What does the photocurrent of a solar cell depend on?

Physics > Modern Physics > Solid state physics

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/615d94e7b107c10003773aac

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Teacher information

Application

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Test setup

Solar cells offer a good opportunity to combine the principle of the photoelectric effect with the basic principles of semiconductor sensor technology.

As a consequence, this experiment focuses on the study of the behavior of solar cells at different light intensities and shows the differences between the linear correlation expected by the photoelectric effect and the actual correlation due to the material.

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Other teacher information (1/2)

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Previous

Students should be familiar with the photoelectric effect and that semiconductors can be used as photosensors.

Principle

Light rays hit the surface of the solar cell and excite electrons in the semiconductor located there. This creates electron-hole pairs in the semiconductor, which migrate according to their charge to the diodes located in the material and thus form a photocurrent, which can be used to generate energy.

Other teacher information (2/2)

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Learning

The aim is to identify and explain the nonlinear relationship between light intensity and generated photocurrent.

Tasks

- Measurement of the photocurrent as a function of the intensity of the light source.

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Student Information

Motivation

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In times of climate change it is more and more important to be aware of the alternative energy sources that already exist and how they work.

This experiment demonstrates how exactly a solar cell responds to incident light and how the electricity generated is related to the strength of the incident light.

Solar system

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Equipment

Position	Material	Item No.	Quantity
1	Support base, variable	02001-00	1
2	Support rod, stainless steel, l = 600 mm, d = 10 mm	02037-00	2
3	Slide mount without angle scale	09851-02	2
4	Diaphragm holder, attachable	11604-09	2
5	Solar cell 3.3 x 6.5 cm, with plugs, 0.5 V, 330 mA	06752-09	1
6	Halogen lamp, 12 V/10 W, mounted with 4 mm plugs	09852-00	1
7	PHYWE Power supply, 230 V, DC: 0...12 V, 2 A / AC: 6 V, 12 V, 5 A	13506-93	1
8	Digital multimeter, 600V AC/DC, 10A AC/DC, 20 MΩ, 200 µF, 20 kHz, −20°C… 760°C	07122-00	3
9	Connecting cord, 32 A, 750 mm, red	07362-01	3
10	Connecting cord, 32 A, 750 mm, blue	07362-04	2

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Structure (1/2)

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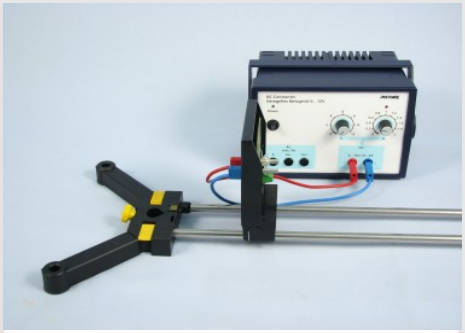
- The halogen lamp is placed on the stand material with a rider and connected to the power supply unit.
- A multimeter is connected between the halogen lamp and the power supply unit as an ammeter, measuring range: 2 A.

Step 1



Step 2

Step 3

Structure (2/2)

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- A multimeter is connected in parallel to the voltage source as a voltmeter, measuring range: 20 V.
- Opposite the halogen lamp, the solar cell is placed on the tripod material in such a way that the rider feet touch each other. Make sure that the solar cell is horizontally centered in the aperture holder. A multimeter is connected to the solar cell as an ammeter, measuring range: 2 mA.

Step 4

Step 5

Step 6

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Procedure

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- Set the power supply to 12 V.
- Measure the photocurrent at the solar cell after 10 seconds and note it in Table 1. 10 seconds are needed for the halogen lamp to get warm!
- Measure the current flowing through the halogen lamp and record it in Table 1.
- Set the power supply according to the specifications in Table 1 and read the gauges. Then make a note of the values.

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Report

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Task 1

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	Halogen lamp		Solar cell
	Voltage in V Current in A Power in W		Current in mA
12			
11			
10			
9			
8			

Task 1 (Part 2)

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	Halogen lamp		Solar cell
	Voltage in V Current in A Power in W		Current in mA
7			
6			
5			
4			
3			
2			

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Task 2

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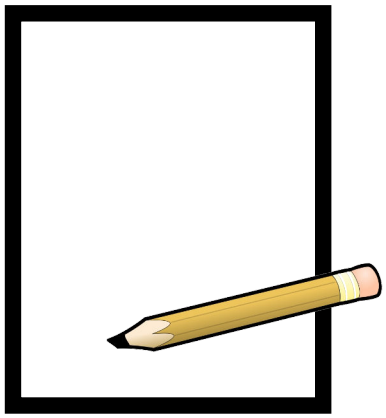
Plot the current through the solar cell against the output of the halogen lamp gaphically.



Task 3

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Which area of the graph deviates from a linear relationship?

- lower area
- none, it is a linear relationship
- upper area

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Slide	Score / Total
Slide 15: Explanation of the non-linear relationship	0/2

Total score 0 / 2

Show solutions | Repeat | Export text

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