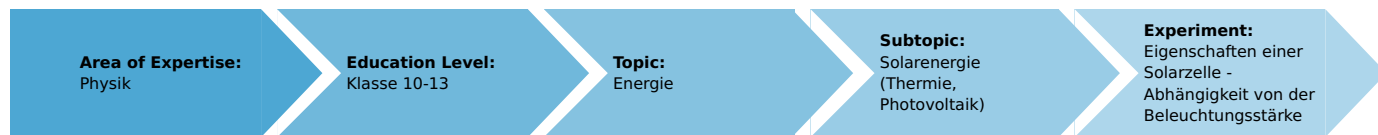


Properties of solar cells - the dependence on the illumination

(Item No.: P1374000)

Curricular Relevance



Difficulty



Easy

Preparation Time



10 Minutes

Execution Time



10 Minutes

Recommended Group Size



2 Students

Additional Requirements:

- Ruler (approx. 30 cm)

Experiment Variations:

Keywords:

Task and equipment

Information for teachers

Additional information

Solar cells play a substantial role in the development of alternative, non-fossil sources of energy. They convert light energy directly into electrical energy.

In this experiment, the influence of the illumination on the short-circuit current and the open-circuit voltage is examined. The illumination can be changed by altering the distance between the solar cell and the light source or by varying the angle of incident light.

Notes on setup and procedure

In the ideal case, there should be no resistance in the circuit when the short-circuit current I_{SC} is measured. The measuring instrument has a resistance, and this loads the solar cell. The measurement range of the measuring instrument should therefore not be below 30 mA, and not be altered during the measurement.

The circuit is open when the open-circuit voltage U_{OC} is measured. This can be clearly seen, as no amperemeter is in the circuit during U_{OC} -measurement.

Properties of solar cells - the dependence on the illumination

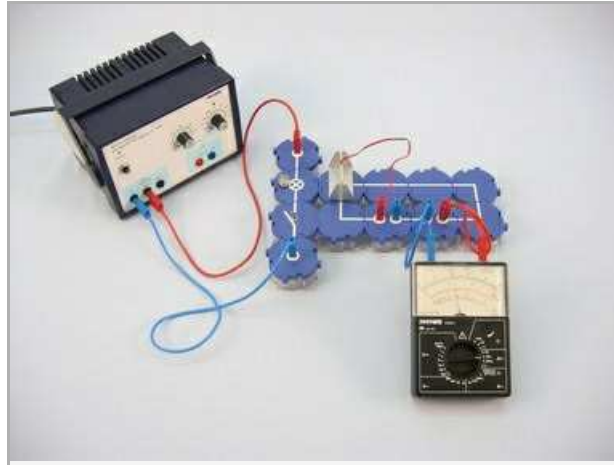
(Item No.: P1374000)

Task and equipment

Task

How does the illumination influence the behaviour of the solar cell?

Examine the influence of the illumination on the short-circuit current and the open-circuit voltage of a solar cell.



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	Junction module, SB	05601-10	2
5	On-off switch module, SB	05602-01	1
6	Socket module for incandescent lamp E10, SB	05604-00	1
7	Solar cell 2.5 x5 cm, with plugs	06752-11	1
8	Holder for solar cell 2.5 x5 cm, with plugs	06752-12	1
9	Connecting cord, 32 A, 250 mm, red	07360-01	1
10	Connecting cord, 32 A, 250 mm, blue	07360-04	1
11	Connecting cord, 32 A, 500 mm, red	07361-01	1
12	Connecting cord, 32 A, 500 mm, blue	07361-04	1
13	Filament lamp 6 V/3 W, E10, 10 pcs.	35673-03	1 piece
14	Multi-range meter, analogue	07028-01	2
15	PHYWE power supply DC: 0...12 V, 2 A / AC: 6 V, 12 V, 5 A	13506-93	1
Additional material			
	Ruler (approx. 30 cm)		1

Set-up and procedure

Set-up

The filament lamp is switched off to start with. To measure the short-circuit current I_{SC} , connect the circuit as shown in Fig. 1 and Fig. 2; fit the solar cell in the holder module (Fig. 3, Fig. 4).

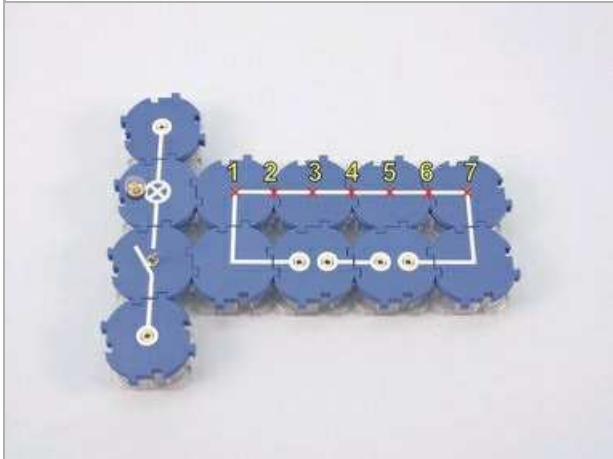


Fig. 1

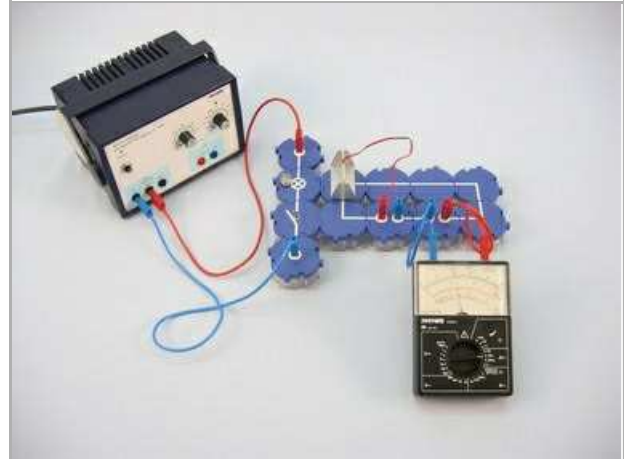


Fig. 2

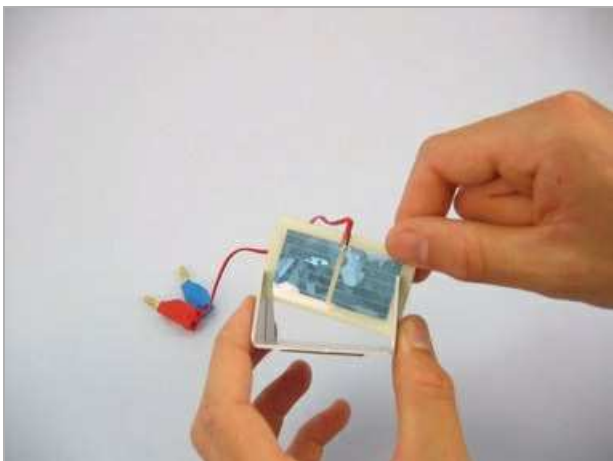


Fig. 3



Fig. 4

Procedure

- Switch on the filament lamp.
- Place the solar cell to position 1 (see Fig. 1), and adjust it to be illuminated centrally by the filament lamp; turn the solar cell in all directions and so change the angle to the illumination; observe the short-circuit current and describe it under Result - Observations in the report.
- Bring the solar cell back to vertical at position 1, measure the short-circuit current I_{SC} , enter the value in Table 1 (column 2) in the report.
- Do this measurement also for the other numbered positions, without changing the measurement range.
- Switch off the filament lamp.
- To measure the open-circuit voltage U_{OC} , set up the experiment as shown in Fig. 5 and Fig. 6.
- Switch on the filament lamp.
- Measure the open-circuit voltage U_{OC} with the solar cell at the various positions and enter the values in Table 1 (column 3).
- Switch off the filament lamp.
- Measure the distance d of the solar cell from the filament lamp at all positions and enter the values in Table 1 (column 4).



Fig. 5

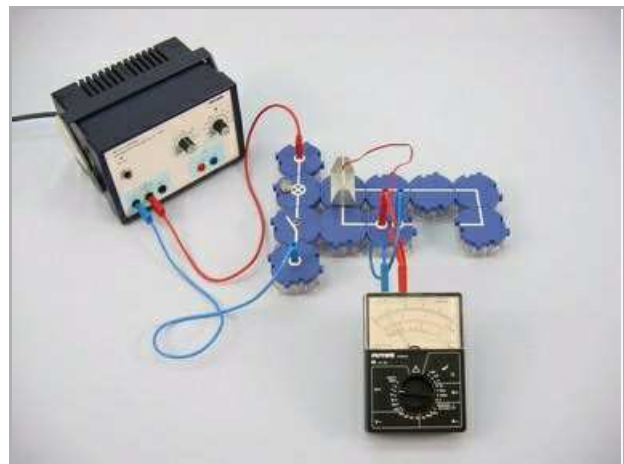


Fig. 6

Report: Properties of solar cells - the dependence on the illumination

Result - Observations

Note your observations.

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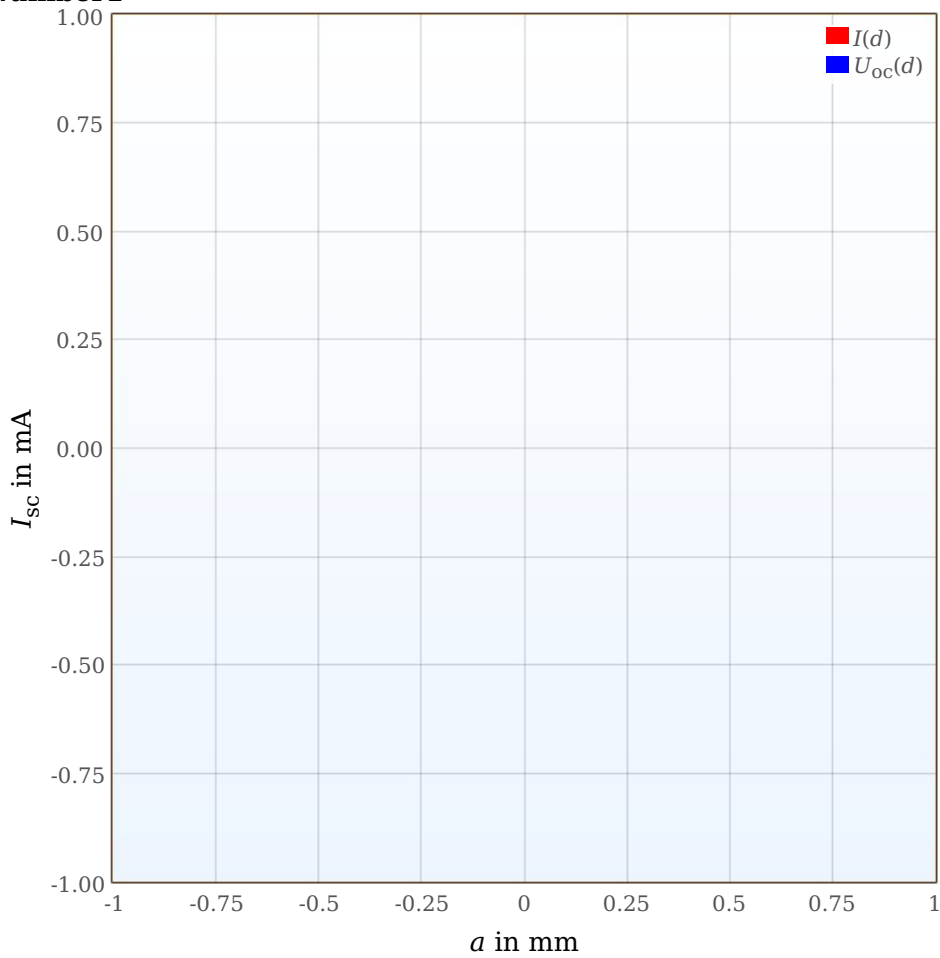
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Result - Table 1

Record your measured values.

Position	I_{SC} in mA	U_{OC} in V	d in mm
1	1 ±0	1 ±0	1 ±0
2	1 ±0	1 ±0	1 ±0
3	1 ±0	1 ±0	1 ±0
4	1 ±0	1 ±0	1 ±0
5	1 ±0	1 ±0	1 ±0
6	1 ±0	1 ±0	1 ±0
7	1 ±0	1 ±0	1 ±0

Number1



Evaluation - Question 1

How do I_{sc} and U_{oc} change with the distance d ?

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Evaluation - Question 2

Explain the observed relationship between the illuminating angle and I_{sc} .

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