EXPERIMENT MANUAL

Solar Race Car



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What's inside your experiment kit:



J	No.	Description	Quantity	Part No.
0	P1	Gear (red)	1	726702-A
0	P2	Gear with shaft	1	726702-B
0	P3	Foam pads	2	726702-C
0	P4	Round shaft (short)	1	726702-D
0	P5	Round shaft (long)	1	726702-E
0	P6	Solar panel with motor	1	726702-F
0	P7	Sticker sheet	1	726703
0	A1	Upper chassis	1	726700-A

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	Really Exist? Inside back co	ver



YOU WILL ALSO NEED:

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Diagonal cutters (or scissors and nail file), sunlight

J	No.	Description	Quantity	Part No.
0	A2	Front wheel rim	2	726700-B
Ο	A3	Rear wheel rim	2	726700-C
Ο	A4	Cover	1	726700-D
Ο	A5	Solar panel mount	1	726700-E
Ο	A6	Chassis floor	1	726700-F
Ο	A7	Solar panel joint	1	726700-G
0	A8	Helmet	1	726700-H
0	B1	Rear wheel tire	2	726701-A
0	B2	Front wheel tire	2	726701-B

SAFETY INFORMATION

WARNING

WARNING. Not suitable for

children under 3 years. Choking hazard small parts may be swallowed or inhaled. **WARNING:** This toy is only intended for use by children over the age of 8 years, due to accessible electronic components. Instructions for parents or caregivers are included and shall be followed. Keep packaging and instructions as they contain important information.

Notes on disposal of electrical and electronic components:

The electronic components of this product are recyclable/reusable. For the sake of the environment, do not throw them into the household trash at the end of their lifespan. They must be delivered to a collection location for electronic waste, as indicated by the following symbol:

Please contact your local authorities for the appropriate disposal location.



INFORMATION ON THE HANDLING OF ELECTRONIC BUILDING COMPONENTS

- > Don't allow any liquids to make contact with the electronic / metal components.
- Do not use any energy source other than the solar cell provided.
- After experimenting, don't leave the solar race car in the sun or under strong light. The model should not be allowed to move unattended.

> When playing outdoors, make sure that no sand or dirt gets into the gears.

THE RIGHT TOOL

Using the right tool can make assembling your models easier and it can also make your models work better in the end. It is best to cut the plastic parts out of their frames with small diagonal cutters (such as those used for electronics work) or model pliers. Using these tools, the parts can be precisely cut so that no burrs remain on the parts and there is no need to file them down.

If you don't have these diagonal cutters at home, you can use scissors and a nail file. Normal scissors do not cut as precisely as diagonal cutters, so you may have to file some of the rough edges down with the nail file.

IMPORTANT INFORMATION

Dear Parents!

- Children want to explore, understand, and create new things. They want to try things and do it by themselves. They want to gain knowledge! They can do all of this with Thames & Kosmos experiment kits. With every single experiment, they grow smarter and more knowledgeable.

- Before building and experimenting, read the instructions together with your child and discuss any safety instructions.
- Support your child with advice and a helping hand, especially during tricky assembly steps or experiments.



— When cutting the plastic parts out of the frames with the diagonal cutters or scissors, special care must be taken, not just because of the sharp edges on the tools, but also because the plastic parts can yield sharp edges or burrs. These can be removed with the help of the diagonal cutters or a nail file. Supervise your child when they are using the sharp tools until you trust they can handle the tools independently.







'Yay!

Let's start building!

- Your small solar race car has a lot of power, despite not using batteries. All you need is plenty of sunshine, as its solar cells supply the built-in electric motor with energy from the sun. On the following pages, you'll learn how to assemble the solar race car, and then we'll explain how a solar cell works on page 12. Let's go!

Assembling the Solar Race Cas

HIDDEN VALLEY DARWIN

ASSEMBLING THE SOLAR RACE CAR











Solar Race Car











CHECK IT OUT

HOW DOES A Solar Cell WORK?

A solar cell is typically made of **silicon semiconductors**, which have special properties that allow them to generate **electricity** from light. A semiconductor is a material that is in between materials that conduct electricity, like metals, and materials that do not conduct electricity, like wood.

To make a semiconductor out of silicon, other elements are added to it. Silicon semiconductors include two types of layers: N-type layers, which have phosphorous atoms added to the silicon, and P-type layers, which have boron atoms added. Phosphorous has one more electron in its outer shell than silicon, so the N-type layer has extra negative charges that are free to roam around. Boron has one fewer electron than is required to bond with the surrounding silicon atoms, so the P-type layer has positively-charged electron vacancies or "holes."

When the layers are put next to each other, the free electrons in the N-type layer fill the holes of the P-type layer, and these free electrons become bound. This separation of charges results in an electric potential, or electric field, between the two layers: the side with the boron atoms, which originally had the holes, now is negatively charged, and the side with the phosphorous atoms is now positively charged.

When sunlight strikes a solar cell, the electrons that are bound in the P-type layer absorb energy from the light and become free again. The electric field between the two layers forces the electrons to flow, thus creating an electric current. The flow of electricity will continue as long as the sunlight hits the solar cell.

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Silicon-Phosphorus-Boron Lattice



Solar cell with N-type and P-type layers in cross section



While cars with solar cells already exist, they are rarely seen on the road. Nevertheless, research has been going on for years and continues, and there are several competitions to determine the best solar cars in the world. The Solar World Cup in Australia, for example, is an event in which solar cars are driven over 3,000 kilometers (1,800 miles).

In contrast to other energyefficient vehicles, solar cars have a big **advantage.** In optimal conditions, they can run on the power of the sun alone, and additional batteries are not needed. However, as a precaution, some solar cars have built-in batteries that can be recharged when the car is parked.

However, cars with solar cells also have some **disadvantages.** In order to drive well, they need optimal weather conditions and a lot of direct sunshine, but these conditions are not available everywhere in the world, or all the time. In addition, the cars themselves have to be light in weight, otherwise the energy of the solar cells will not be sufficient to move them. Lastly, the cars must be very large in order to make enough space for the solar cells, making the vehicles unsuitable for driving on tight city streets.

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