Voltage and current in a parallel connection of solar cells

Task and equipment

Information for teachers

Additional Information

The pupils should examine a parallel connection of solar cells by measuring the open circuit voltage, Uges, and the short-circuit current, Iges.
Using a connection in parallel, greater currents can be reached.
Furthermore, the currents I_1 and I_2 at each solar cell will be measured. Using this information and Iges, the relation relation for the parallel connection of the solar cells can be derived: $I_{ges} = I_1 + I_2$.
The voltage at each solar cell is equal to the open circuit voltage, U_{ges}: $U_{ges} = U_1 = U_2$.

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Task and equipment

Task

What happens when you connect two solar cells in parallel?

Connect two solar cells in parallel and examine the voltage and the current.

Student's Sheet

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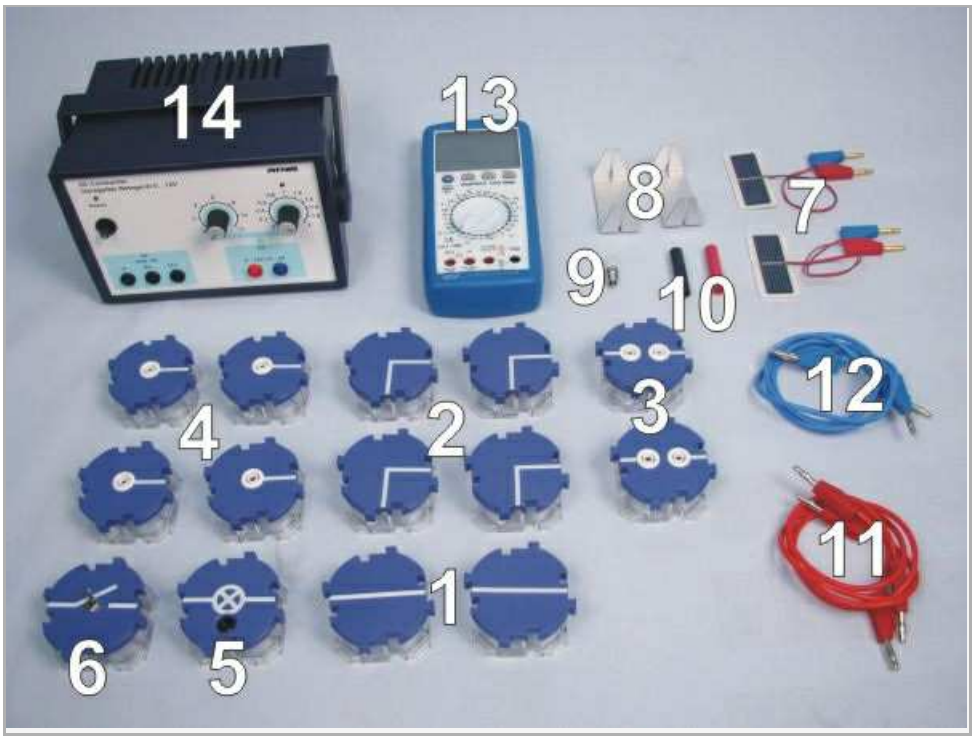
Equipment



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	4
5	Socket module for incandescent lamp E10, SB	05604-00	1
6	On-off switch module, SB	05602-01	1
7	Solar cell 2.5 x5 cm, with plugs	06752-11	2
8	Holder for solar cell 2.5 x5 cm, with plugs	06752-12	2
9	Filament lamp 6 V/3 W, E10, 10 pcs.	35673-03	(1)
10	Double sockets,1 pair,red a.black	07264-00	1
11	Connecting cord, 32 A, 500 mm, red	07361-01	2
12	Connecting cord, 32 A, 500 mm, blue	07361-04	2
13	DMM with NiCr-Ni thermo couple	07122-00	1
14	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

Build the lamp circuit as in Fig. 1. Then prepare the circuit for the solar cells (Fig. 2).

Fig. 1

Fig. 2

Join both circuits as shown in Fig. 3.

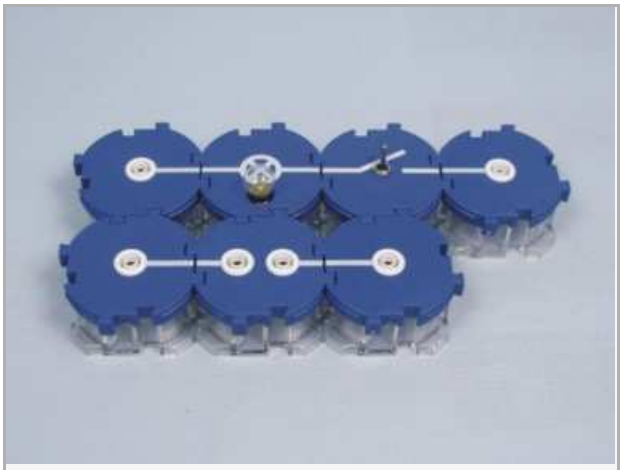


Fig. 3

Place each cell in its holder (Fig. 4) and connect them as shown in Fig. 5.

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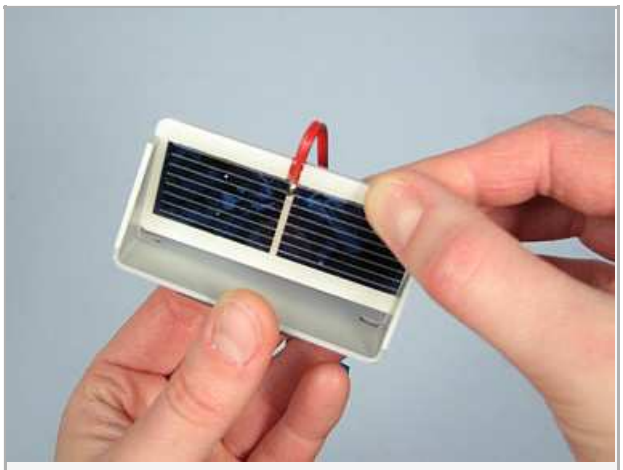

Fig. 4

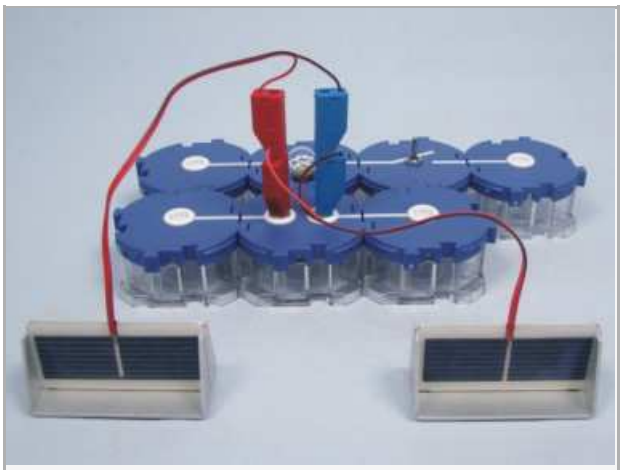

Fig. 5

Place the solar cells next to the bulb at the same distance (Fig. 6).

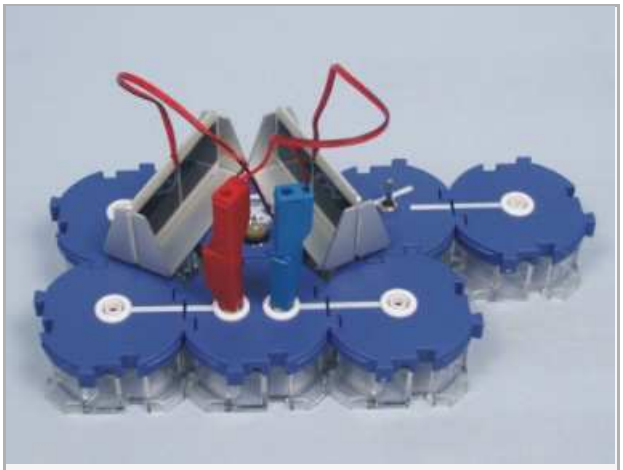

Fig. 6

Procedure

Measuring the voltage

Connect the lamp circuit to the power supply, as shown in Fig. 7.

The power supply is off and the on-off switch in the circuit is open.

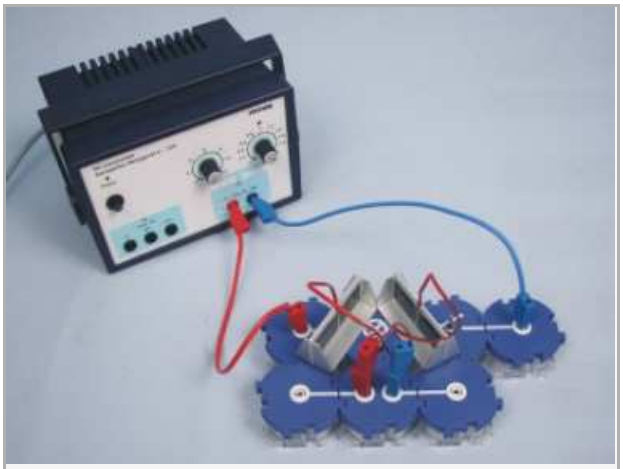

Fig. 7

Set the measuring range of the multimeter to 20 V- and connect it to the solar cell circuit (Fig. 8).

Turn on the power supply and set the voltage knob to 6 V.

Close the on-off switch in the circuit and turn on the measurement device.

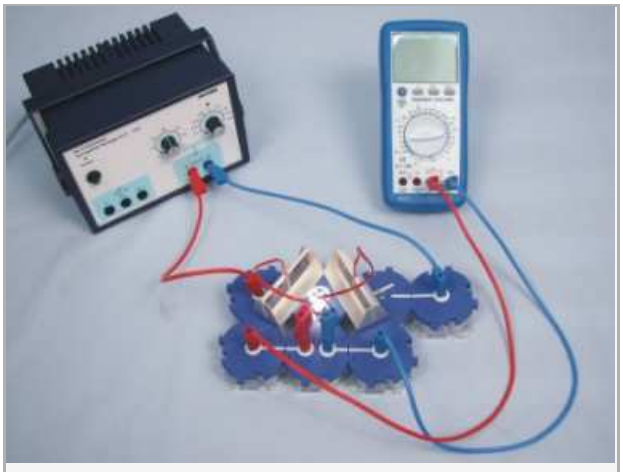

Fig. 8

Read the voltage displayed, U_{ges}, and write it down in Result - Observations in the report.

Measuring the current

Open the on-off switch.

Build a circuit for the solar cells with which you can measure the current (Fig. 9).

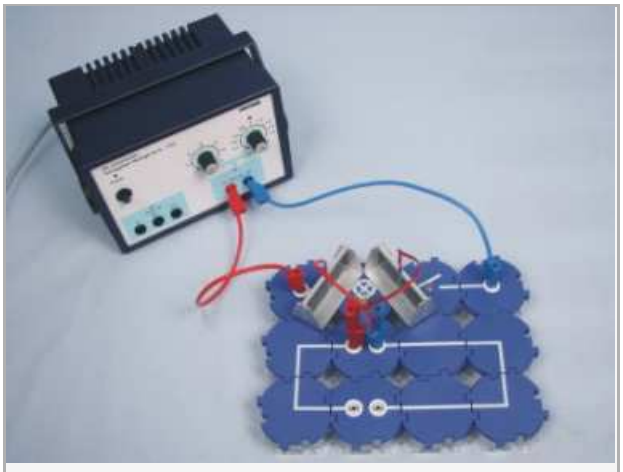

Fig. 9

Set the measuring range of the multimeter to 200 mA- and connect it (Fig. 10).

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Fig. 10

Close the on-off switch, read the total current, Iges, and write it down in Result - Observations.

Rebuild the circuit so that you can read the current of each cell (Fig. 11).

Close the on-off switch and read the current I_1 at the first cell.

Repeat the measurement for the second cell and read the current I_2. Record the results in Result - Observations.

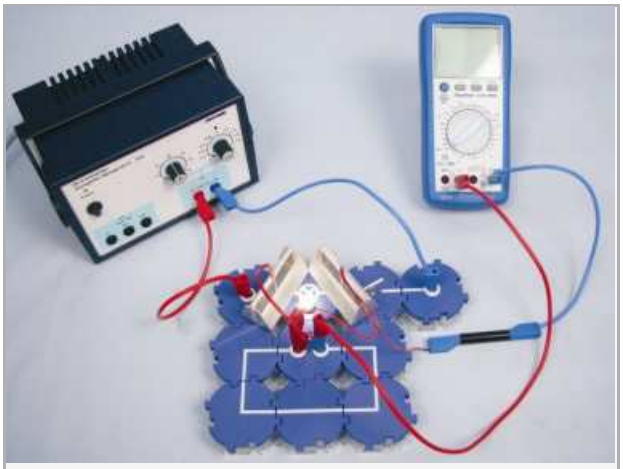

Fig. 11

Report: Voltage and current in a parallel connection of solar cells

Result - Observations

Record your measured values:

U_{ges} = ... V

I_{ges} = ... mA

I_1 = ... mA

I_2 = ... mA

Evaluation - Question 1

What can be achieved by connecting solar cells in parallel?

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Evaluation - Question 2

What is the relation between the total current, I_{ges}, and the current values for the individual cells, I_1 and I_2, in the case of a connection in parallel?

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