

innovative Solarsysteme für Schule und Ausbildung
innovative solar- systems for school, college, technical education

- Solardidaktik
- Solarzellen
- Solarmodule
- Photovoltaik- Experimentiergeräte
- Photovoltaik- 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- experiment- manuals
- solar- workshops
- solar consulting
- solar education
- solar training for teachers
- solar toys

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Experimental learning stations on solar energy

Photovoltaics, solar radiation, solar heat, optoelectronics

Experiments from the learning workshop NILS-ISFH for classes, training, workshops, project days, labs

Execution in sunlight/daylight outdoors or with halogen spot lamps indoors

www.nils-isfh.de

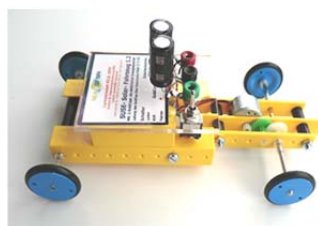
Field of application: high school, Levels: 1 (easy) 2(medium) 3(advanced)

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Experimental learning stations

ISCED = International Standard Classification of Education

Gruppe	Field of application Level	Time demand ca. min	Age group ca. years
A	ISCED-2 1,2	30 min	11 - 14
B	ISCED-2 2,3	45 min	12 - 15
C	ISCED-2 2,3	> 45 min	14 - 16
D	ISCED-3	≥60 min	16 - >18
E	Self-construction Solar modules, solar vehicles, solar boats	≥60 min	>13
F	<p>For students from 8- 11 years: 25 learning stations for Elementary School (ISCED-1) An extensive experimentation manual with bill of materials, setup instructions, experiments, basic information, and assignments belongs to every learning station. Info and offers can be obtained from nils@isfh.de or info@sundidactics.de</p>		



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General view of the learning stations A

Age group 11-14 years

Group	No.	Topic	Time ca.min	Levels Advice
A	1	Connection of solar motors and LEDs to a solar module with SUSE 4.3 RB, 4.16, 4.15	30-45	1,2
A	2	Measuring voltage, current, power of a solar cell with SUSE 4.33	30-45	1,2
A	3	SUSE 4.12 as solar energy storage with SUSE 4.3 RB, 4.12, 4.15, 4.16	30-45	1,2
A	4	Radio operation with solar module and solar storage with SUSE 4.3RB, 4.36, 4.12	30-45	1,2
A	5	Experiments with solar motors and generators with SUSE 4.3RB, 4.16	30-45	1,2
A	6	Series connection of solar cells with 2x SUSE 4.33	30-45	1,2
A	7	Series connection of solar cells with 6x SUSE CM6B	30-45	1,2
A	8	Parallel connection of solar cells with SUSE 4.33	30-45	1,2
A	9	Parallel connection of solar cells with 6x SUSE CM6B	30-45	1,2
A	10	Simple experiments with solar cell fragments	30-45	1,2
A	11	Charging a smartphone on a solar module with SUSE 4.51, 4.17	30-45	1,2
A	12	Experiments on solar radiation and light radiation with SUSE 4.24 and SUSE 5.23	30-45	1,2
A	13	Experiments with the solar vehicle 4 with solar vehicle 4 and solar filling station SUSE 4.34	30-45	1,2
A	14	Experiments with the solar vehicle 1.2 and solar filling station with SUSE 4.3 RB, 4.35, solar vehicle 1.2	30-45	1,2
A	15	Simple experiments with the solar vehicle 3B with solar vehicle 3B	30-45	1,2
A	16	Experiments with the solar thermal collector (stagnation collector) with the stagnation collector ES	30-45	1,2
A	17	Experiments with solar toys with solar boat, solar cricket, racer, solar helicopter...	30-45	1,2
A	18	Experiments with a 5W solar module with SUSE 4.51	30-45	1,2
A	19	Experiments with the solar construction kit 6-in-1 with 6in1	30-45	1,2
A	20	Experiments with the solar vehicle 5	30-45	1,2

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General view of the learning stations B

Age group 13-16 years

Group	No.	Topic	Time ca.min	Levels Advice
B	1	Experiments with the solar module SUSE 4.33 with SUSE 4.33	45	2,3
B	2	Experiments with the solar module SUSE 4.3 with SUSE 4.3	45	2,3
B	3	Experiments with the solar module SUSE 4.3RB with SUSE 4.3 RB	45	2,3
B	4	Experiments with the 5W solar module SUSE 4.43 with SUSE 4.43	45	2,3
B	5	Experiments with the solar crane with SUSEmod1 and SUSE solar crane	45	2,3
B	6	Determination of the light intensity = irradiance with SUSE 5.22	45	2,3
B	7	Experiments with the solar vehicle 1.2 with SUSE 4.36,4.43, solar vehicle 1.2	45	2,3
B	8	Experiments with the solar thermal collector with the thermosiphon solar collector	45	2,3
B	9	Quality determination of solar cells with SUSE 5.22, solar cell fragments	45	2,3
B	10	Dependence of V,I,P from solar cell area with SUSE 4.33	45	2,3
B	11	Solar module as charging station for a smartphone and powerbank with SUSE 4.43, 4.17, Powerbank rechargeable battery	45	2,3
B	12	Experiments with big solar modules 10W.....50W with SUSE 4.41 (10W), 4.42(20W), 4.45(50W)	45	2,3
B	13	LEDs as solar cells with SUSE 4.15	45	2,3
B	14	Angle dependence of V,I,P of a solar cell with SUSE 5.22alpha, 5.16	45	2,3
B	15	Efficiency factor determination of solar cells with SUSE 5.22, solar cell fragments, raw solar cells	45	2,3
B	16	Reduced output of solar modules: clouding/shadowing with SUSE 5.22	45	2,3
B	17	Experiments with the solar vehicle 3B with solar vehicle 3B	45	2,3
B	18	Experiments on solar radiation/light radiation with SUSE 5.23	45	2,3
B	19	Experiments with the LED module SUSE 4.20IRRB with SUSE 4.20IRRB, SUSE 4.3RB	45	2,3
B	20	Intensity measurements with solar cells on an overhead projector with SUSE CM6B	45	2,3
B	21	Experiments with a vacuum tube solar thermal collector and with a heat pipe solar collector	45	2,3
B	22	Experiments with the solar boat 4	45	2

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General view of the learning stations C Age group 14-17 years

Group	No.	Topic	Time ca.min	Levels Advice
C	1	Experiments with the solar module SUSE CM4MBV with SUSE CM4MBV, 4.16, 4.15, 4.36, 4.12	≥45 <small>digest possible</small>	2,3
C	2	Experiments with the solar module SUSE CM6MS with SUSE CM4MBV, 4.16, 4.15, 4.36	≥45 <small>digest possible</small>	2,3
C	3	Experiments with the solar module SUSE 4.3RB with 4x SUSE 4.3RB, 4.15, 4.16, 4.17, 4.19, solar vehicle 1.2	≥45 <small>digest possible</small>	2,3
C	4	Experiments with the solar thermal collector Taking temperature curves	≥45 <small>digest possible</small>	2,3
C	5	Experiments with the solar module 4.3 with SUSE 4.3, 4.16, 4.15, 4.36	≥45 <small>digest possible</small>	2,3
C	6	Experiments with 2 solar modules by comparison 10W- 40W with solar modules 10W, 40W, 4.17, Powerbank	≥45	2,3
C	7	Experiments with 2 solar modules by comparison 5W- 20W with solar modules 5W,20W, 4.17, Powerbank	≥45	2,3
C	8	Experiments with 2 solar modules by comparison 5W- 5W with 2 different solar modules 5W, 4.17, Powerbank	≥45	2,3
C	9	Experiments with 2 solar modules by comparison 5W- 53W with solar modules 5W, 53W, 4.17, Powerbank	≥45	2,3
C	10	Experiments with a solar module 125 W with solar module 125 W	≥45	2,3
C	11	Experiments with the solar measurement module SUSE 5.23 with SUSE 5.23	≥45	2,3
C	12	Experiments with the solar vehicle 3B with solar vehicle 3B + PC interface	≥45	2,3
C	13	Taking I-V and P-V characteristic curves with SUSE 5.15 + PC interface	≥45	2,3
C	14	Experiments with the solar module SUSE 4.41 10W	≥45	2,3
C	15	Experiments with the solar module SUSE CM312 with SUSE CM312, 4,36, 4.16	≥45 <small>digest possible</small>	2,3
C	16	Experiments with the solar module SUSE CM315 with SUSE CM315, 4,36, 4.16	≥45 <small>digest possible</small>	2,3
C	17	Experiments on the decrease of V,I,P from shadowing with SUSE 5.22, PC interface	≥45	2,3
C	18	Experiments with the 5W solar module SUSE 4.51 with 2x SUSE 4.51	≥45	2,3
C	19	Experiments with the 10W solar module SUSE 4.41 with 2x SUSE 4.41	≥45	2,3
C	20	Experiments with the 20W solar module SUSE 4.42 with 2x SUSE 4.42	≥45	2,3

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General view of the learning stations D Age group 16->18 years

College level **with topic focus** ISCED = International Standard Classification of Education

Group	No.	Topic	Time ca.min	Levels Advice
D	1	Experiments with the characteristic curves module SUSE 5.15 with SUSE 5.15, PC interface Taking characteristic curves and efficiency factor determination <i>Radiation, semiconductor physics, el. fields, energy conversion</i>	90	ISCED 3
D	2	Experiments with the solar vehicle 3B with capacitor charging and discharging <i>El. fields, energy conversion, radiation</i>	60	ISCED 3
D	3	Experiments with the solar vehicle 1 with capacitor charging and discharging <i>El. fields, energy conversion, radiation</i>	60	ISCED 3
D	4	Experiments with the solar vehicle 1.2 with capacitor charging and discharging <i>El. fields, energy conversion, radiation</i>	60	ISCED 3
D	5	Experiments with the LED module SUSE 5.9-6 with SUSE 5.9-6 <i>Semiconductor physics, el. fields, quantum physics, wave physics, radiation</i>	60	ISCED 3
D	6	Spectral analysis with the LED module SUSE 5.9-6 Quantum physical effects on LEDs <i>Semiconductor physics, el. fields, quantum physics, wave physics, radiation</i>	60	ISCED 3
D	7	Collector cooling and capacitor in comparison with solar collector and GoldCap capacitors <i>Thermodynamics, el. fields, energy conversion, radiation</i>	60	ISCED 3
D	8	Capacitor charging on a solar module with SUSE 4.3RB, 4.43, 4.12 <i>El. fields, radiation</i>	60	ISCED 3
D	9	Capacitor discharging on a solar module with SUSE 4.3RB, 4.43, 4.12, 4.16 <i>El. fields, energy conversion, radiation</i>	60	ISCED 3
D	10	Angle dependence of V,I,P of a solar cell with SUSE 5.22alpha, 5.16 <i>Semiconductor physics, radiation</i>	30	ISCED 3
D	11	Heating and cooling a solar thermal collector Measurement and calculation of stagnation temperature, efficiency factor determination <i>Thermodynamics</i>	60	ISCED 3
D	12	PV experiments with the solar module SUSE CM6MS <i>Semiconductor physics, radiation</i>	90	ISCED 3
D	13	Experiments with the SUSE solar vehicle 4 and solar filling station SUSE 4.34, energy conversion processes, capacitor charging and discharging <i>Energy conversion, Mechanics, el. fields</i>	90	ISCED 3

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General view of the learning stations E Age group > 13 years Self-construction of solar modules

Group	No.	Topic	Time ca.min	Levels Advice
E	1	Self-construction of the solar module SUSE CM312 Experiments with the solar module SUSE CM312 and accessory devices	>60	DIY + experiments
E	2	Self-construction of the solar module SUSE CM315 Experiments with the solar module SUSE CM315 and accessory devices	>60	DIY + experiments
E	3	Self-construction of the solar module SUSE CM4MBV Experiments with the solar module SUSE CM4MBV and accessory devices	>60	DIY + experiments
E	4	Self-construction of the solar module SUSE CM6MS Experiments with the solar module SUSE CM6MS and accessory devices	>60	DIY + experiments
E	5	Self-construction of a solar module from solar cell fragments Experiments with the solar module and accessory devices	>60	DIY + experiments
E	6	Self-construction of the solar boat 4 Experiments with the solar boat	>60	DIY + experiments
E	7	Self-construction of the solar vehicle 1	ca.60	DIY + experiments
E	8	Self-construction of the solar vehicle 1.2	>60	DIY + experiments
E	9	Self-construction of the solar vehicle 3B	>60	DIY + experiments
E	10	Self-construction of the solar vehicle 4	>60	DIY + experiments
E	11	Self-construction of the solar vehicle 5	ca. 60	DIY + experiments
E	12	Self-construction of the solar module 4.34 (Solar filling station for SV1,SV4)	ca. 45	DIY + experiments
E	13	Self-construction of the solar vehicle Solar-Racer	ca.30	DIY + experiments
E	14	Self-construction of the solar module 4.35 (Solar filling station for SV1.2)	ca. 45	DIY + experiments

F For Elementary Schools (ISCED 1, 8-11 years) there is Hamelin's suncatcher box with 25 experimental learning stations and an extensive teacher's manual and students' booklet.

General view of the suncatcher box on www.nils-isfh.de or www.sundidactics.de

Info via nils@isfh.de or info@sundidactics.de