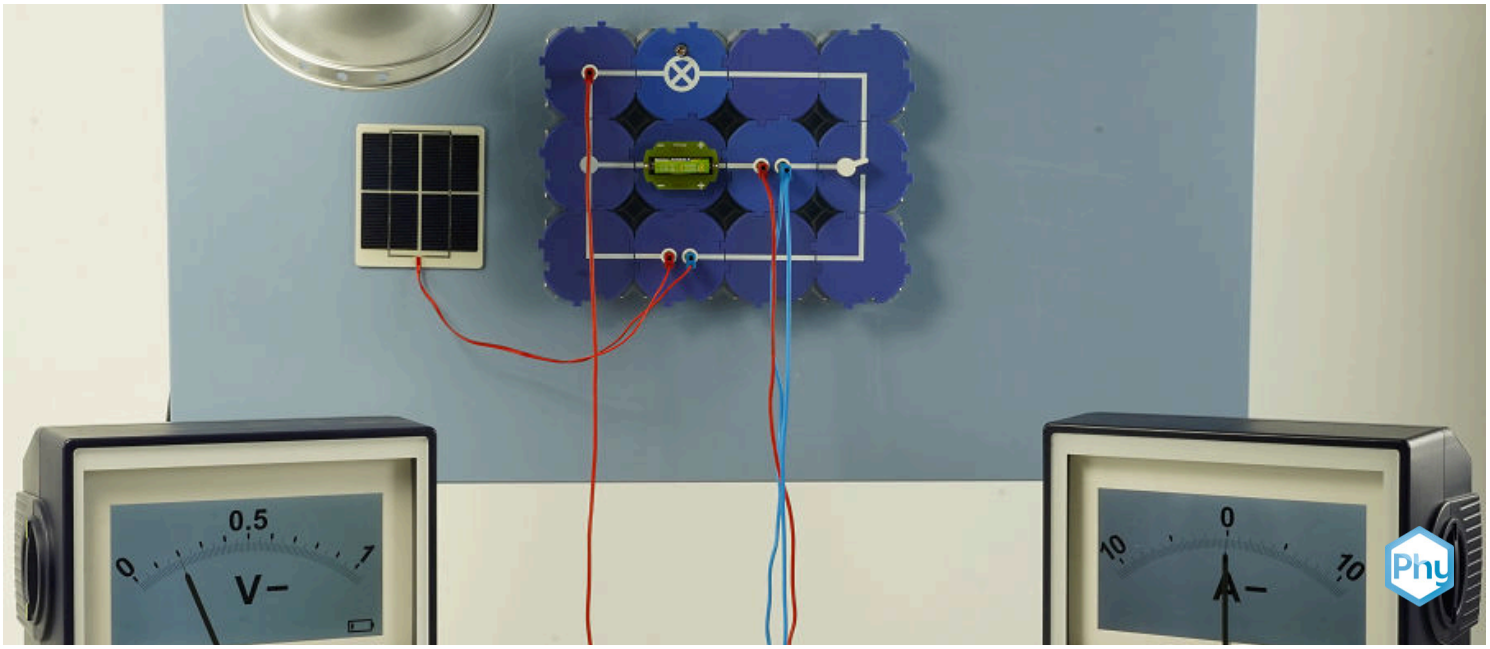
Storing the electrical energy of a solar cell with a rechargeable battery with ADM3



Storing the electrical energy of a solar cell with a rechargeable battery

Physics | Energy | Renewable energies: Sun

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

This content can also be found online at:

http://localhost:1337/c/64a7cf3e896cc40002f80169

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General information

Application

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Solar cell

Storing the electrical energy of a solar cell with a rechargeable battery

With renewable energy sources, improving storage options is important because, for example, solar energy is not available at all times.

The aim of this experiment is to show how electrical energy from a solar cell can be stored with a commercially available \ "battery" so that it can be used at another time.

Battery

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Other information (1/2)

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Prior knowledge

The basics of measuring current and voltage as well as determining energy and power from these measurands should be known.

Principle

In an accumulator, electrical energy is converted into chemical energy and stored. The best accumulators can release up to 95 % of the energy supplied. The efficiency of the Ni-MH accumulator used in this experiment is up to 70 %.

In this experiment, the charging and discharging of the battery is examined at four different charging times.

Other information (2/2)

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Learning

The pupils recognise the connection between the energy emitted by a solar cell for storage and later use.

Note

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

To improve the test results, it is necessary to condition the battery by charging and discharging it several times before the actual test.

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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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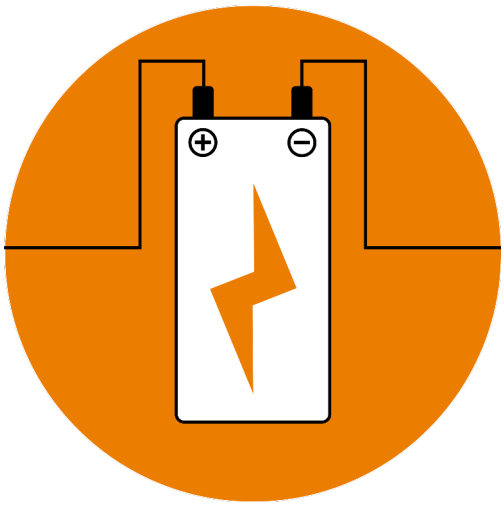
- The accumulator is a rechargeable element.
- During charging, electrical energy is converted into chemical energy in an accumulator.
- If a consumer is connected, the chemical energy is converted back into electrical energy.
- Each accumulator has a nominal voltage as a reference value or marking.



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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, straight, module DB	09401-01	2
3	Connector, angled, module DB	09401-02	4
4	Connector, T-shaped, module DB	09401-03	1
5	Connector interrupted, module DB	09401-04	2
6	Junction, module DB	09401-10	3
7	Socket for incandescent lamp E10 ,module DB	09404-00	1
8	Switch, change-over, module DB	09402-02	1
9	Solar battery, with cable, connectorsand magnet pads	06752-23	1
10	Battery holder module (AA type), SB	05606-00	1
11	Clamp on holder	02164-00	1
12	Ni-MH accus, size AA, 1.3 Ah / 1.2V, 1 pair	07922-03	1
13	Filament lamps 1.5V/0.15A,E10,10 pieces	06150-03	1
14	PHYWE Demo Physics board with stand	02150-00	1
15	Support rod, stainless steel, 750 mm	02033-00	1
16	Ceramic lamp socket E27, with reflector, switch and security plug	06751-01	1
17	Filament lamp, 220V/120W, with reflector	06759-93	1
18	Connecting cord, 32 A, 250 mm, blue	07360-04	1
19	Connecting cord, 32 A, 250 mm, yellow	07360-02	1
20	Connecting cord, 32 A, 500 mm, red	07361-01	1
21	Connecting cord, 32 A, 500 mm, blue	07361-04	1
22	G-clamp	02014-01	2

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Setup and procedure

Structure (1/2)

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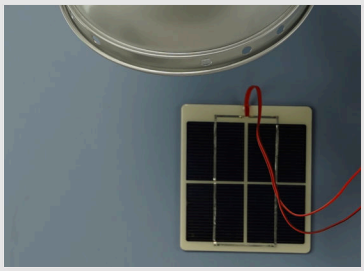

- Above the solar battery on the upper edge of the panel, carefully screw the clamp onto the support.
- Attach the tripod rod in it and align the lamp with the solar battery.
- The distance between the centre of the solar battery and the front of the lamp should be approx. 35 cm.

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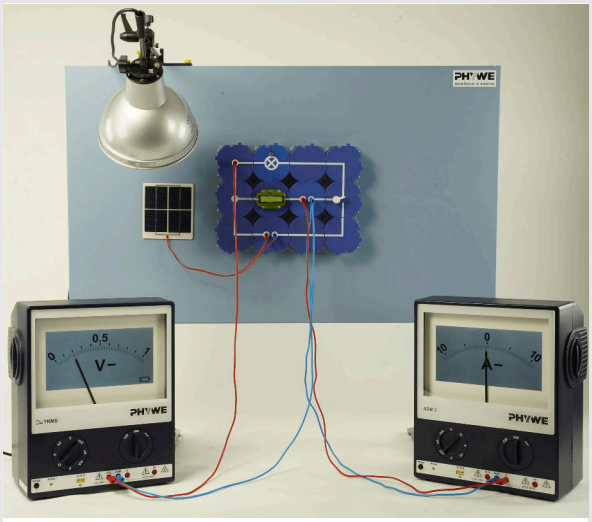
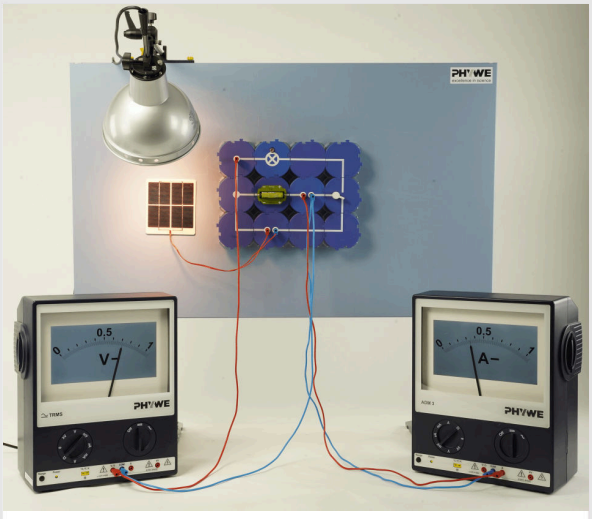
Structure (2/2)



Experimental setup

- Set up the circuit according to the illustration.
- Connect the battery and pay attention to the polarity.
- The changeover switch should be capable of closing the circuit.
- Integrate the multimeters for measuring current and voltage into the circuit.
- **NOTE:** With the solar cell, any background lighting can falsify the measured values! So darken the room as much as possible.

Procedure (1/3)



Carrying out - Charging the battery

- Align the lamp with the solar cell and switch on.
- Flip the switch and charge the battery for 30 seconds.
- After 30 seconds, calculate the electrical work using the known quantities. At the same time, switch off the lamp.
- Note the determined values in the evaluation (table).

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Procedure (2/3)

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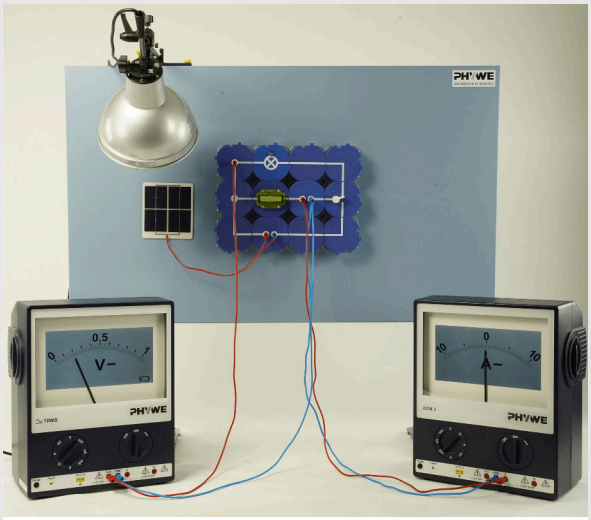

Carrying out - discharging the battery

- Rebuild the circuit (illustration)
- Flip the switch and discharge the battery.
- Watch the bulb.
- Note the time when the light bulb stops glowing.
- Note the electrical work that the light bulb took to discharge the battery.

Procedure (3/3)

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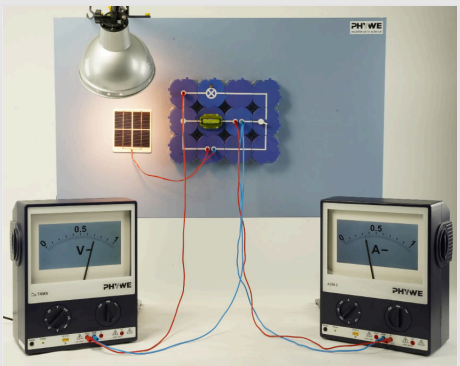
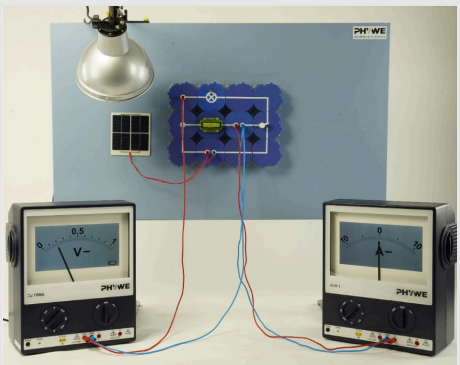
- Repeat the test with a battery charging time of 60 seconds and then also with 120 and 240 seconds.
- Transfer measured values to the table in the evaluation.





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Evaluation (1/2)

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The following values have been determined:

Loading time	30s	60s	120s	240s
Lighting duration				
Electr. work (load)				
Elecr. work (discharged)				

Fill in the missing words.

If the charging time is longer, the bulb will shine longer. However, the duration of the light bulb never reaches the length of the [ ].

Check

Evaluation (2/2)

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Draw the correct words into the gaps!

The electrical work is significantly less when [ ] than when [ ] the accumulator. This is due on the one hand to the [ ] of the nickel-metal hydride accumulator, which is about 70 %, and on the other hand to the fact that the incandescent lamp radiates most of its energy in the form of [ ] and a smaller part in the form of [ ].

charging
efficiency
heat
light
discharging

Check

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Slide	Score / Total
Slide 14: Lighting duration	0/1
Slide 15: Electrical work	0/5

Total score 0 / 6

Show solutions | Repeat | Export text

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