EXPERIMENT MANUAL

PHYSICS

SOLAR WORKSHOP

THAMES & KOSMOS

Franckh-Kosmos Verlags-GmbH & Co. KG, Pfizerstr. 5-7, 70184 Stuttgart, Germany | +49 (0) 711 2191-0 | www.kosmos.de
Thames & Kosmos, 301 Friendship St., Providence, RI, 02903, USA | 1-800-587-2872 | www.thamesandkosmos.com
Thames & Kosmos UK Ltd, Goudhurst, Kent, TN17 2QZ, United Kingdom | 01580 212000 | www.thamesandkosmos.co.uk

GOOD TO KNOW!

If you are missing any parts, contact Thames & Kosmos customer service.

What's inside your experiment kit:

Checklist: Find — Inspect – Checkoff

✔	No.	Description	Quantity	Item No.
❍	1	Diagonal connector	4	716 174
❍	2	7-hole wide rounded rod	4	716 161
❍	3	7-hole flat rounded rod	4	716 162
❍	4	3-hole wide rounded rod	4	716 160
❍	5	Tube 6 mm, length 20 cm	1	716 178
❍	6	Hinge	10	714 191
❍	7	Middle part	1	716 166
❍	8	Connector square	1	716 175
❍	9	Triangle	1	716 176
❍	10	Cross rod with pegs	1	716 164
❍	11	Horn	4	716 177
❍	12	Two-to-one converter	7	714 190
❍	13	Stand support	2	714 198
❍	14	Motor	1	716 033
❍	15	Dual battery holder	1	716 619
❍	16	Solar panel	1	716 180
❍	17	13-hole flat curved rod	2	716 163
❍	18	5-hole dual rod B	2	716 158
❍	19	5-hole rod	1	716 157
❍	20	5-hole dual rod C	4	716 159
❍	21	3-hole cross rod	7	716 155
❍	22	3-hole rod	3	716 154
❍	23	3-hole dual rod	3	716 156
❍	24	90-degree converter - X	4	716 167
❍	25	90-degree converter - Y	4	716 168

✔	No.	Description	Quantity	Item No.
❍	26	Curved rod	2	716 169
❍	27	Square frame	4	716 165
❍	28	Large body plate	2	716 172
❍	29	Body plate 3	1	716 170
❍	30	Body plate 4	1	716 171
❍	31	Small body plate	1	716 173
❍	32	Anchor pin lever	1	702 590
❍	33	Axle	2	713 490
❍	34	Joint pin	8	702 524
❍	35	Axle lock	2	702 813
❍	36	Motor shaft	2	715 677
❍	37	Medium gear, blue	6	716 179
❍	38	Small gear, red	3	710 062
❍	39	Short anchor pin	14	714 129
❍	40	Shaft pin	4	702 526
❍	41	Shaft plug	4	702 525
❍	42	Anchor pin	8	702 527

Materials not contained in the kit are listed *in italics* under the "You will need" section in each experiment.

You will also need:

For all experiments: 2 rechargeable AA batteries (1.2-volt, type HR6/KR6)

You will need the following things in order to be able to conduct the experiments: different light sources (such as a portable light, LED light, desktop lamp, flashlight, etc.), transparencies (transparent sheets), cardboard box (for example, an empty tea box), scale, weights such as coins, and other common household items

ENERGY FROM THE SUN

"Solar energy" and "solar power" refer to the energy of the solar radiation that we are able to exploit technically.

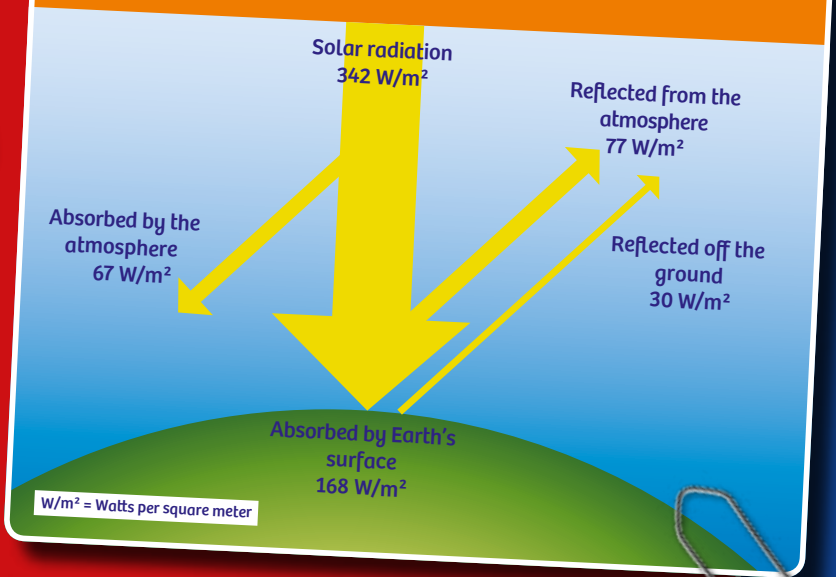
The sun is a star that is 150 million kilometers from our Earth, on average. But despite this immense distance, solar energy has an enormous impact on our life. More precisely, life is not possible without the sun! You can feel how strong solar energy is on any sunny day. Just lay out for a bit in the sun in the middle of summer. But be careful — you need to protect yourself adequately against sunburn. The sun emits so much energy because it is a gigantic nuclear reactor. It is so hot on the inside that the atoms, the building blocks of all matter, fuse together. Even on the sun's surface, it is still around 5500 degrees Celsius. The nuclear fusion produces nearly inexhaustible amounts of energy. This is radiated out into space. And some of it strikes the Earth's surface as electromagnetic radiation, as light.

UNIMAGINABLE ENERGY RESERVES

The solar energy striking Earth's atmosphere each year is an unimaginable 1,500,000,000,000,000 kilowatt hours. This corresponds to about 10,000 times the energy consumption of all of humanity (as of 2010).

By comparison: A 3-person household in a single-family home consumes 4000 kilowatt hours of power each year on average, which is but a tiny fraction of the incident solar energy.

However, a large portion of the solar energy is lost in the atmosphere, since it is "swallowed up" there or reflected back. The rest of it is enough, though, to give us sunlight that we can make use of technically.



INDIRECT USE

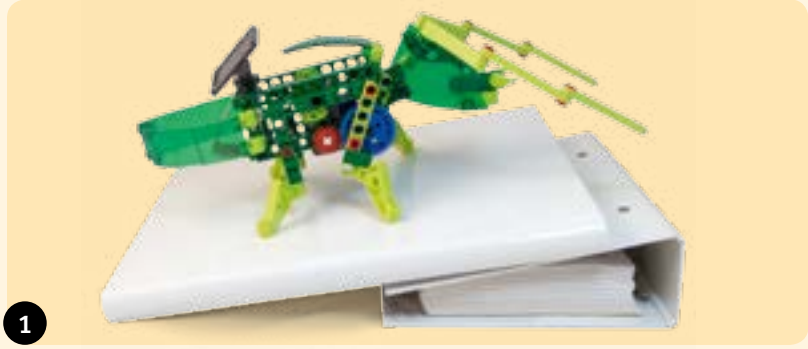
By the way, solar radiation is also responsible for the differences in air pressure in the atmosphere that cause wind. Earth's water cycle is also "driven" by solar energy. That's why it's also possible to use solar energy indirectly to produce energy:

- The plants and plant wastes that we process into useful liquids such as cooking oil and biogas — with which automobiles can be powered — depend on sunlight to grow. Even the petroleum and natural gas that we use to make fuels, lubricants and plastics, could not have formed without the energy radiating from the sun. They are vast underground storehouses of solar energy.
- Wind and water power stations generate electric current.
- So-called passive solar energy heats houses, thus reducing the energy required for heating.

Mastering inclines

YOU WILL NEED

› **The assembled bug in the solar configuration**
› *Board (shelf)*
› *Books*
› *Towel*


1

HERE'S HOW

1. Now things are going to get challenging, at least for your solar bug. Place a board measuring about 80 or 100 centimeters in length — such as a shelf or binder — as an inclined surface in front of your solar bug. You can use a book as the support for the higher end.

2. Try to get your solar bug to climb up the incline. What is the steepest slope it can climb? Change the angle of inclination by changing the thickness or number of books.


3

WHAT'S HAPPENING?

The legs of your solar bug are driven by an "eccentric." In this case, the eccentric is the red plug that fastens the green rod to the blue gear. Since the plug is not in the center of the gear, it is able to convert the rotational movement of the gear into a longitudinal movement. As a result, the bug doesn't roll but walks like an insect instead.

DID YOU KNOW?

The Mars rover Opportunity (see page 16) was also designed to climb. This enabled it to explore the hill called "Solander Point" at the edge of a crater on Mars. Solander Point rises some 40 meters above the surrounding plain.

KEYWORD: INSECT

Researchers have discovered a dye in the belly of the oriental hornet with which the animal generates electric current from sunlight. In emulating the hornets' solar cells, they were able to generate a current of about a half-volt. It's still unclear what the hornets need the current for. The conversion of solar energy might influence the animals' metabolism.