

The characteristic current-voltage curves of solar cells

Task and equipment

Information for teachers

Additional information

The maximum utilisable power of a solar cell is dependent on the intensity of the incident light. Characteristic current-voltage curves are prepared under various illuminations.

Notes on setup and procedure

A potentiometer is used as a load resistor to record the characteristic current-voltage curves of a solar cell. The internal resistance of the amperemeter has to be taken into account as additional resistance in this measurement. When the potentiometer is turned to the left stop, then its resistance is 0, but the voltage shown is not 0. The value of the voltage is dependent on the measuring range of the amperemeter, as the various measurement ranges have different resistances. The measurements are taken in the 20 mA measurement range and this should not be changed during the entire experiment.

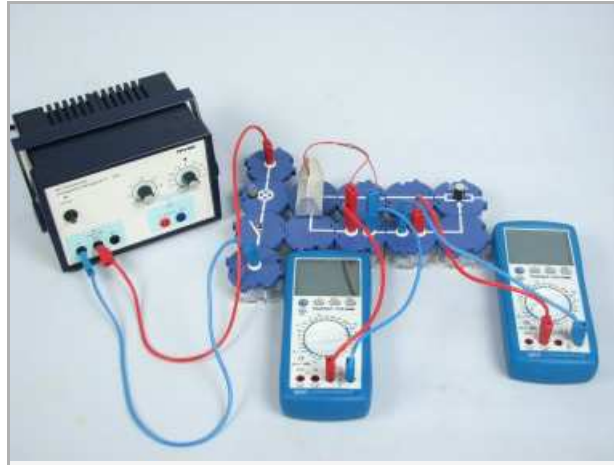
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Task

How does a load change the current and voltage of a solar cell?

Load a solar cell with a variable resistor. Note the values of the current and voltage at various values of the loading resistance.



Equipment



Position No.	Material	Order No.	Quantity
1	Straight connector module, SB	05601-01	2
2	Angled connector module, SB	05601-02	3
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	Potentiometer module 250 Ohm, SB	05623-25	1
8	Solar cell 2.5 x5 cm, with plugs	06752-11	1
9	Holder for solar cell 2.5 x5 cm, with plugs	06752-12	1
10	Connecting cord, 32 A, 250 mm, red	07360-01	2
11	Connecting cord, 32 A, 250 mm, blue	07360-04	2
12	Connecting cord, 32 A, 500 mm, red	07361-01	1
13	Connecting cord, 32 A, 500 mm, blue	07361-04	1
14	Filament lamp 6 V/3 W, E10, 10 pcs.	35673-03	(1)
15	DMM with NiCr-Ni thermo couple	07122-00	2
16	PHYWE power supply DC: 0...12 V, 2 A / AC: 6 V, 12 V, 5 A	13506-93	1

Set-up and procedure

Set-up

Set up the experiment as shown in Fig. 1, Fig. 2 and Fig. 3; fit the solar cell in the solar cell holder (Fig. 4). The filament lamp is first switched off.

Turn the potentiometer back to the left stop.

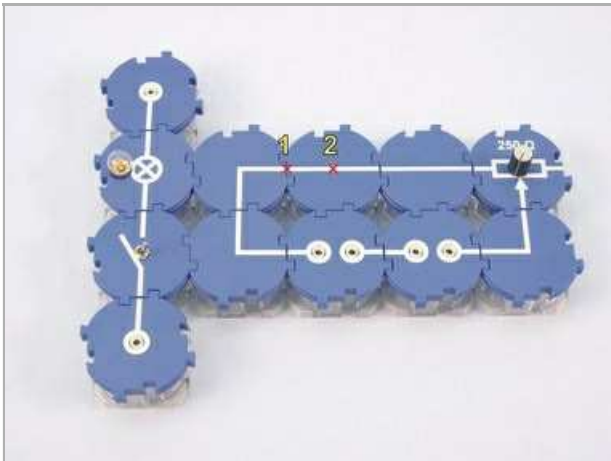


Fig. 1

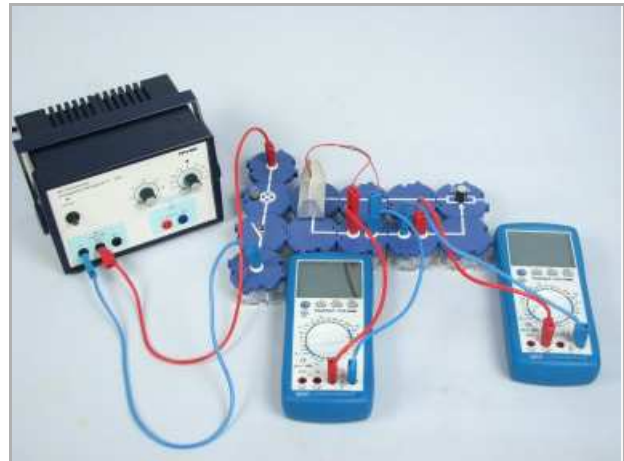


Fig. 2

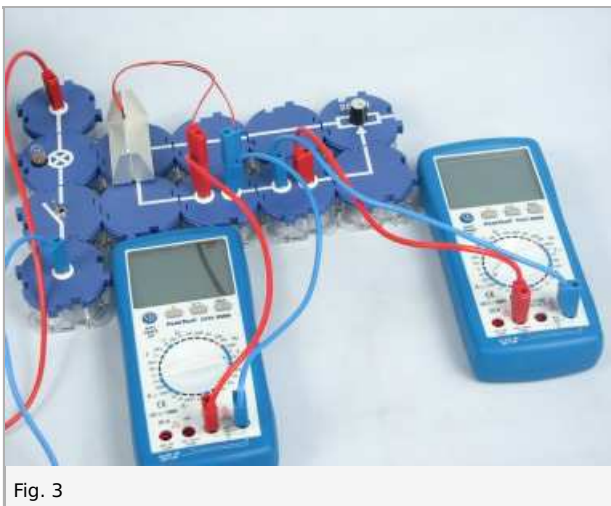


Fig. 3

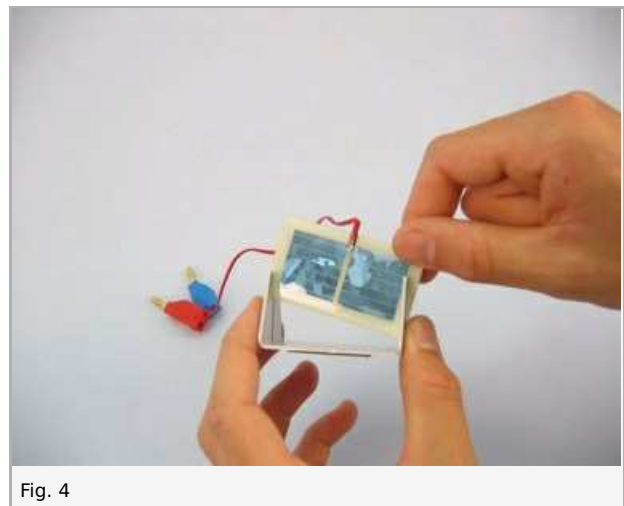


Fig. 4

Procedure

Switch on the filament lamp.

Fit in the solar cell at position 1 (see Fig. 1); set the amperemeter to the 20 mA measurement range.

Slowly turn the potentiometer to the right stop, first only qualitatively observe the voltage and the current.

Turn the potentiometer back to the left stop.

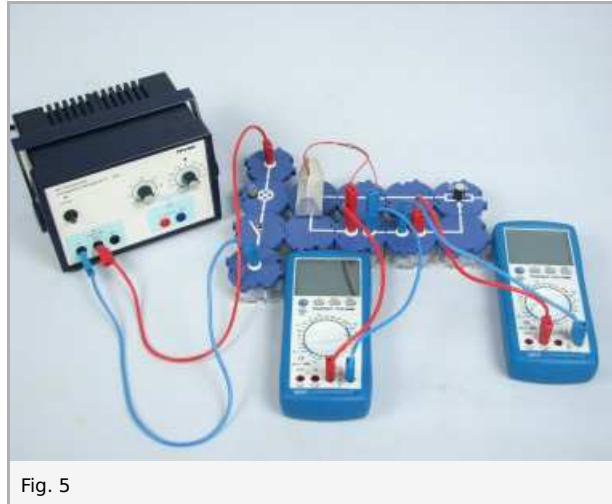


Fig. 5

Slowly turn the potentiometer to the right stop, taking measurements of voltage and current: measure about three pairs of voltage and current values in the voltage range up to 0.4 V, from then increase the voltage in 0.01 V steps and take measurements at each step. Note the measurement values in Table 1 in the report.

Take the same measurement also at position 2, without changing the measurement range of the multimeters. Note the measurement values in Table 2 in the report.

Remove the potentiometer from the circuit as shown in Fig. 5, then measure the voltage at $I = 0$ A for both positions of the solar cell.

Switch off the filament lamp.

Report: The characteristic current-voltage curves of solar cells

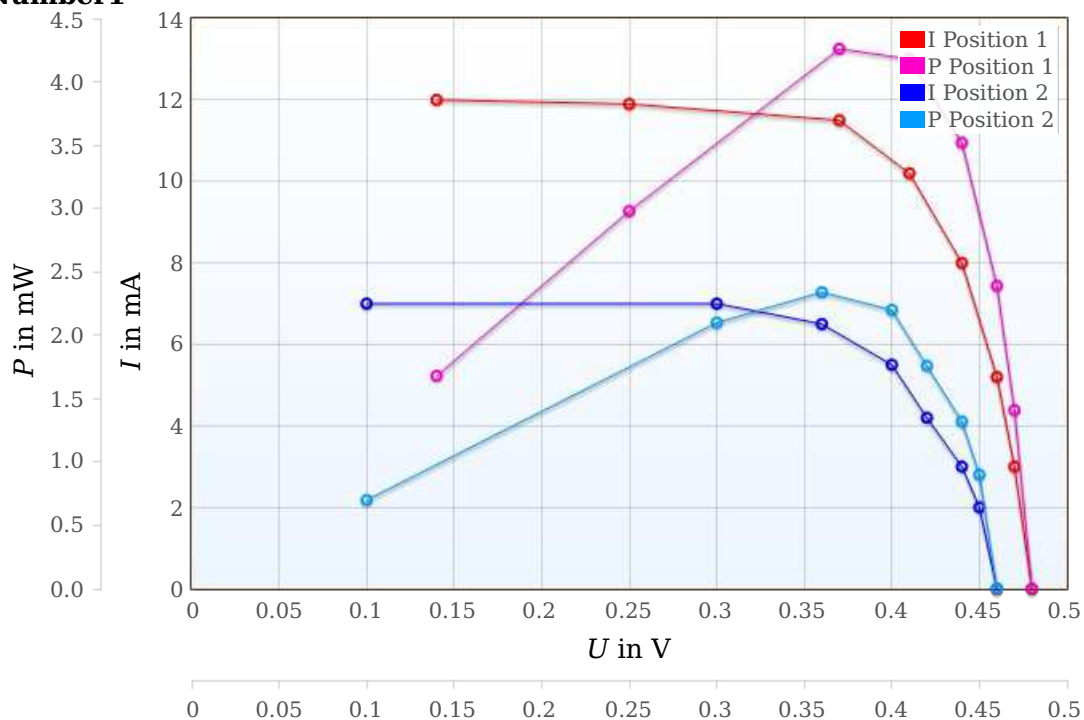
Result - Table 1

Enter your measured values in the table.

Calculate the electrical power $P = U \times I$ for each measured value and enter the values in table.

Position 1						Position 2					
U in V			I in mA			P in mW			U in V		
0,14	1	12,0	1	1,68	1	0,10	1	7,0	1	0,70	1
0,25	1	11,9	1	2,98	1	0,30	1	7,0	1	2,10	1
0,37	1	11,5	1	4,26	1	0,36	1	6,5	1	2,34	1
0,41	1	10,2	1	4,18	1	0,40	1	5,5	1	2,20	1
0,44	1	8,0	1	3,52	1	0,42	1	4,2	1	1,76	1
0,46	1	5,2	1	2,39	1	0,44	1	3,0	1	1,32	1
0,47	1	3,0	1	1,41	1	0,45	1	2,0	1	0,90	1
0,48	1	0,0	1	0,00	1	0,46	1	0,0	1	0,00	1

Number1



Evaluation - Question 1

How does the maximum power change with the load?

Evaluation - Question 2

How do I and U change on increasing the load resistance?

Evaluation - Question 3

Take a close look at the characteristic current-voltage curves, and qualitatively describe at which point on each current-voltage curve the maximum power is given.

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