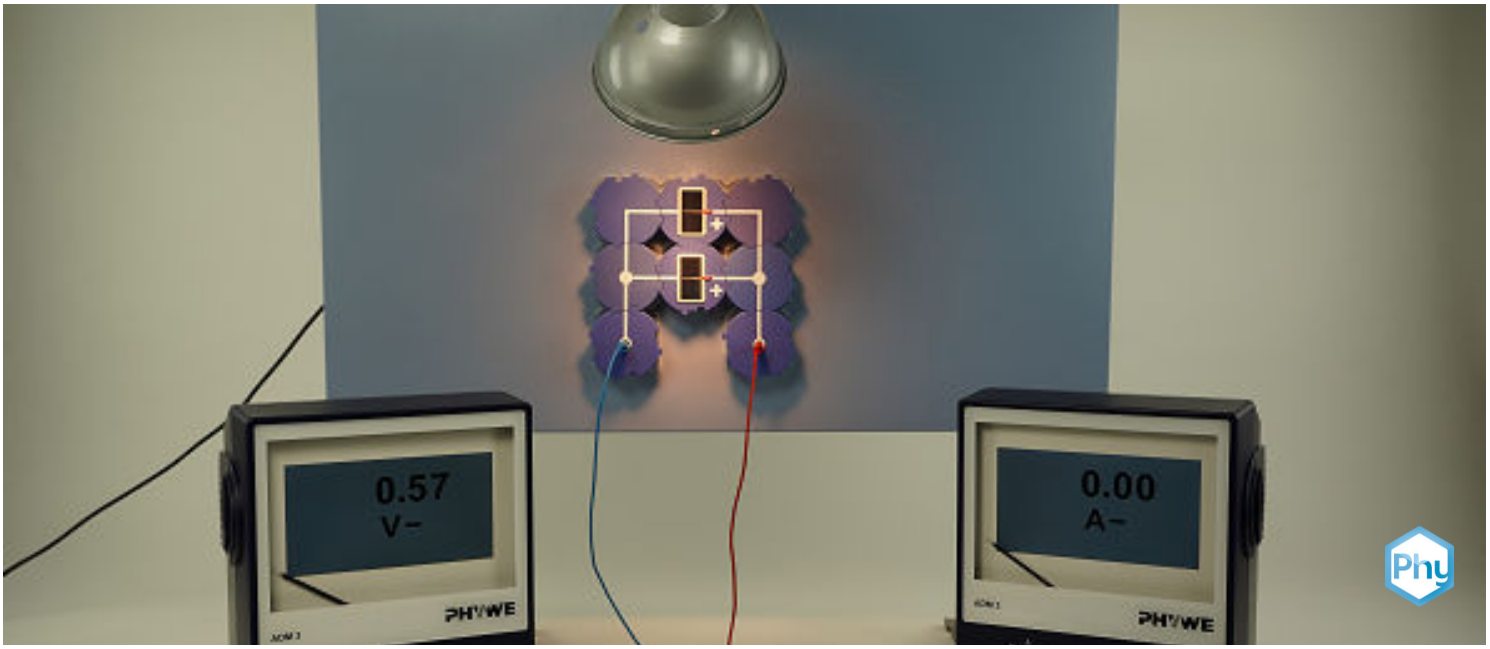
Voltage and current for series and parallel connection of solar cells with ADM3



Voltage and current for series and parallel connection of solar cells

Physics | Energy | Renewable energies: Sun

Difficulty level	Group size	Preparation time	Execution time
easy	-	10 minutes	20 minutes

This content can also be found online at:

http://localhost:1337/c/64a6b7e4108e10000205b996

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General information

Application

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Voltage and current for series and parallel connection of solar cells

Solar modules consist of several solar cells connected in series.

For larger systems, these modules are then connected both in series and in parallel, which also has the advantage that the power loss is minimised if individual cells fail.

These solar systems can be used directly. However, transformers and inverters are often used to generate higher voltages in order to feed the generated electrical energy into the existing power grid.

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Other information (1/2)

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Prior

A single solar cell only supplies a voltage of 0.5 V, which is not sufficient to operate light-emitting diodes or small incandescent lamps. To generate higher voltages, several solar cells are therefore connected in series.

Principle

In this experiment, the properties of series or parallel connections of solar cells are to be shown. In each case, the open-circuit voltages and short-circuit currents are measured and compared with the values of a single cell.

Other information (2/2)

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Learning

The meaning of the terms open-circuit voltage and short-circuit current strength should be explained to the pupils. The measurement of the short-circuit current strength should be explained, as an ammeter is always connected in series with a resistor in the circuit.

In this case, however, the resistance consists of only one lead wire. The ADM3 multimeter should therefore be connected directly to the solar cell to measure the current.

Note

The power of the solar cell decreases when it is very hot. The lamp must therefore be switched off immediately after each measurement.

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Safety instructions

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

For H and P phrases, please refer to the safety data sheet of the respective chemical.

Theory

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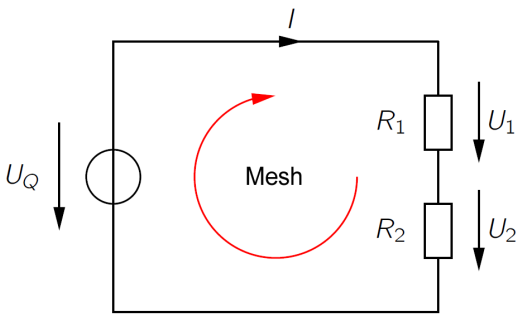
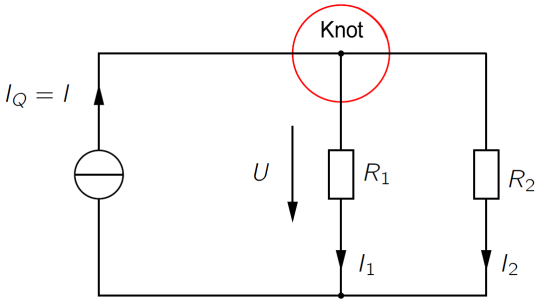
Series connection



- The special characteristic of a series connection is that the same current flows through the components. I flows.

Parallel connection



- The special characteristic of a parallel circuit is that the voltage is U is identical for all components.

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Equipment

Position	Material	Item No.	Quantity
1	PHYWE Demo Multimeter ADM 3: current, voltage, resistance, temperature	13840-00	2
2	Connector, angled, module DB	09401-02	2
3	Connector, T-shaped, module DB	09401-03	2
4	Junction, module DB	09401-10	2
5	Solar cell (2.5x5)cm,module DB	09470-00	2
6	Clamp on holder	02164-00	1
7	PHYWE Demo Physics board with stand	02150-00	1
8	Support rod, stainless steel, 750 mm	02033-00	1
9	Ceramic lamp socket E27, with reflector, switch and security plug	06751-01	1
10	Filament lamp, 220V/120W, with reflector	06759-93	1
11	Connecting cord, 32 A, 500 mm, red	07361-01	1
12	Connecting cord, 32 A, 500 mm, blue	07361-04	1
13	Connecting cord, 32 A, 500 mm, yellow	07361-02	1
14	G-clamp	02014-01	2

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Setup and procedure

Structure (1/2)

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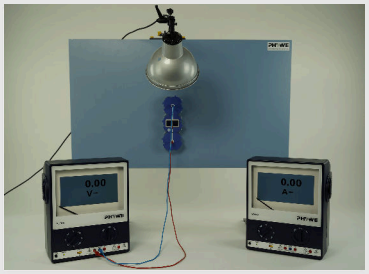

- Position the clamp on the upper edge of the panel above the solar battery on the support and screw it down carefully.
- Attach the support rod with the lamp in it and align it with the solar battery.
- The distance between the centre of the solar battery and the front of the lamp should be approx. 35 cm.

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Structure (2/2)

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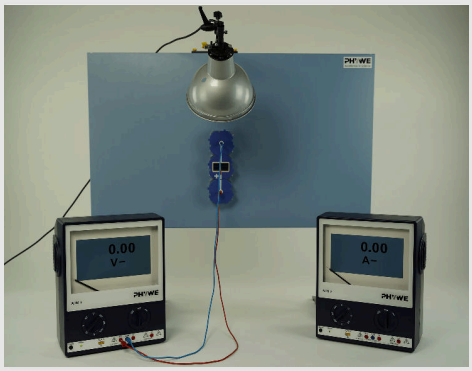
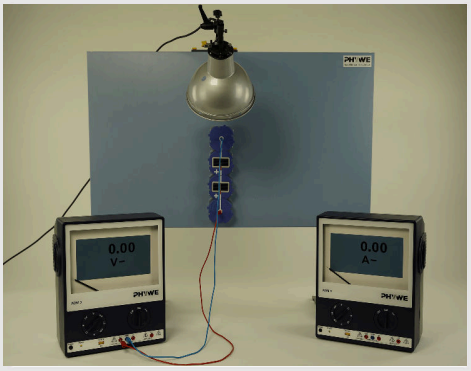
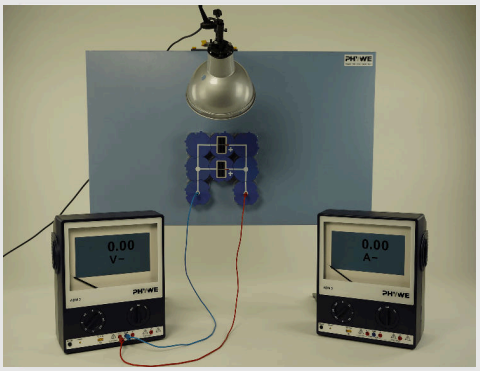
- To measure the voltage and the current, the circuit is to be set up in 3 different variants.

Procedure (1/2)

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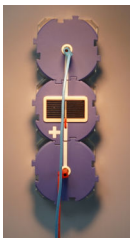
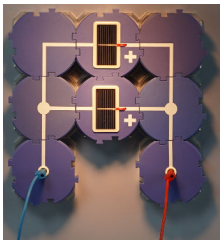
Voltage measurement

- Aim the lamp at the solar cell and take a single measurement for each of the three variants (set-up). Enter the value in the corresponding column.

Single solar cell	Series connection	Parallel connection
		

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Procedure (2/2)

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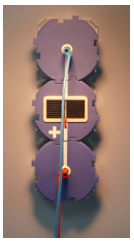
Current measurement

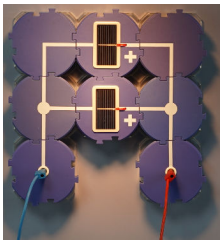
- Set up the circuit to measure the current and, as with the voltage measurement, take a reading for the current for each of the three variants.

Single solar cell



Series connection

Parallel connection



Evaluation (1/2)

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Voltage measurement

Fill in the missing words.

The parallel connection delivers approximately the _____ voltage as a single solar cell. The series connection, on the other hand, produces about _____ the voltage.

Check

Current measurement

Fill in the missing words.

The series connection delivers approximately the _____ amperage as a single solar cell. The parallel connection, on the other hand, produces approximately _____ the current.

Check

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Evaluation (2/2)

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Draw the correct words into the gaps!

You can clearly see that the voltage in a _____ is twice that of a single solar cell. The current in a _____ of two cells is about twice that of a single cell.
In a series connection, the _____ is the same at each point, while the _____ from the individual voltage sources adds up. In a parallel circuit, however, it is _____. The voltage is _____ at every point in the circuit and the current is added together.

parallel connection
the other way round
voltage
series connection
current
equal

Check

Slide	Score / Total
Slide 13: Multiple tasks	0/4
Slide 14: Series and parallel connection	0/6

Total score 0 / 10

Show solutions | Repeat | Export text

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