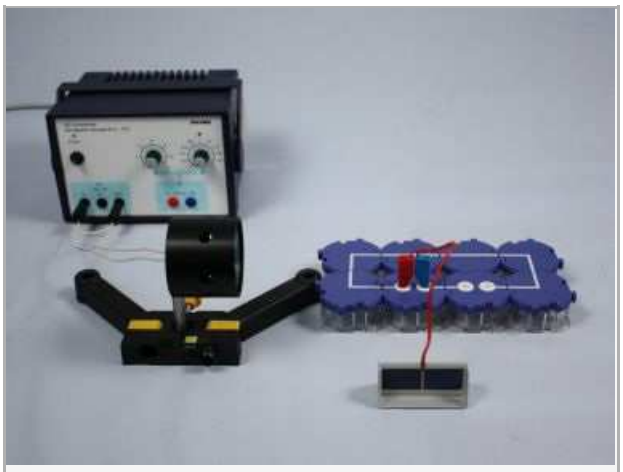

Fig. 4

Place the solar cell in the centre of the turned glass and adjust it according to illustration 5 (position 1).

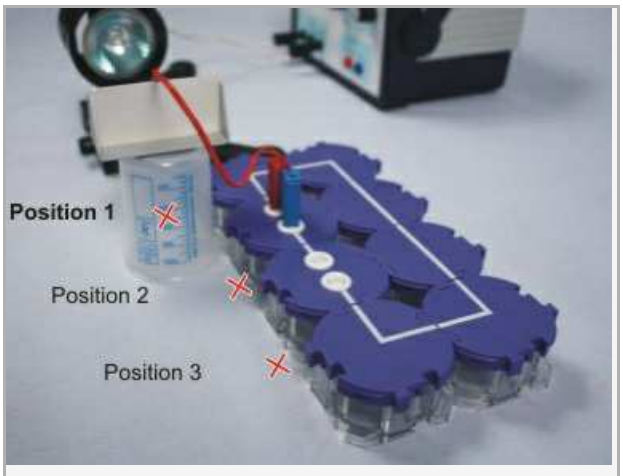

Fig. 5

Procedure

Measurement of the voltage of a solar cell due to different distances to the source of light

Place the measurement range of the multimeter on 20 V and connect it with the electric circuit of the solar cell (fig. 6).

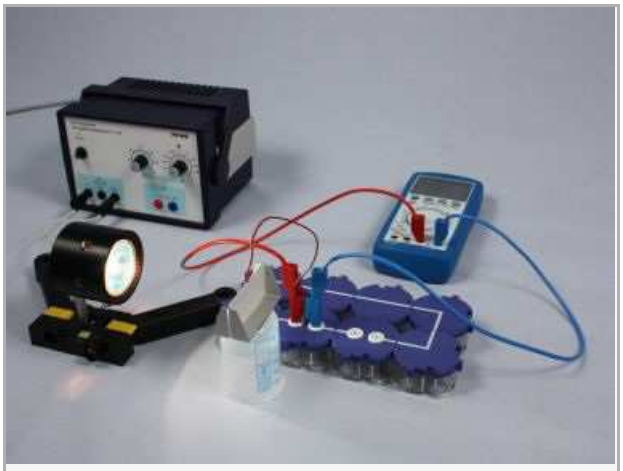

Fig. 6

Read the displayed voltage U in the multimeter and enter the value in the result table in the report under Postition 1.

Move the solar cell further to the back on position 2. Read the voltage once more and write it down in the table respectively.

Make another measurement on position 3.

Measurement of the current intensity of a solar cell due to different distances to the source of light

Connect the multimeter in such a way that you can measure the current intensity (fig. 7).

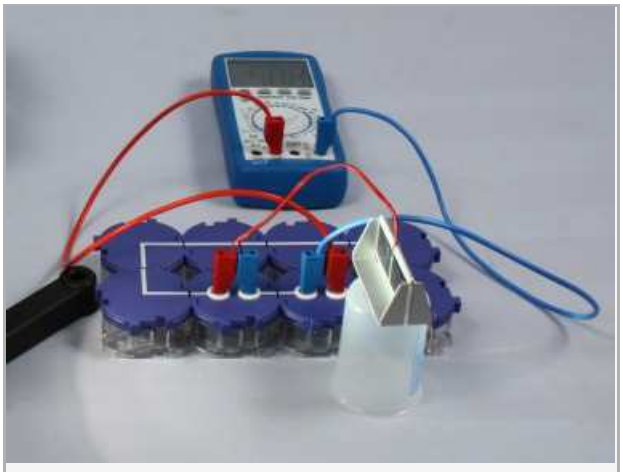

Fig. 7

Put the multimeter on 200 mA-.

Place the solar cell on position 1 again and read the current intensity in the multimeter.

Make two other measurements analogous to the first part of the test. Write down the values in the result table.

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Report: Influence of illumination level on voltage and current intensity of a solar cell

Result - Table 1

Record your measured values in the table.

Position	*I* in mA	*U* in V
1	1 ±1	1 ±1
2	1 ±1	1 ±1
3	1 ±1	1 ±1

Evaluation - Question 1

How does the distance of the light source affect the voltage of a solar cell?

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Evaluation - Question 2

How does the distance of a light source affect the current intensity of a solar cell?

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Evaluation - Question 3

On light bulbs and many engines the required voltage is given. Which one of the following devices could you operate with the solar cell?

Engine: 0.5 V to 5 V
Electric light bulb: 1.5 V
Light-emitting diode: 2 V

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