Influence of surface area of a solar cell on voltage and current

Task and equipment

Information for teachers

Notes on the Setup and Procedure

In this experiment a reduction of the solar cell surface goes along with a decreasing current intensity. Varying values can result from an inexact covering of the solar cell surface.
In this experiment a piece of black cardboard is held up in front of the solar cell in order to reduce its surface. If one wants to be able to move both hands freely, one can fold the cardboard lengthwise, crosswise and diagonally. Now it can be fixed on the solar cell holder in front of the solar cell.

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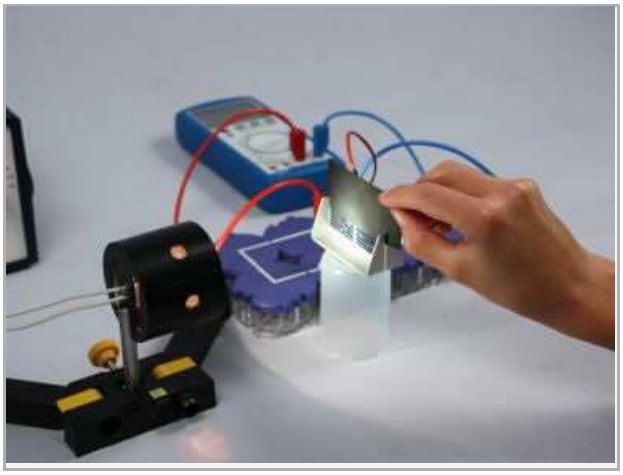
Task and equipment

Task

How does the solar cell behave when its surface is reduced?

In the experiment the surface of the solar cell is covered with black cardboard. The current intensity and the voltage of the solar cell are measured.



Student's Sheet

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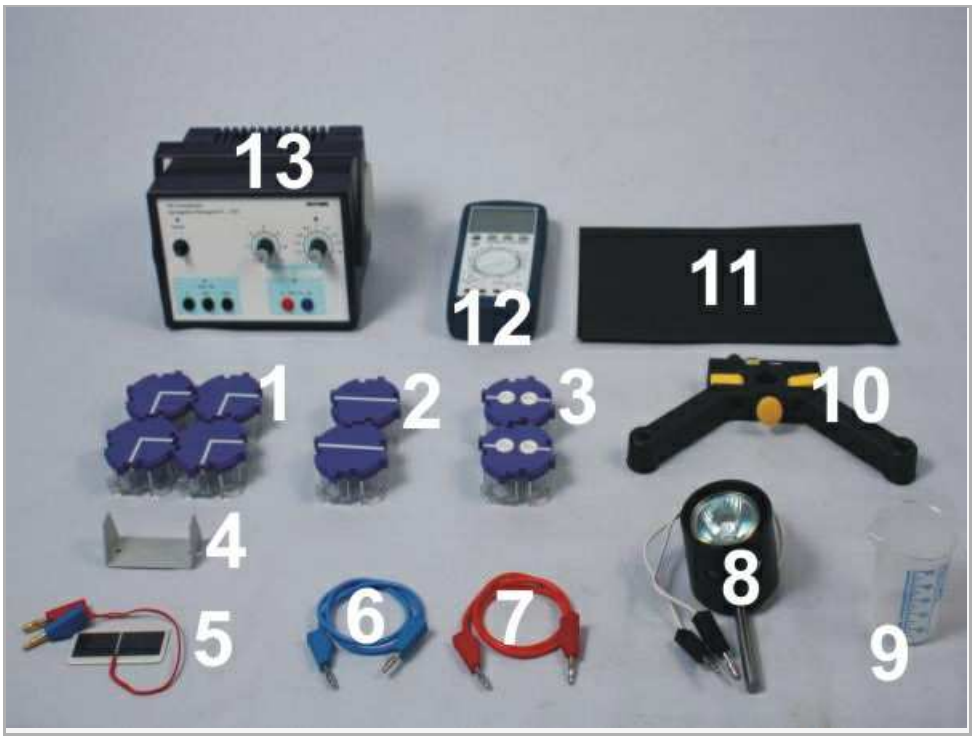
Equipment



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	Cardboards 200x300mm,black,10 pcs	06306-01	1
12	DMM with NiCr-Ni thermo couple	07122-00	1
13	PHYWE power supply DC: 0...12 V, 2 A / AC: 6 V, 12 V, 5 A	13506-93	1
Additional material			
	Scissors		

Set-up and procedure

Set-up

Fix 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.

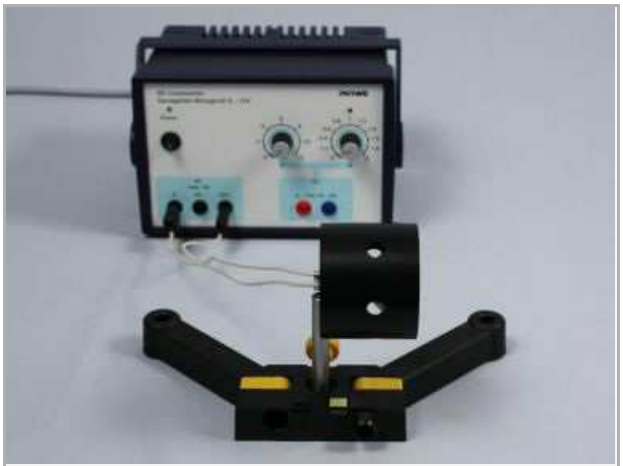


Fig. 1

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

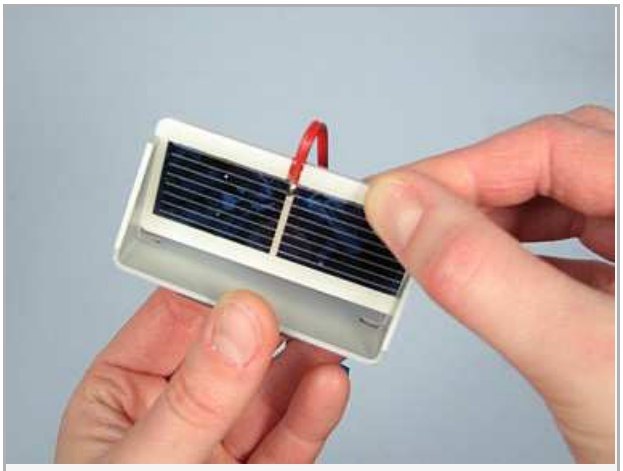


Fig. 2

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.

Robert-Bosch-Breite 10
D - 37079 Göttingen
Tel: +49 551 604 - 0
Fax: +49 551 604 - 107
info@phywe.de
www.phywe.com

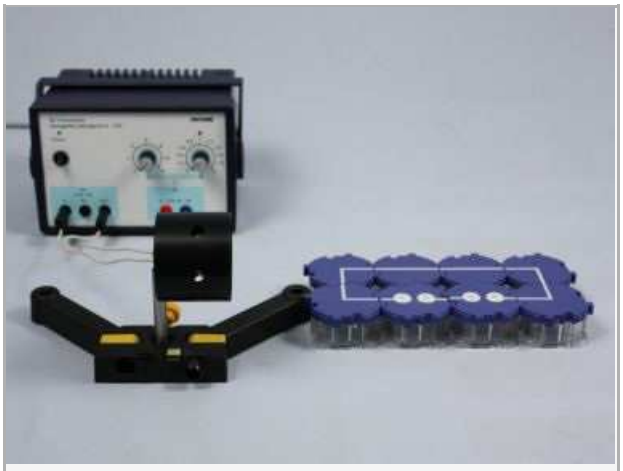


Fig. 3

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

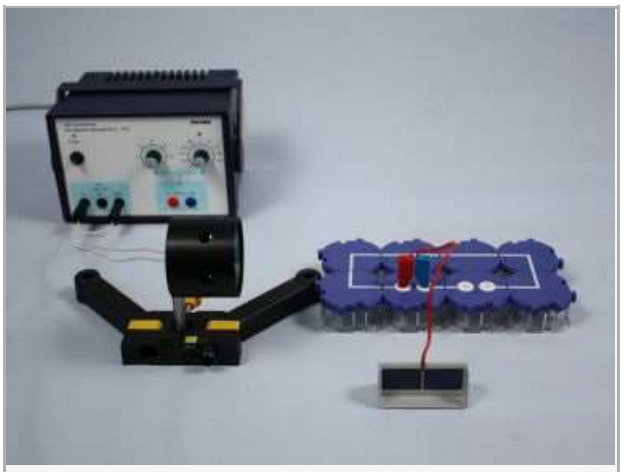


Fig. 4

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

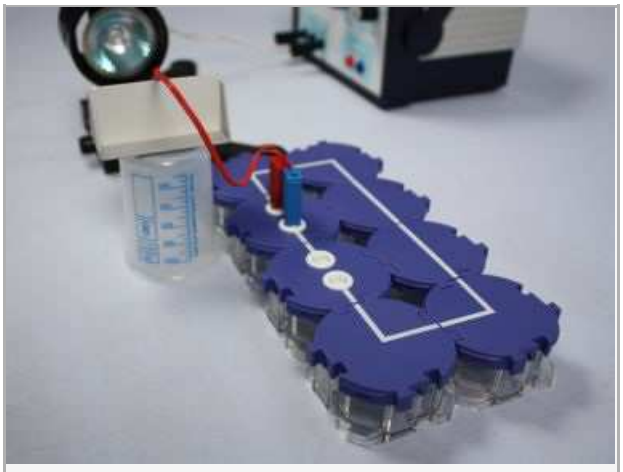


Fig. 5

Cut a piece of black cardboard (9 x 4 cm).

Procedure

Measurement of the voltage of a solar cell due to different surfaces of the

solar cell

Put the measurement range of the multimeter on 20 V and connect it with the electric circuit of the solar cell (Fig. 6). Read the displayed voltage *U* in the multimeter and enter the value in the result table.

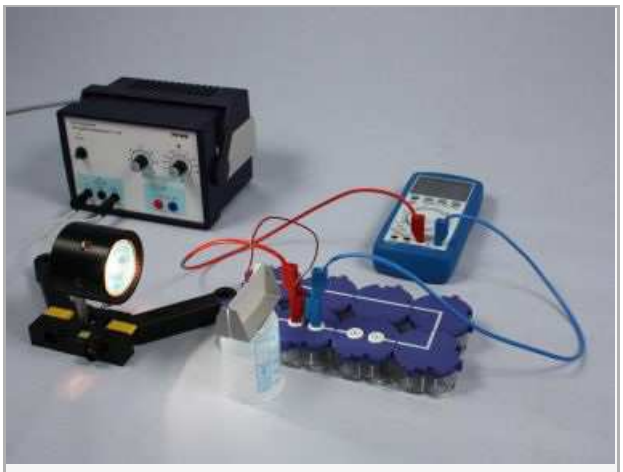


Fig. 6

Cover one quarter of the solar cell with the black cardboard (Fig. 7).

Orientate yourself by the lines on the solar cell. Take care that you touch the solar cell only from the back.

Read the voltage once more and write it down in the table respectively.

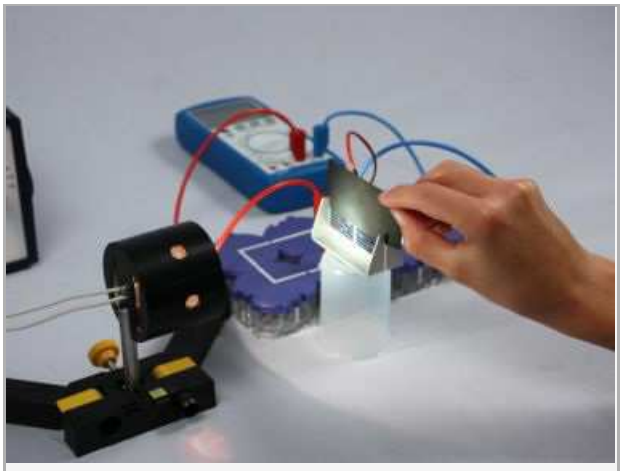


Fig. 7

Make two other measurements by covering one half of the solar cell as well as the whole solar cell. Take down your results.

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

Connect the multimeter in such a way that you can measure the current intensity (Fig. 8).

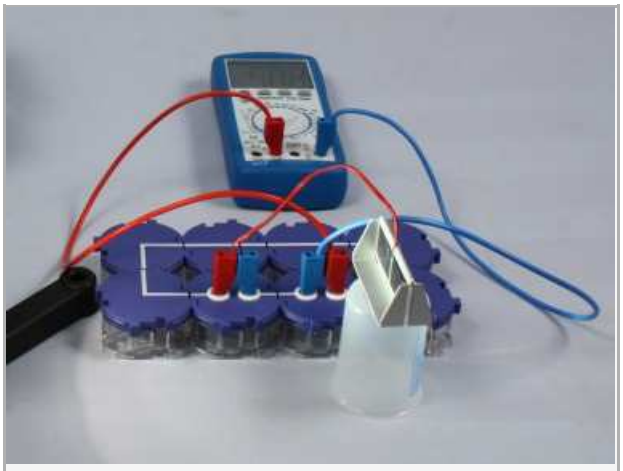


Fig. 8

Put the multimeter on 200 mA.

Now measure the current intensity without covering the solar cell. Take down the value in the table in the report.

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

Robert-Bosch-Breite 10
D - 37079 Göttingen

Tel: +49 551 604 - 0
Fax: +49 551 604 - 107

info@phywe.de
www.phywe.com

Report: Influence of surface area of a solar cell on voltage and current

Result - Table 1

Record your values in the table.

Surface	*I* in mA	*U* in V
full	1 ±0	1 ±0
3/4	1 ±0	1 ±0
1/2	1 ±0	1 ±0
1/4	1 ±0	1 ±0
0	1 ±0	1 ±0

Evaluation - Question 1

How does the illuminated area of a solar cell affect the voltage intensity?

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Robert-Bosch-Breite 10
D - 37079 Göttingen

Tel: +49 551 604 - 0
Fax: +49 551 604 - 107

info@phywe.de
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Evaluation - Question 2

How does the illuminated area of a solar cell affect the current intensity?

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Evaluation - Question 3

Why are the solar cells for the supply of a whole household much bigger than the solar cell in the experiment?

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