SUNdidactics
SolarEnergyDidactics
SolarEducation
SolarEngineering
innovative Solarsysteme für Schule und Ausbildung
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Solardidaktik Solarzellen Solarmodule
PV- Experimentiergeräte PV- Gerätentwicklung
Experimentieranleitungen didaktische Konzepte
Solarberatung Solar- Workshops
Solar- Fortbildung für Lehrkräfte
solare Aus- und Weiterbildung Solarspielzeuge

Solardidactics solar- cells solar modules
photovoltaic experiment devices solar- workshops
solar toys solar education and solar training

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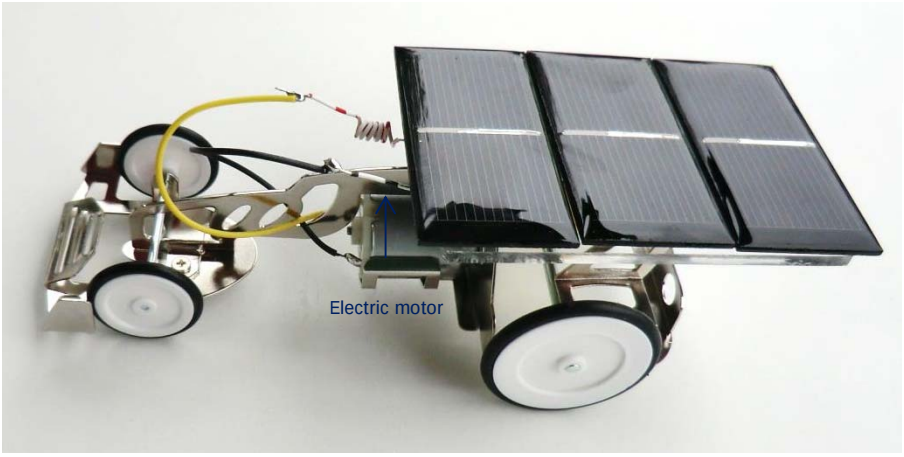
The SUSE solar vehicle 5

Powerful solar vehicle with solar module 1.8 V/450 mA
Construction manual and technical data

Learning station
E7



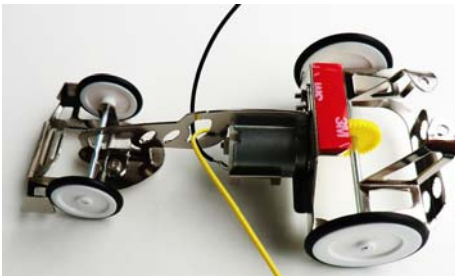
The solar vehicle 5

On the surface the 3-solar-cell solar module with U_{oc} = 1.8 V and I_{sc} = 450 mA can be seen. The solar module feeds the electric motor with electric energy, which is gained through the transformation of the light's radiation energy.

The construction manual

Parts: Inpro-Solar construction kit + additional package SF5 from SUNdidactics
Tools: Small toolbox with screwdriver, long-nosed pliers, side cutters, scissors, soldering station (just once for all participants)

Assembly phase 1 with the basic Inpro-Solar construction kit
The vehicle is assembled according to the Inpro-Solar manual, prior to the start of construction a 3 cm long strip of double-faced adhesive tape has to be attached to the metal tail part.
Furthermore the „ears“ have to be bent 90° with long-nosed pliers (see photo).
Now the car is assembled according to the manual up to step 4. Free movement of the axes is important, the front axle as well as the rear axle have to be easy to rotate.

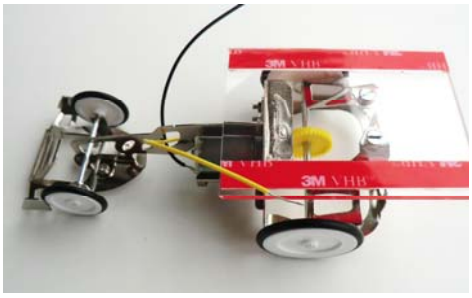


The photo shows the vehicle at the end of assembly step 4.
The remaining parts of the basic construction kit are not needed, only the small solar module is necessary for the subsequent experiments.

Assembly phase 2 with the additional packagesolar vehicle 5

Now the parts of the additional package 5 are needed: Perforated plexiglass plate with 2x double-faced adhesive tape, solar module with connecting wires black (negative) and yellow (positive), 2 countersunk bolts M2 and 2 nuts. The Inpro-Solar solar cell (1.2 V/125 mA) is replaced by a fundamentally stronger and more efficient solar module (1.8 V/450 mA).

Installation of the plexiglass plate: First the red protective film of the adhesive tape **on the metal strip** is removed. The plexiglass plate is held with the tape pointing upwards, both of the bolts are inserted through the holes and then carefully through the holes of the „ears“ and the plexiglass plate is pressed against the adhesive tape on the metal stripe in the front. Now the two nuts are screwed on from below and tightened firmly. The photo shows the mounted plexiglass plate.



Installation of the solar module: Now the red protective film is removed carefully from both of the stripes of double-faced tape and the solar module is pressed carefully onto them, the width is identical, but the module overlaps in the front and the back by 5 mm. In driving direction the yellow wire should be up front.
The yellow positive wire of the solar module is twisted with the yellow (positive) motor wire, the black module wire (negative) with the black motor wire (negative).

Afterwards the twisted wire connections are soldered up. The wire contacts must not touch each other! The photo shows the finished vehicle. In the end the transparent protective film is removed from the surface of the solar cells.
For a decrease in friction the passes of the axes through the metal profiles are sprayed with silicone spray. Check the front and the rear axle for smooth running before testing and correct, if necessary.

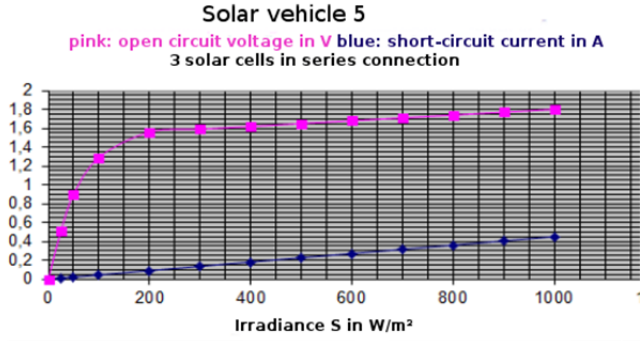
Test run: Outside in the light of bright sunshine or inside with illumination by a halogen spot lamp or on a window ledge illuminated by the sun the vehicle should run forwards speedily.

The assembly of the SUSE solar vehicle 5 is finished successfully, now experiments can be conducted with the vehicle and the solar module from the basic package.

Technical data:

Vehicle:
Metal chassis, synthetical wheels with rubber tires
Motor and gear:
Solar electric motor DC, single-level reduction gear
Solar module:
3 mono silicon solar cells 600 mV/450 mA in intern series connection, U_{oc}= 1.8 V
I_{sc} = 450 mA with an irradiance of S = 1000 W/m²
Single cell: 52 x 26 mm
Single module: 60 x 30 mm
Whole module: 90 x 60 mm

Extensive Experiments with this vehicle are included in the experiments file: suxSolarfahrzeug5-0415
= learning stations A20 (easy) and B22 (sophisticated)



The U(S) and the I(S) characteristic curves of the solar module:
On the x axis the light's intensity = irradiance S is shown in units of W/m², 0 means total darkness, 1000 means bright sunshine with deep blue sky in the summer.
The module's voltage (pink curve) first increases strongly from 0 on and then slowly approximates a value of 0.6 V, mathematically it's an exponential function.
The short-circuit current I_{sc} increases in a linear fashion from 0 to it's maximum value of 0.45 A = 450 mA.
Because of the linear trend the irradiance can easily be determined from the short-circuit current, this is done in the experiments.