Influence of illumination level on voltage and current of asolar cell

Physics | Energy | Renewable energies: Sun

Difficulty level	Group size	Preparation time	Execution time
easy	1	10 minutes	10 minutes

This content can also be found online at:

http://localhost:1337/c/62f39a0832e0850003fc613a

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Teacher information

Application

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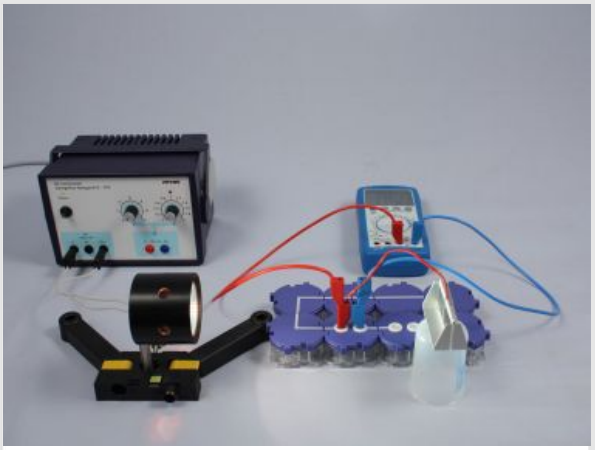

Experimental setup

Solar cells play an important role in the development of alternative, non-fossil energy sources.

It directly converts light energy into electrical energy.

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Other teacher information (1/2)

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Prior knowledge

The students should have gained first experimental experience in using the student power supply unit.

Principle

Students investigate whether the distance of the light source affects the voltage and current generated by a solar cell.

Hint: Since the current generated depends not only on the distance but also on the angle to the light source, the measured currents can vary.

Other teacher information (2/2)

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Learning objective

The pupils find that the voltage of a solar cell decreases only slightly, while the current strength decreases sharply with distance from the light source.

Tasks

In the experiment, the illumination is changed by the distance of the solar cell from the light source. The current and voltage of the solar cell are measured.

Hint: To measure a voltage of 0.5 V, a measuring range of 20 V is used in this experiment, so that the students can only note two decimal places. This makes it easier to illustrate that the measured voltage values remain almost constant.

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Safety instructions

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The general instructions for safe experimentation in science lessons apply to this experiment.

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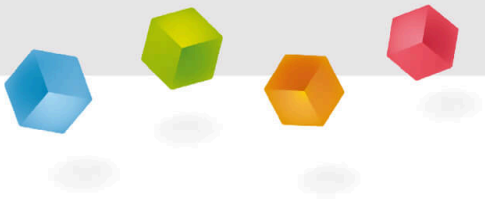

Student information

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Motivation

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A solar system

Solar cells make it possible to generate electricity in an environmentally friendly way, which in turn is used in almost all aspects of modern life.

A well-known example of this are the solar systems that can be found on the roofs of residential buildings or in the desert.

In order to use this technology more efficiently and effectively, it is beneficial to understand which factors have which influence on the effect of solar cells.

Tasks

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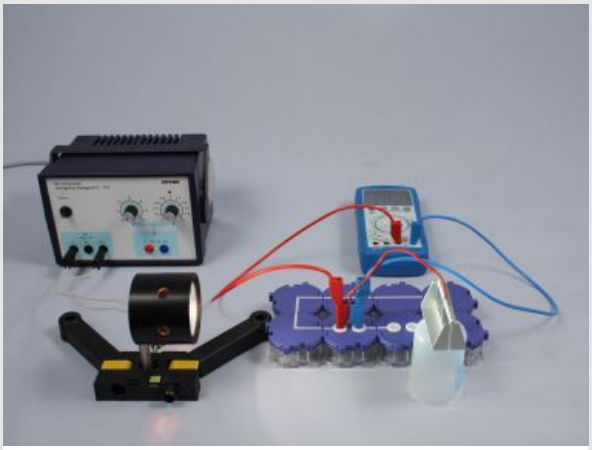

The experimental setup

Change the illumination of the solar cell by the distance to the light source.

Measure the current and voltage generated by the solar cell.

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Equipment

Position	Material	Art.-Nr.	Menge
1	Becherglas, Boro, hohe Form, 600 ml	46029-00	1
2	Dreibein, Ring-d = 140 mm, h = 240 mm	33302-00	1
3	Pinzette, l = 130 mm, gerade, stumpf	64610-00	1
4	Drahtnetz mit Keramik, 160 x 160 mm	33287-01	1
5	Universal-Wärmeschrank, 32 l	49559-93	1
6	Sicherheits-Gasschlauch, DVGW , lfd. Meter	39281-10	1
7	Bunsenbrenner mit Hahn, für Erdgas, Standard	32167-05	1
8	Petrischale, Glas, d = 100 mm	64705-00	10
9	Kompaktwaage, OHAUS TA 302, 300 g : 10 mg	49241-93	1
10	Messzylinder, Boro, hohe Form, 100 ml	36629-00	1
11	Objektträger, 76 mm x 26 mm, 50 Stück	64691-00	1
12	Messpipette, 10 ml, Teilung 0,1 ml	36600-00	1
13	Reagenzglasgestell, 12 Bohrungen, d = 22 mm, Holz, 6 Abtropfstäbe	37686-10	1
14	Erlenmeyerkolben, Duran®, Enghals, 500 ml	36121-00	2
15	Reagenzglas, d = 16 mm, l = 160 mm, 100 Stück	37656-10	1
16	Liebigs Fleischextrakt, 10 g	31521-03	1
17	Pepton aus Fleisch 50 g	31708-05	1
18	Doppelspatel, Stahl, l = 150 mm	33460-00	1
19	Glasrührstab, Boro, l = 300 mm, d = 7 mm	40485-05	1
20	Steristopfen für di = 15 mm, 250 Stück	39266-00	1
21	Steristopfen für di = 29 mm, 100 Stück	39267-00	1
22	Pipettierball, Flip-Modell, Pipetten bis 100 ml	36592-00	1
23	Tisch-Autoklav mit Einsatz	04431-93	1
24	Heizplatte, d= 185 mm,, 230 V für Versuche in der Wärmelehre	04025-93	1
25	pH Teststäbchen, pH 6,5-10, 100 Stück	30301-04	1
26	Natriumhydroxid, Perlen, 500 g	30157-50	1
27	Wasser, destilliert, 5 l	31246-81	1
28	Agar-Agar, gepulvert, 100 g	31083-10	1
29	Ethanol, absolut, 500 ml	30008-50	1

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Set-up (1/3)

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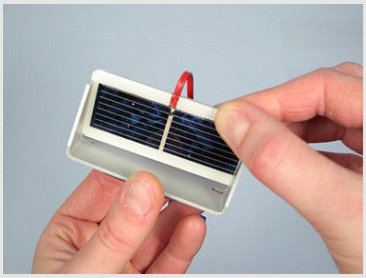

1. Place the halogen lamp in one half of the stand base and connect it to the AC output of the power supply unit (12 V~).

The power supply unit is switched off.

2.Put the solar cell in its holder.

Set-up (2/3)

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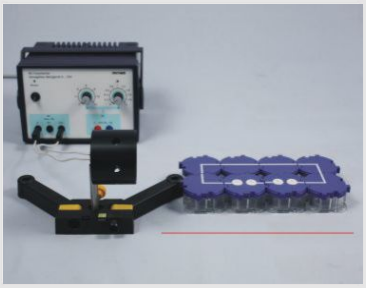

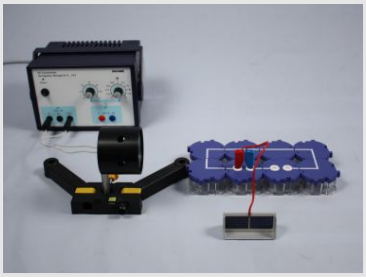

3.Build the circuit for the solar cell.

Place it in front of the halogen lamp so that the tripod base touches the centre of the two front switching elements.

Align the lamp and the building blocks along a line.

4. Connect the solar cell to the circuit.

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Set-up (3/3)

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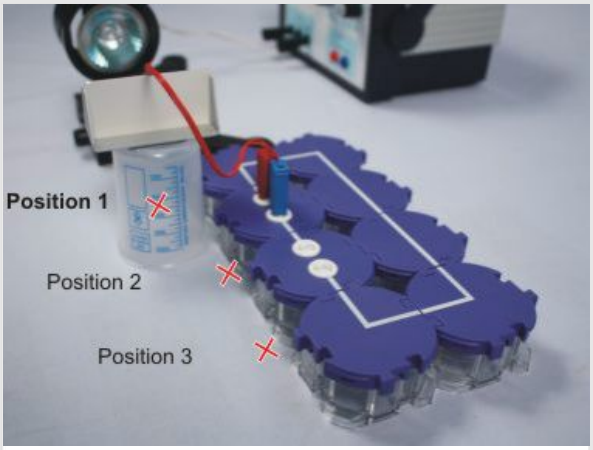

The individual positions

5.Place the solar cell in the centre of the upturned beaker and place it in position 1 as shown in the illustration.

Procedure (1/2)

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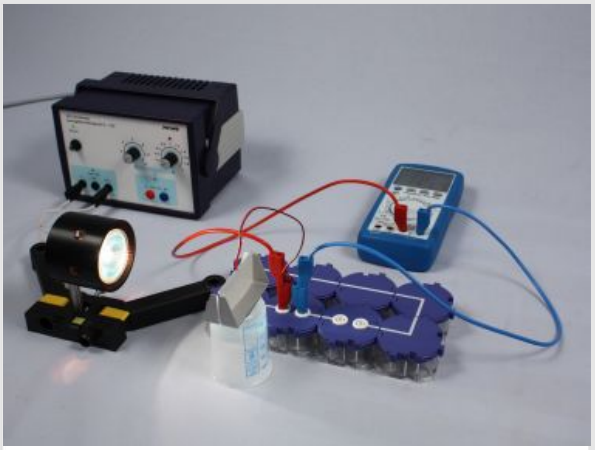

Voltage measurement

Measuring the voltage of a solar cell at different distances from the light source

1. Switch on the power supply unit, set the measuring range of the multimeter to 20 V- and connect the multimeter to the circuit of the solar cell.
2. Read the displayed voltage *U* on the multimeter and enter the value in the results table under item 1.
3. Move the solar cell further back to position 2. Read the voltage again and note it in the table accordingly.
4. Take another measurement at position 3.

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Procedure (2/2)

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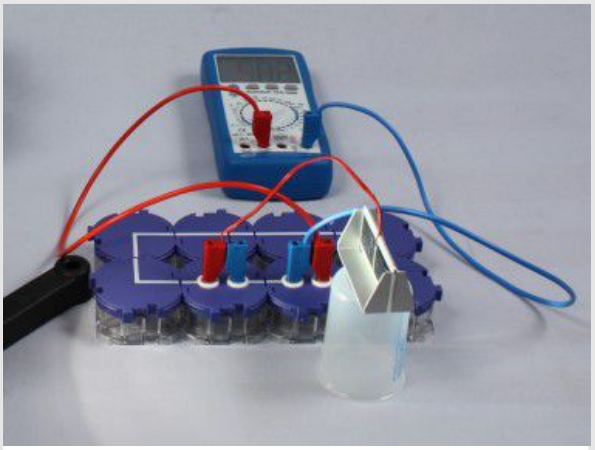

Current measurement

Measuring the current of a solar cell at different distances from the light source

1. Connect the multimeter in such a way that you can measure the current. *I*can measure
2. Set the multimeter to 200 mA-.
3. Set the solar cell to position 1 again and read the current on the multimeter.
4. Take two more measurements analogous to the first part of the experiment. Enter the values in the results table.

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Task 1

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The required voltages are indicated on light bulbs and many motors. Which of the following devices could you operate with the solar cell?

- ○ Motor from 0.5V
- ○ Light emitting diode from 2V
- ○ Bulb from 1.5V

Check

Task 2

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Which of these statements is true?

- ○ Both physical quantities are independent of the distance.
- ○ As the distance increases, the voltage decreases linearly and the current decreases quadratically.
- ○ As the distance increases, the voltage remains constant and the current drops quadratically.
- ○ As the distance increases, the voltage increases linearly while the current decreases linearly.

Check

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Task 3

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Place the words in the correct gaps

[ ] convert [ ] into electrical energy, making them a more environmentally friendly alternative to [ ]. \The amount of electricity they produce depends on the strength of the [ ] and their [ ] decreases accordingly with increasing distance.

- lighting
- Solar cells
- light energy
- effectiveness
- fossil fuels

Check

Slide	Score / Total
Slide 16: Tensions	0/1
Slide 17: Voltage and current	0/1
Slide 18: Renewable energy and fossil fuels	0/5
Total	**0 / 7**

Solutions Repeat

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