

## Storage of the electric energy of a solar cell with the aid of a rechargeable battery

### Task and equipment

### Information for teachers

### Additional Information

Batteries can have different charging states.

Before beginning the experiment check whether the Ni-Cd accu is already discharged, so that the glow lamp does not light at the beginning of the experiment. If it glows, the Ni-Cd accu can be discharged faster via the 6-V-glow lamp.

On the other hand, the Ni-Cd accu could be so low discharged that a recharge time of 7 minutes is not enough. In this case the recharge time must be increased.

### Notes on the Setup and Procedure

The students must pay attention to a secure hold of the solar battery on the rider.

If it is a sunny day, the halogen lamp can be substituted by the sun.

In this case the rider, the tripod material and the absorber plate are excluded from the experiment set-up and the solar battery can be placed directly under the sun. In addition, the solar energy of the sun charges much more effectively the Ni-Cd accu in the same time, so that at the end of the experiment the glow lamp lights obviously brighter.

The quantity of the stored energy depends on the charging time, the charging current and the storage capacity of the Ni-Cd accu.

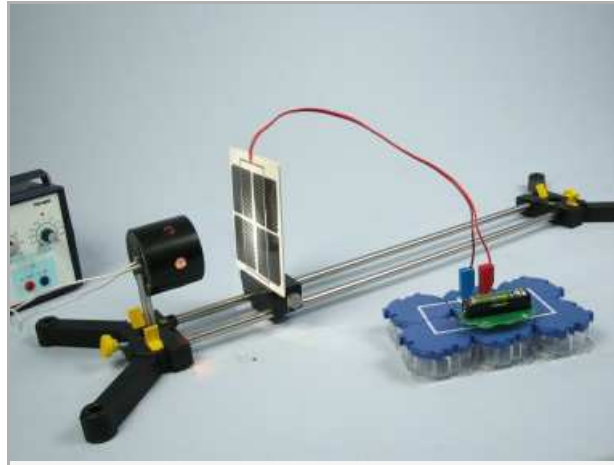
## Storage of the electric energy of a solar cell with the aid of a rechargeable battery

### Task and equipment

#### Task

#### How can solar energy be stored?

Try to store the electric energy generated by a solar battery with a Ni-Cd accu.



## Equipment



Position No.	Material	Order No.	Quantity
1	Angled connector module, SB	05601-02	4
2	Socket module for incandescent lamp E10, SB	05604-00	1
3	Interrupted connector module, SB	05601-04	2
4	Filament lamps 1.5V/0.15A,E10,10 pieces	06150-03	(1)
5	Solar battery, 4 cells, with cable and connectors	06752-20	1
6	Halogen lamp with reflector, 12V / 20W	05780-00	1
6	Mount for halogen lamp with reflector	05781-00	1
7	Battery holder module (AA type), SB	05606-00	1
8	Ni-MH accus, size AA, 1.3 Ah / 1.2V, 1 pair	07922-03	1
9/10	Solar collector for student experiments	05760-00	1
11	Slide mount for optical bench	09822-00	1
12	Support rod, stainless steel, l = 600 mm, d = 10 mm	02037-00	2
13	Measuring tape, l = 2 m	09936-00	1
14	Digital stop watch, 24 h, 1/100 s & 1 s	24025-00	1
15	Support base, variable	02001-00	1
16	PHYWE power supply DC: 0...12 V, 2 A / AC: 6 V, 12 V, 5 A	13505-93	1

## Set-up and procedure

### Set-up

Build up the optical bench using the variable support base and both support rods (fig. 1 and fig. 2).



Fig. 1



Fig. 2

Fix the lamp in the left part of the support base and connect it to the power supply (12 V ~) (fig. 3). The power supply is switched off.



Fig. 3

Put the black absorber plate on the shaft (fig. 4).

Fasten the shaft and the plate to the rider and put both on the optical bench (fig. 5).

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Fig. 4



Fig. 5

Move the rider until the distance between lamp and plate is 7 cm and place the plate parallel to the rider. Place the solar battery on the rider (fig. 6).



Fig. 6

Set the electric circuit by means of the connector module according to fig. 7. Screw the 1,5-V-glow lamp in the socket module for light bulb.

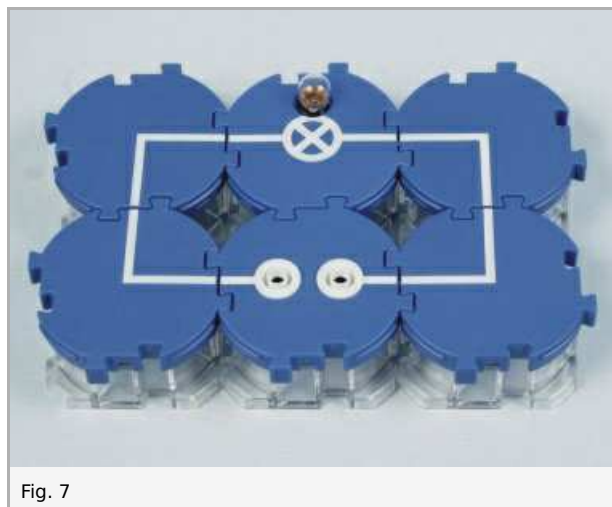


Fig. 7

## Procedure

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Fasten the Ni-Cd accu in the battery holder and put it in the interrupted connector module of the electric circuit (fig. 8).

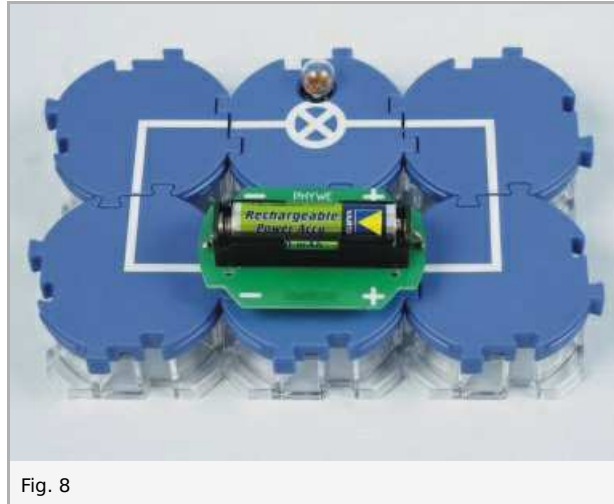


Fig. 8

Write down under Result - Observations 1 whether the light bulb glows.

Remove the module and the light bulb, and then replace them by a connection module for the solar battery (fig. 9).

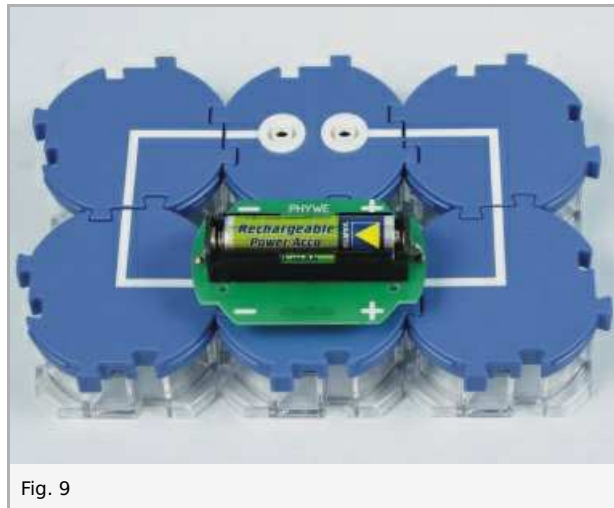


Fig. 9

Connect the solar battery to the current circuit (fig. 10).

Make sure that the red connector points to the positive pole of the battery holder (fig. 11).

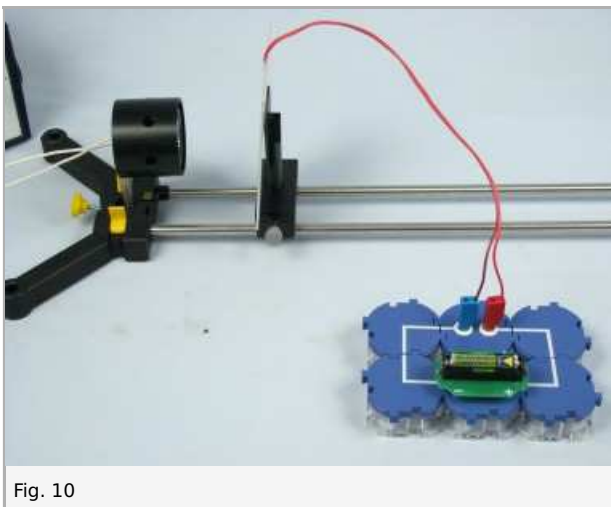


Fig. 10

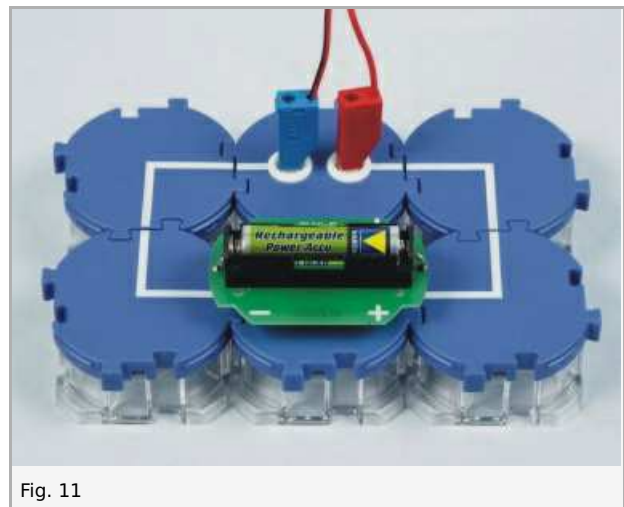


Fig. 11

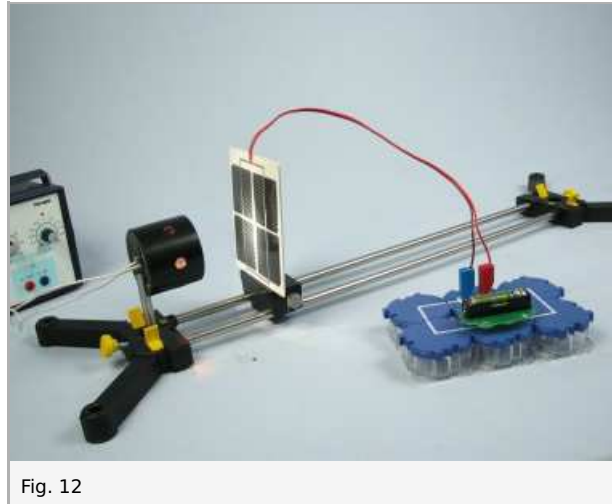
Switch on the halogen lamp and begin the stopwatch.

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Switch off the halogen lamp after 7 minutes (fig. 12).



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Switch off the halogen lamp.

Exchange the interrupted connector module once more by the connector module with the glow lamp.

Write down in Result - Observations 2 whether the light bulb glows or not.

Observe the light bulb during 1 minute. Write down your observations under Result - Observations 3.

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## Result - Observations 1

Note your observations.

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## Result - Observations 2

Note your observations.

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## Result - Observations 3

Note your observations.

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## Evaluation - Question 1

Explain the observations noted down in your results under Observations 1. Which statement can you make with regard to the charging state of the Ni-Cd accu?

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## Evaluation - Question 2

Explain your observations noted down under Observations 2. Include the charging state of the accumulator in your explanation.

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## Evaluation - Question 3

Explain your observations under Observations 3.

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## Evaluation - Question 4

During charging of the accumulator electro-chemical processes take place inside of it. The energy is stored electro-chemically. Which further energy types appear in this experiment?

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