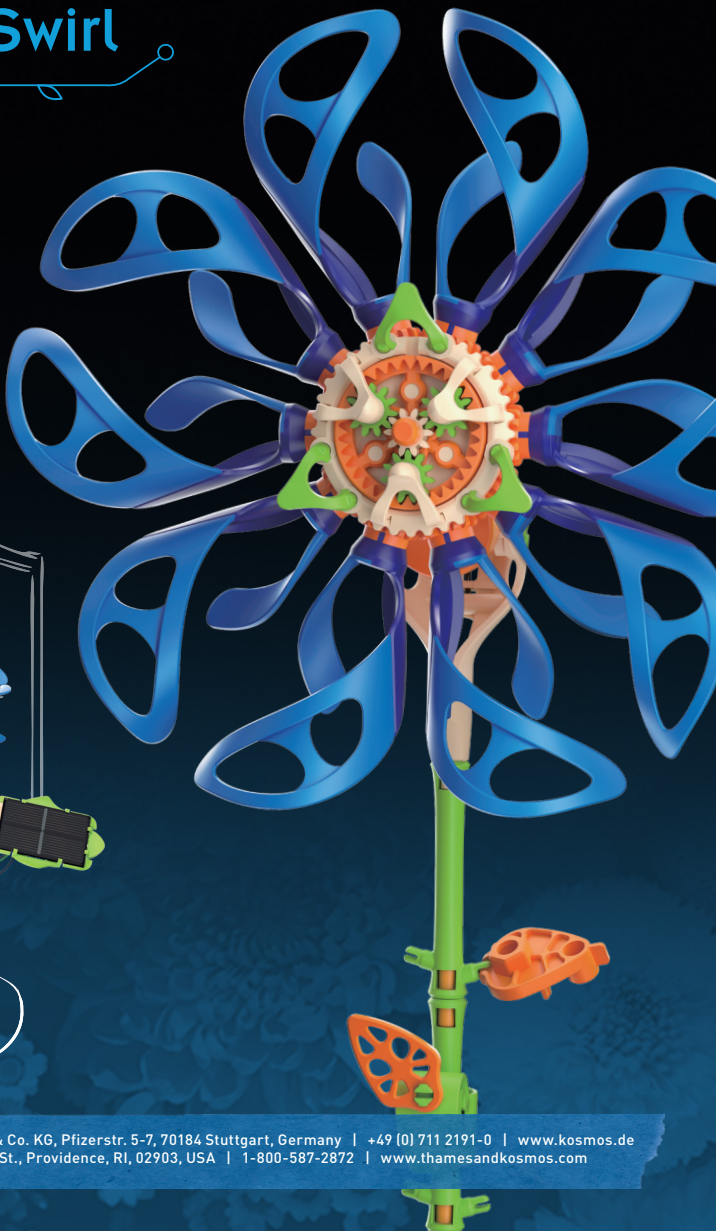
EXPERIMENT MANUAL

SolarFlower

Sapphire Swirl





THAMES & KOSMOS

Franckh-Kosmos Verlags-GmbH & Co. KG, Pfizerstr. 5-7, 70184 Stuttgart, Germany | +49 (0) 711 2191-0 | www.kosmos.de
Thames & Kosmos, 89 Ship St., Providence, RI, 02903, USA | 1-800-587-2872 | www.thamesandkosmos.com

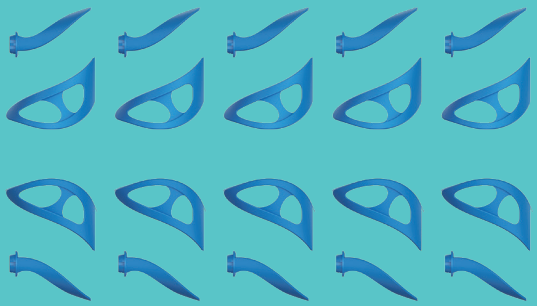
KIT CONTENTS

Good to know!

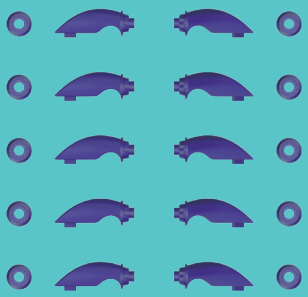
If you are missing any parts, please contact Thames & Kosmos technical support.

What's inside your experiment kit:

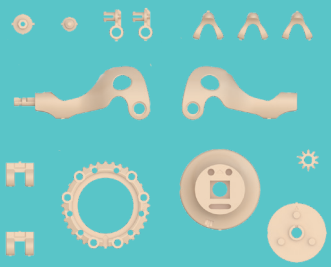
B



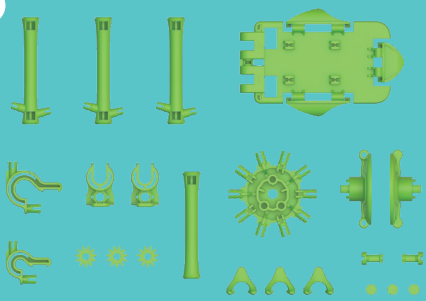
C



D



E



P6

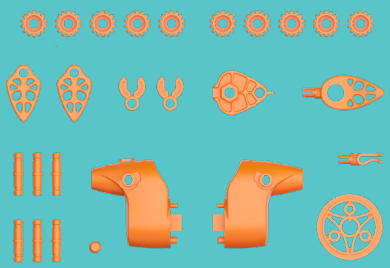


P1

P2



F



P5

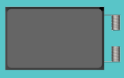


P4

P3



P7



P8



Note: There is no frame A in this kit.

Wow!

So many parts!

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Table of Contents 1
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TIP

YOU WILL FIND ADDITIONAL INFO IN THE "CHECK IT OUT" SECTIONS ON PAGES 20 TO 23.



Checklist:

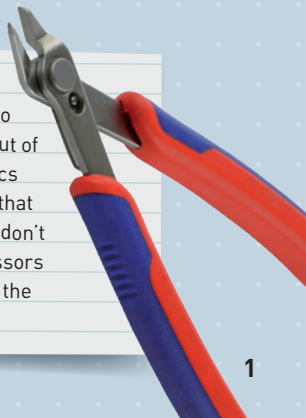
✓	No.	Description	Quantity	Part No.
	P1	Gear 36/10T (translucent)	1	730894
	P2	Gear 44/10T (green)	2	730894
	P3	Gear with metal rod	1	730894
	P4	Round metal rod	1	730894
	P5	Suction cup	1	730752
	P6	Foam sticker sheet	1	730894
	P7	Solar cell with springs	1	730747
	P8	Motor with plug connections	1	730747
	B	Frame B with parts B1 – B4	1	730763
	C	Frame C with parts C1 - C3	1	730764
	D	Frame D with parts D1 - D11	1	730744
	E	Frame E with parts E1 - E13	1	730765
	F	Frame F with parts F1 - F12	1	730746

YOU WILL ALSO NEED:

Diagonal cutter or scissors and nail file, marker, sunlight, incandescent or halogen lamp (minimum 50 watts)

THE RIGHT TOOL

The right tool can make assembling your model much easier and it can also make your model work better in the end. It is best to cut the plastic parts out of their frames with a small diagonal cutter (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 pliers at home, you can use scissors and a nail file. Normal scissors do not cut as precisely as a diagonal cutter, so you may have to file some of the rough edges down with the nail file.



SAFETY INFORMATION

WARNING!!

WARNING! Not suitable for children under 3 years. Choking hazard — small parts may be swallowed or inhaled. Store the experiment material and assembled models out of the reach of small children.

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.

WARNING! This kit contains functional sharp edges or points. Do not injure yourself!

May only be operated when fully assembled. Proper assembly must be checked by an adult before use.

SAFETY FOR EXPERIMENTS WITH ELECTRONIC COMPONENTS

To protect the electrical and mechanical components, operate the SolarFlower indoors only.

Avoid contact with metallic objects and liquids of any kind!

Do not use any power source other than the included solar cell.

Do not short-circuit or bridge the solar cell terminals with a wire.

The solar cell and electric motor must be connected using the cables with the correct polarity (+ and -) (see pages 15 and 18).

If the SolarFlower is not used for an extended period of time, always disconnect the electric motor cables from the solar cell.

The wires must not be plugged into a power outlet.

Disconnect the electrical device/electrical components and dispose of them in accordance with environmental regulations.

NOTES ON DISPOSAL OF ELECTRIC AND ELECTRONIC COMPONENTS

The electronic components of this product are recyclable. 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.

IMPORTANT INFORMATION

Dear parents and supervising adults!

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 beginning the experiments, read through the instructions along with your child, discuss the safety notes, and keep them on hand for reference. Support your child with advice and a helping hand, especially during tricky assembly steps.

— If your child is working at a table, provide them with a protective surface to prevent damage to furniture.

— When cutting the plastic parts out of the frames with the diagonal cutter 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 cutter or a nail file. Supervise your child when they are using the sharp tools until you trust that they can handle the tools independently.

— To avoid broken glass, provide your child with a suitable, stable vase and ensure that the SolarFlower and its electronic parts do not get wet.

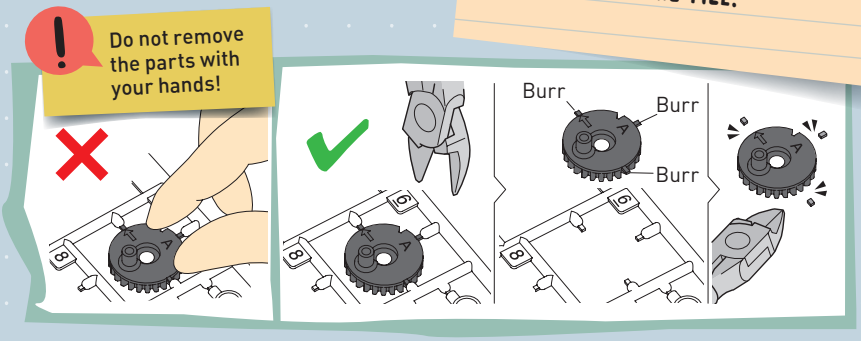
We hope you and your child have a lot of fun building and playing with the SolarFlower!

Have fun!

TIP

IMPORTANT:

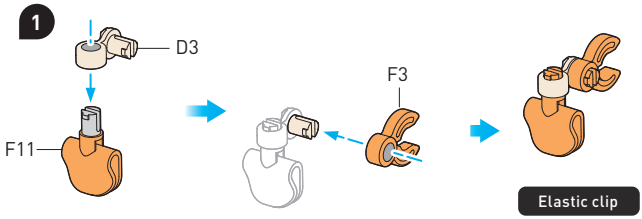
REMOVE THE PARTS FROM THE FRAMES ONLY WHEN THEY ARE NEEDED. REMOVE EXCESS MATERIAL BEFORE ASSEMBLY WITH THE HELP OF A DIAGONAL CUTTER OR SCISSORS AND A NAIL FILE.



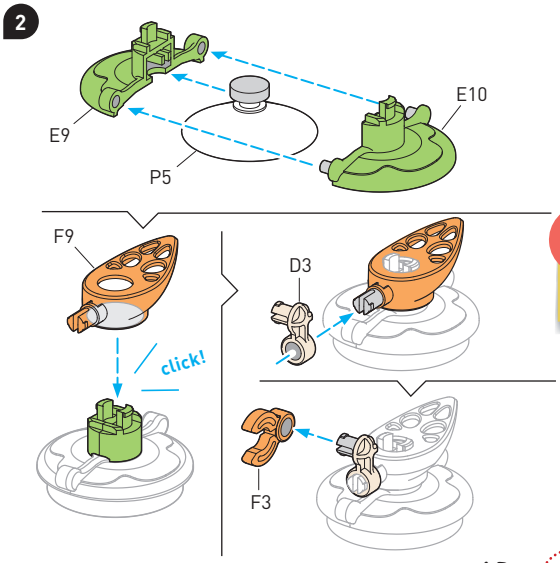
ASSEMBLING THE SOLAR MODULE

Let's GO!

1

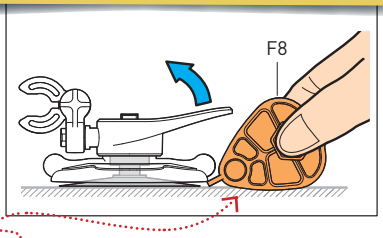


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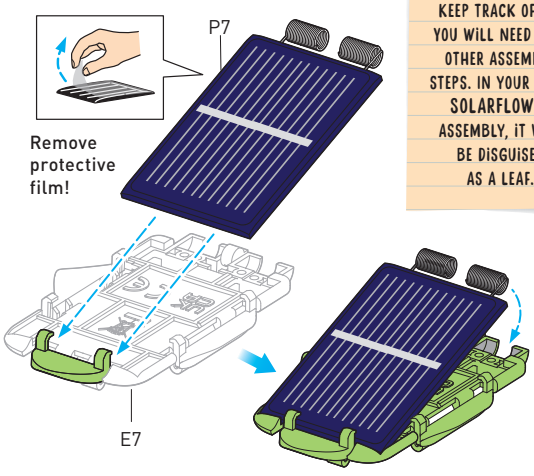




! If the suction cup has stuck to the table, you can gently lift it from below using F8 to release it.



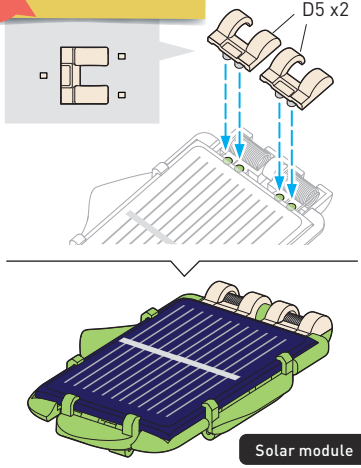
3



TIP

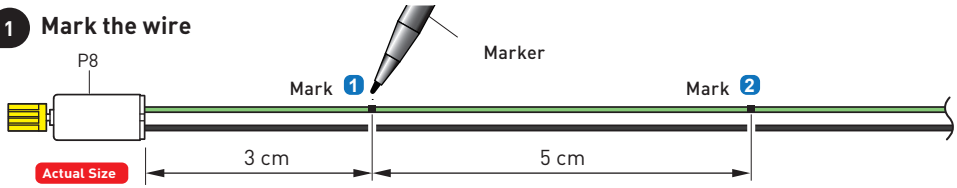
KEEP TRACK OF F8; YOU WILL NEED IT IN OTHER ASSEMBLY STEPS. IN YOUR FINAL SOLARFLOWER ASSEMBLY, IT WILL BE DISGUISED AS A LEAF.

! Remove all burrs.



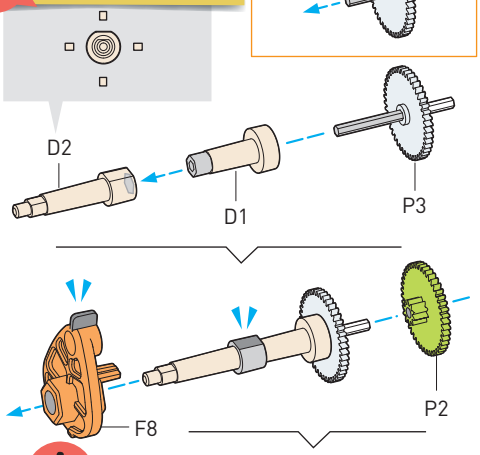
ASSEMBLING THE GEAR BOX

1 Mark the wire

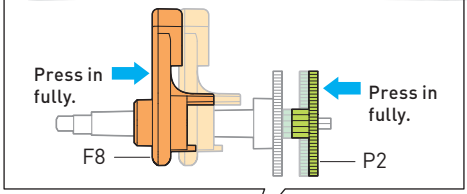


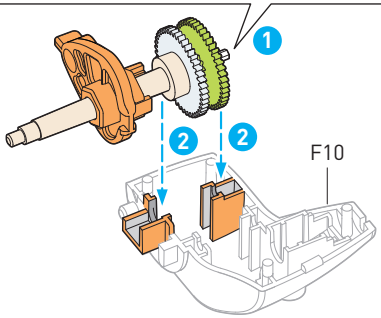
2

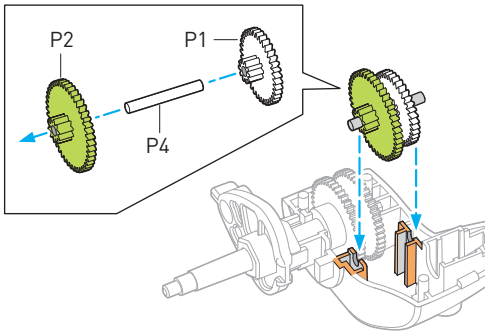
Remove all burrs.

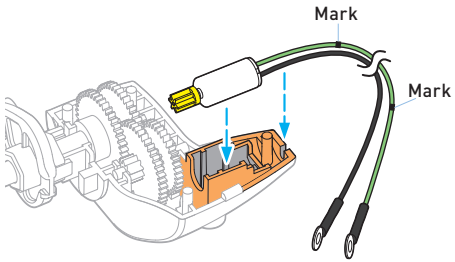


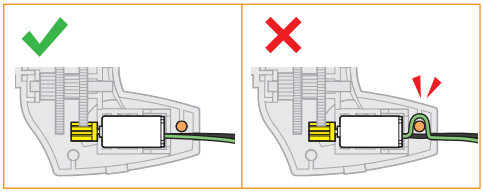
Press F8 and P2 in fully.

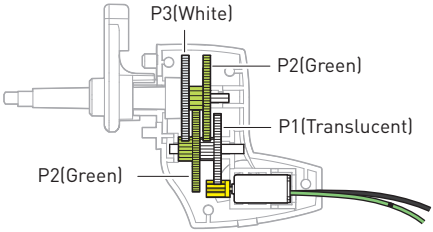


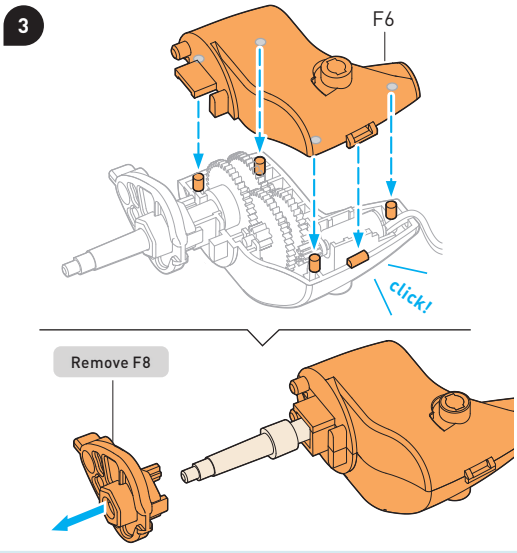


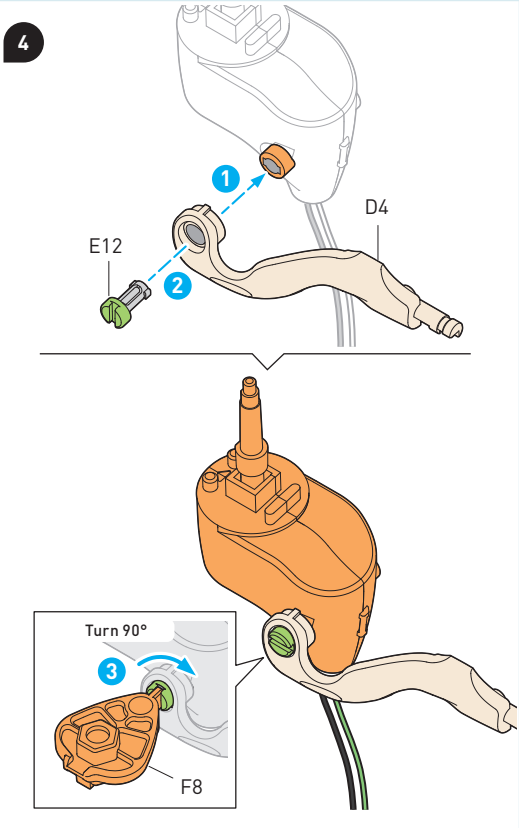


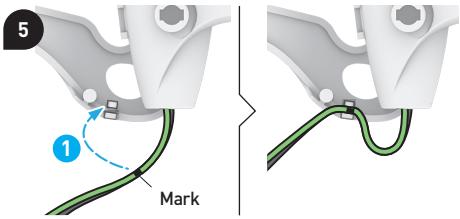


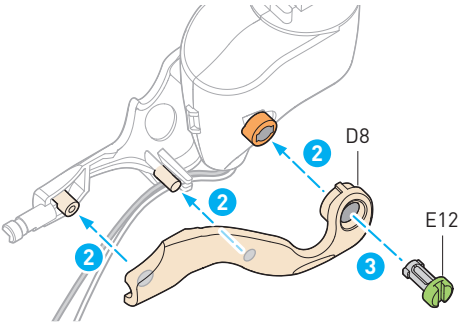


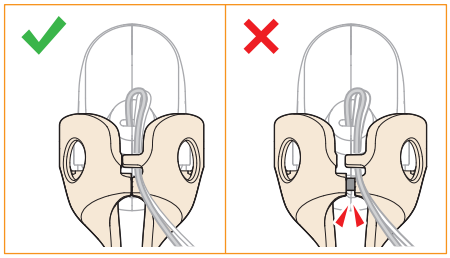


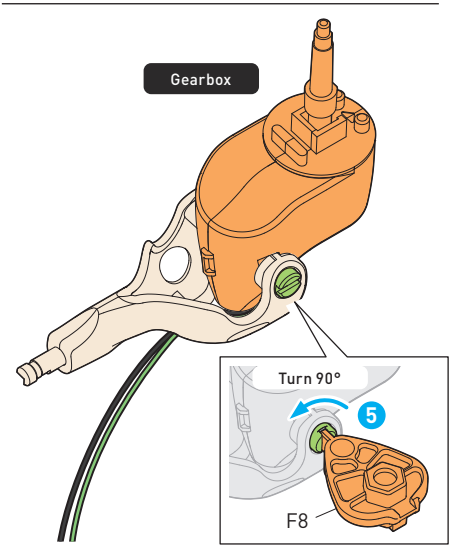

3
F6
click!
Remove F8


4
E12
D4
Turn 90°
3
F8


5
1
Mark

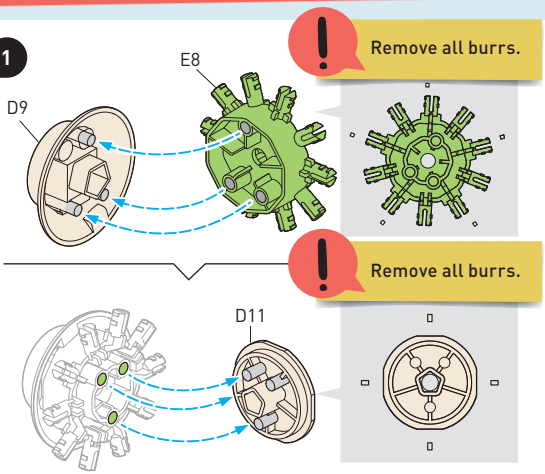

D8
E12
2
2
2
3

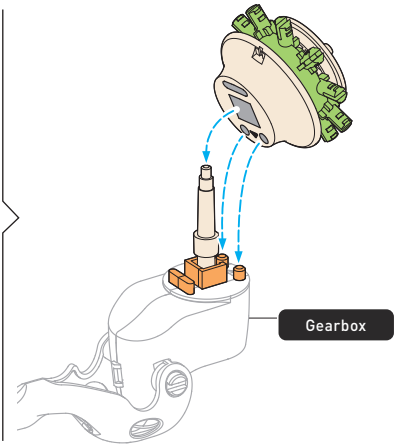



Gearbox
Turn 90°
5
F8

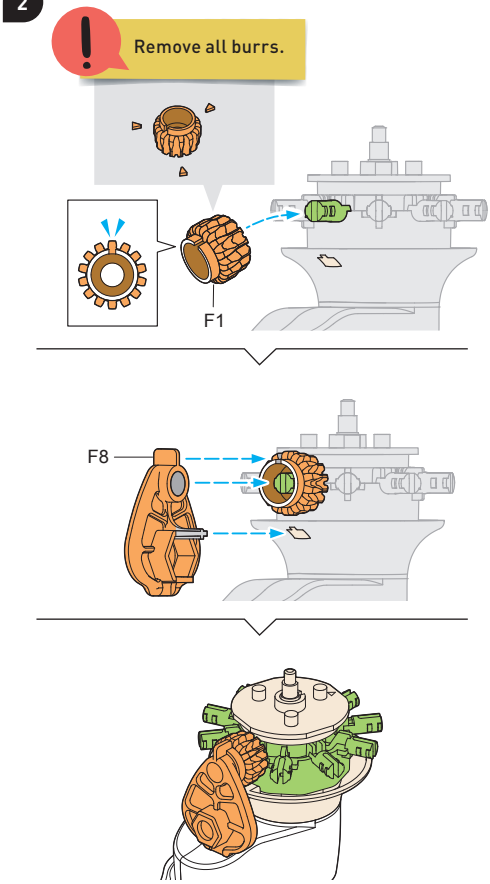
ASSEMBLING THE PISTIL MODULE

1

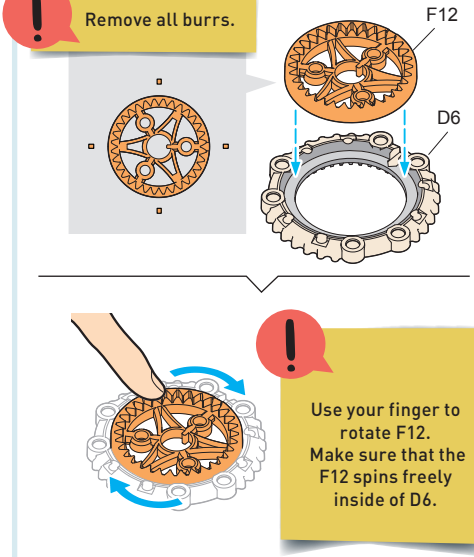




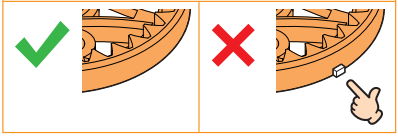
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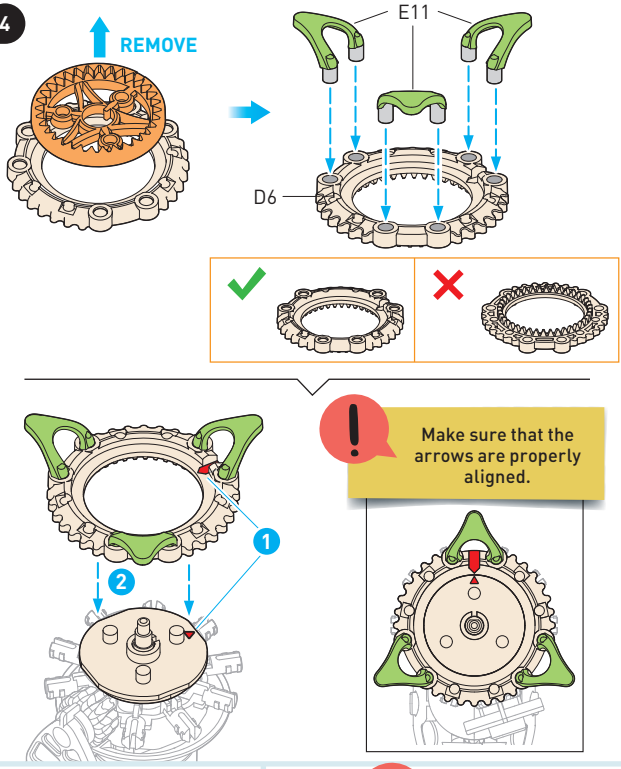
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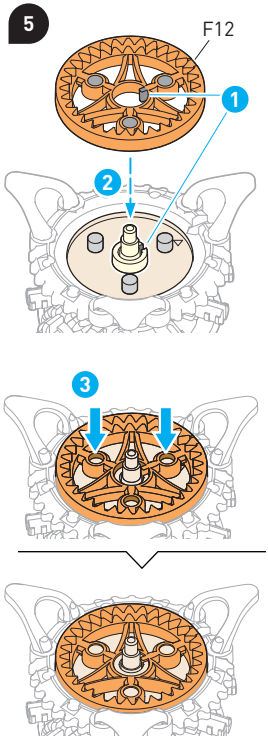
If it does not spin well, check F12 and trim any burrs or rough edges.



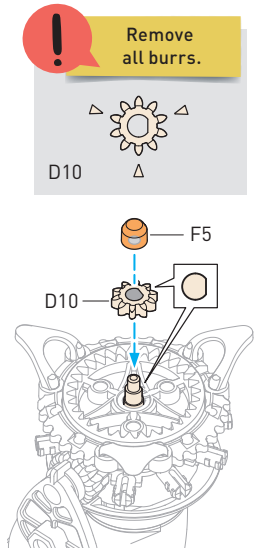
4


REMOVE
E11
D6
1
2
Make sure that the arrows are properly aligned.

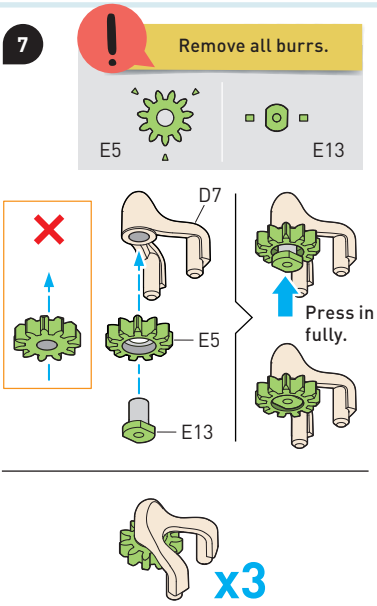
5


F12
1
2
3

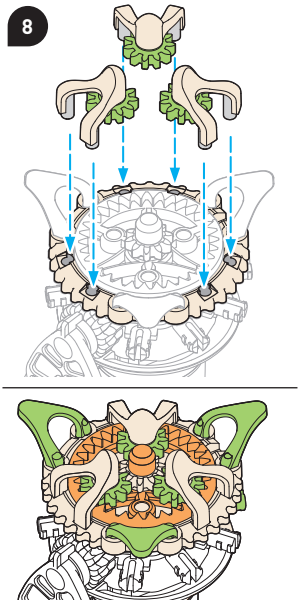
6


Remove all burrs.
D10
F5
D10

7

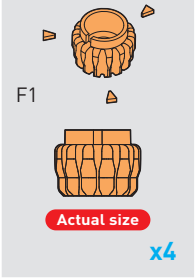

Remove all burrs.
E5
E13
D7
E5
E13
Press in fully.
x3

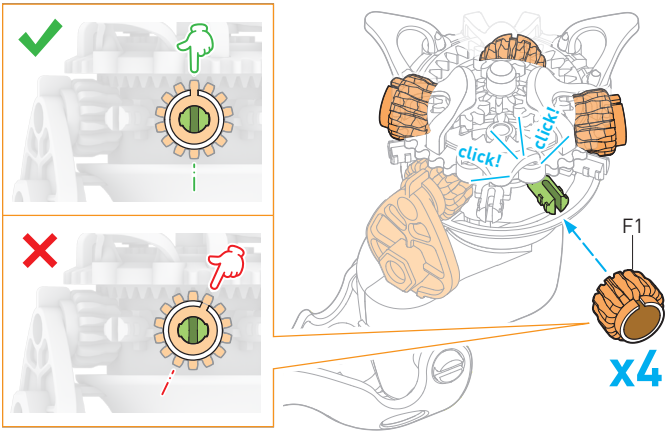
8



9

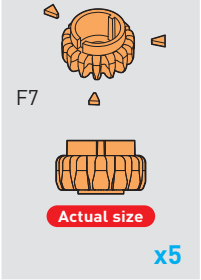
Remove all burrs.

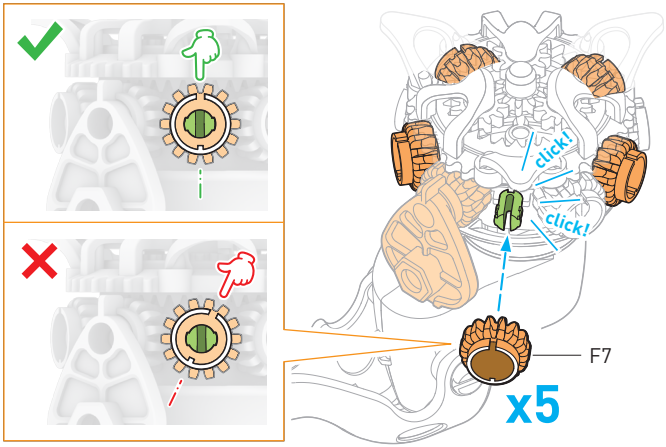


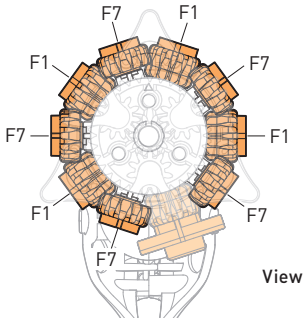


10

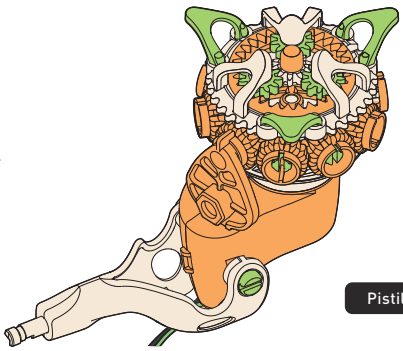
Remove all burrs.







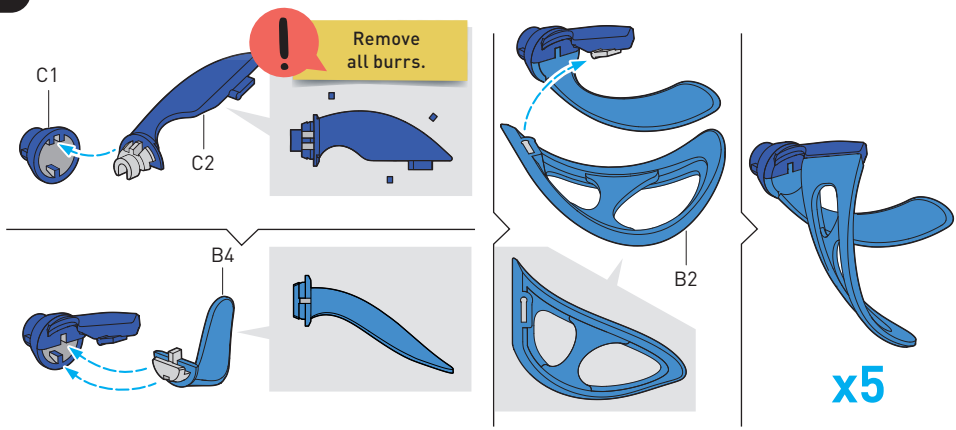
View from above



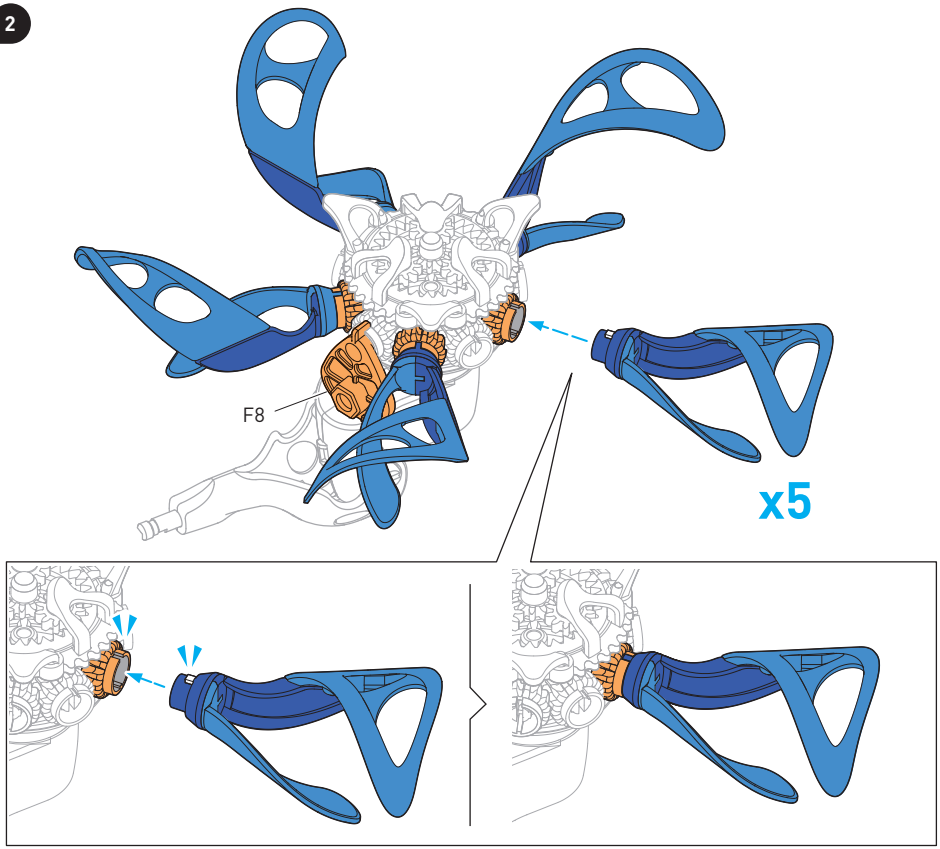
Pistil module

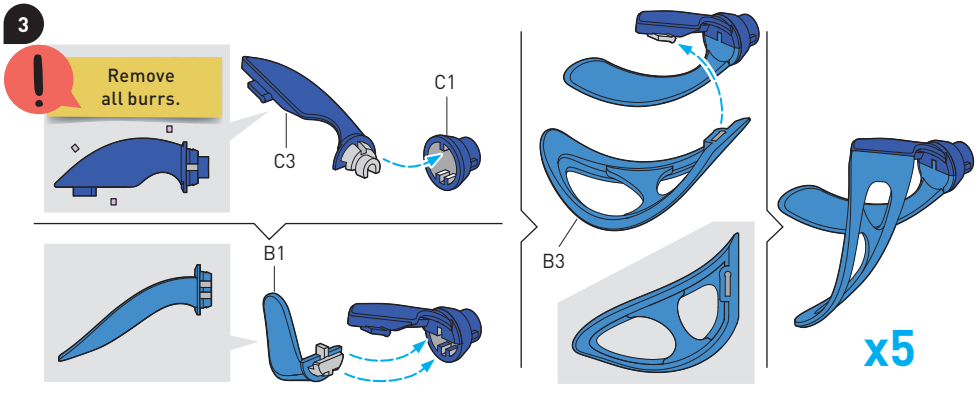
ASSEMBLING THE FLOWER MODULE

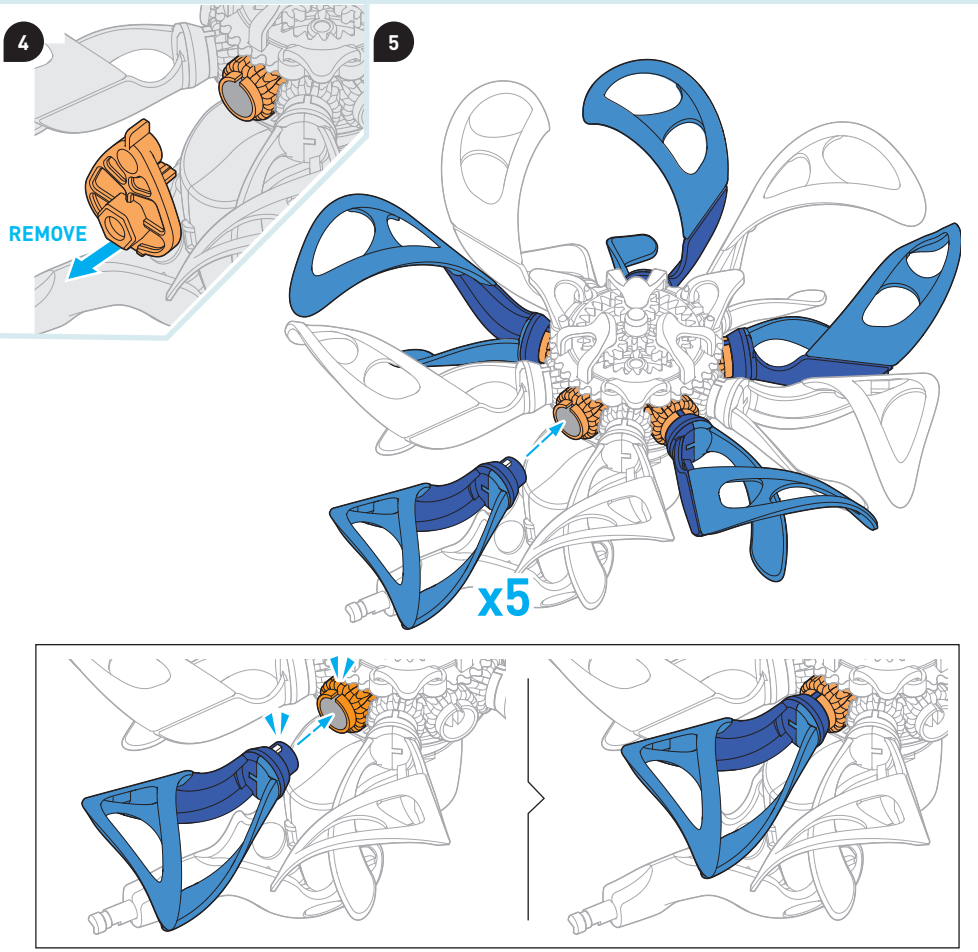
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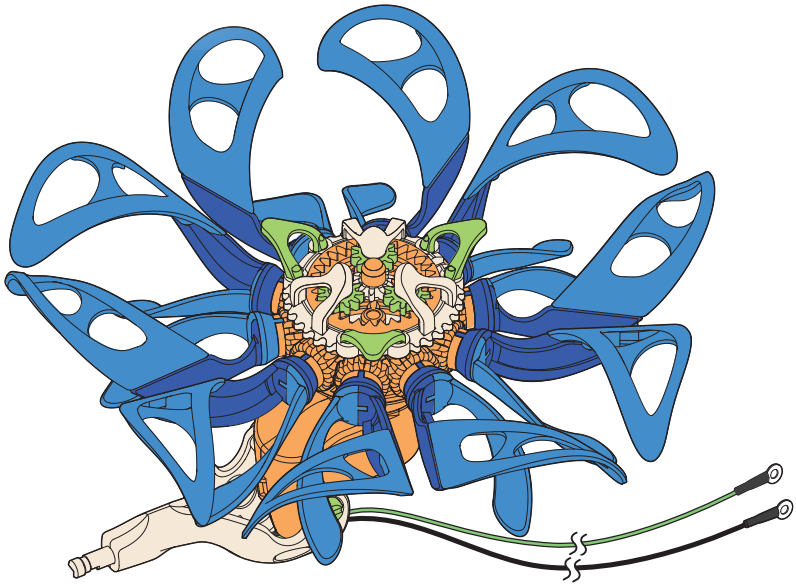
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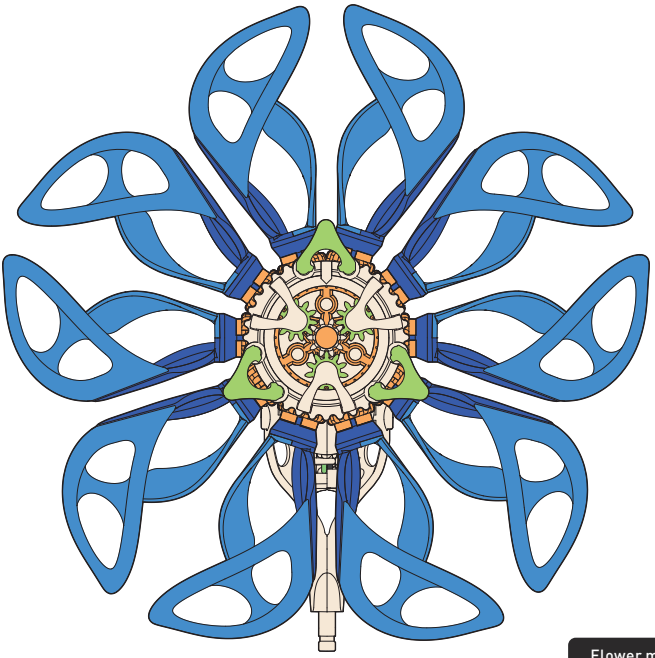



3
Remove
all burrs.
C1
C3
B1
B3
x5


4
REMOVE
5
x5

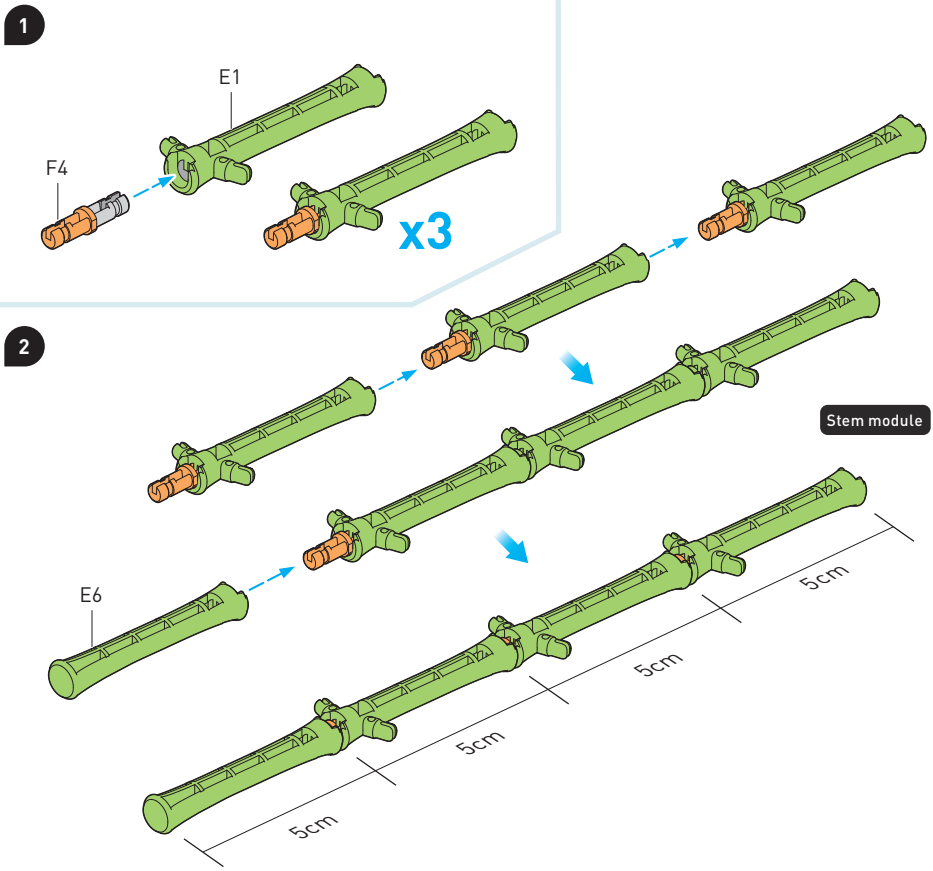
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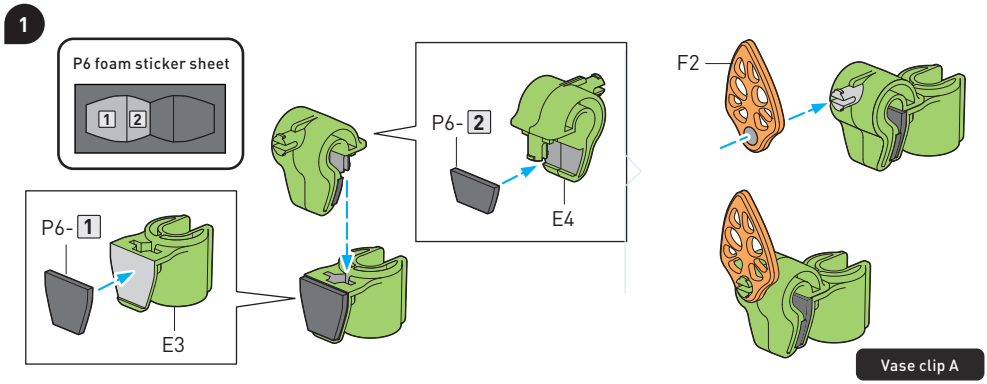


Flower module

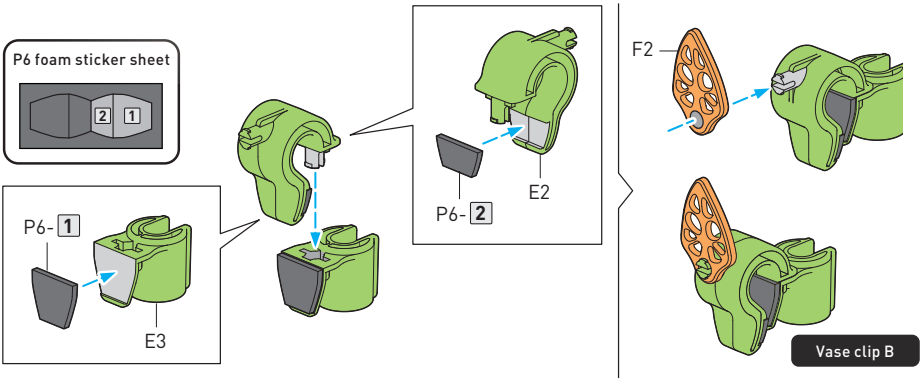
ASSEMBLING THE STEM MODULE



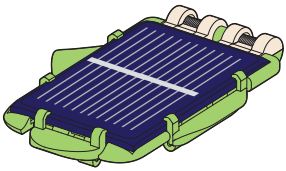
ASSEMBLING THE VASE CLIPS



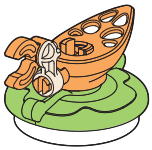
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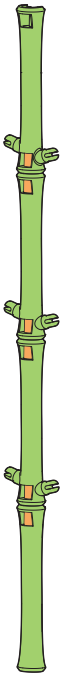


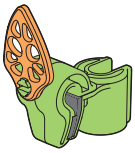
INITIAL SETUP

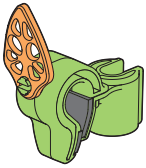

Solar module

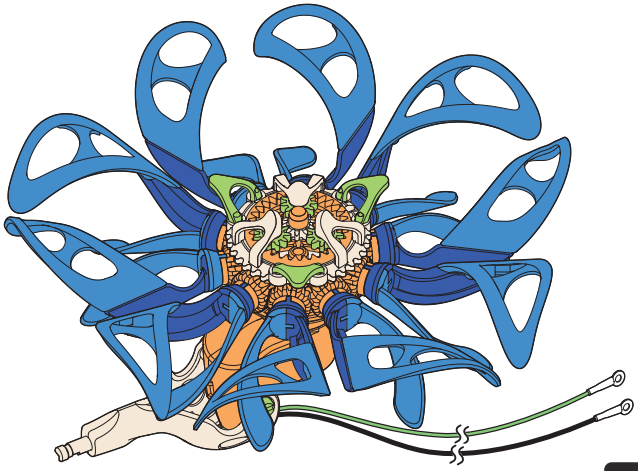

Elastic clip


Suction cup


Stem module

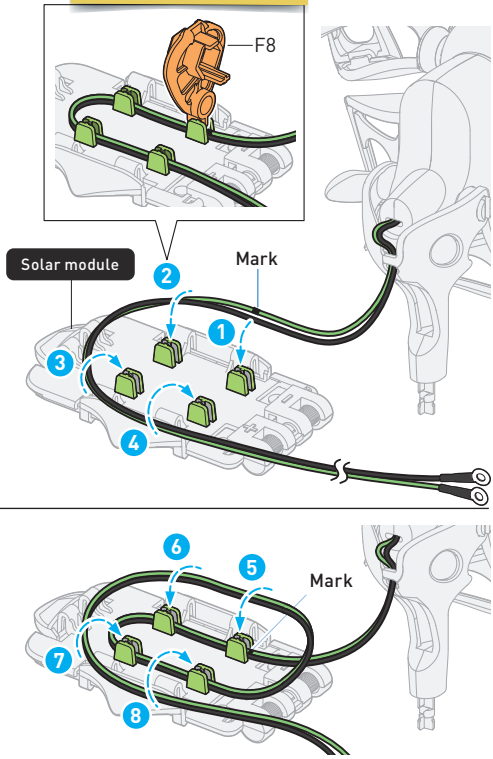

Vase clip A


Vase clip B

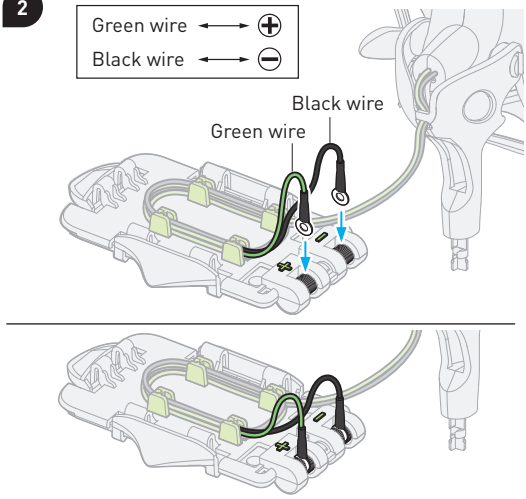

Flower module

1

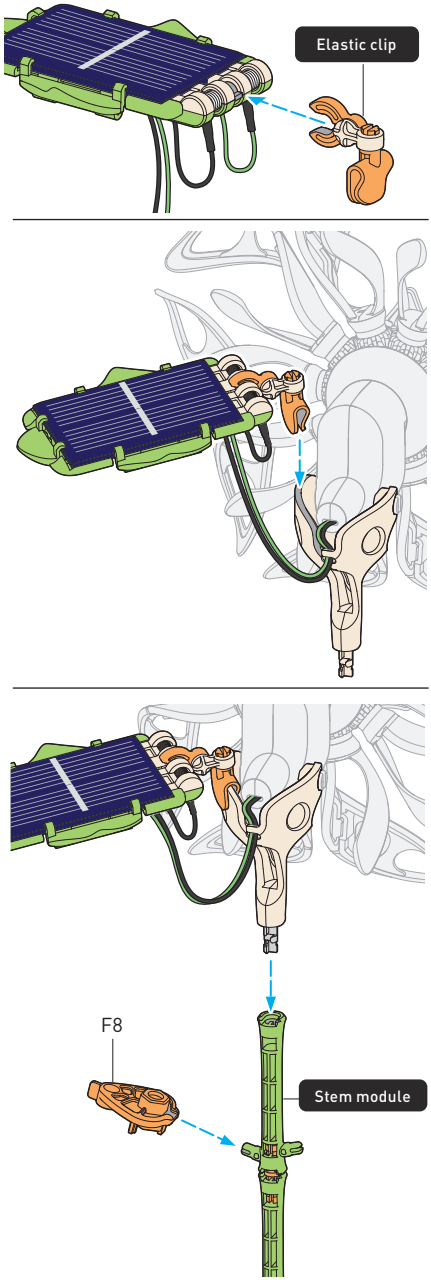
Use F8 to push the wires into the slots.



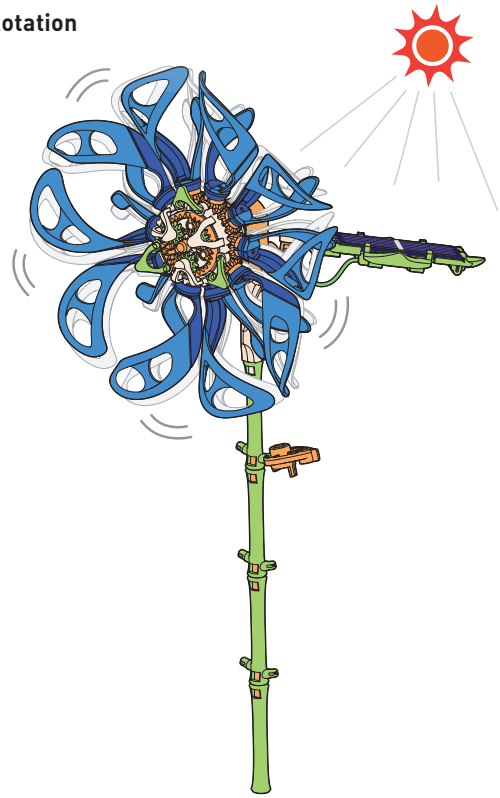
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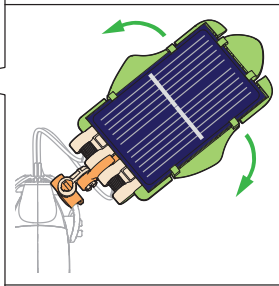
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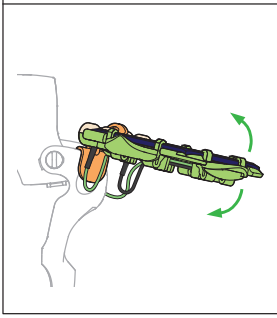


4 Rotation

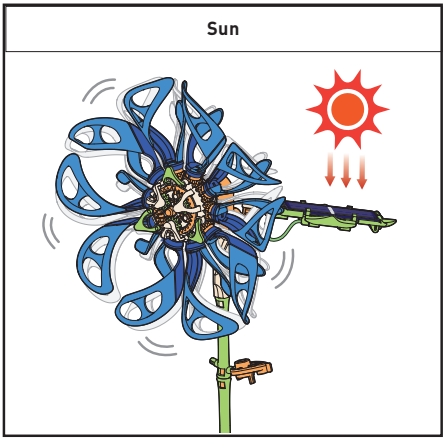


Position the solar cell so it faces the sun directly. This will allow it to receive more sunlight. For extended operation at full power, the solar module must be continually adjusted to follow the sun's path.

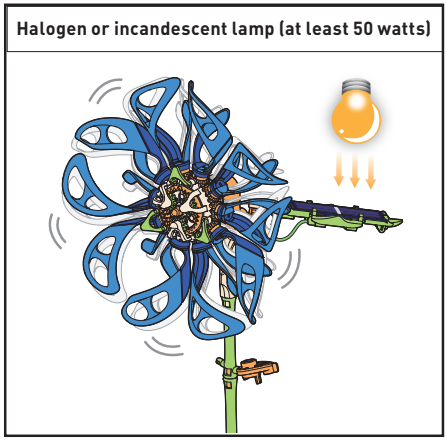




Sun



Halogen or incandescent lamp (at least 50 watts)

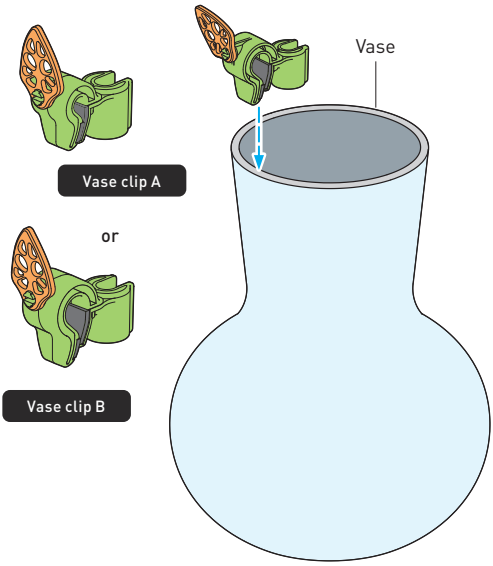


If the gears aren't working, check your assembly steps starting on page 5.

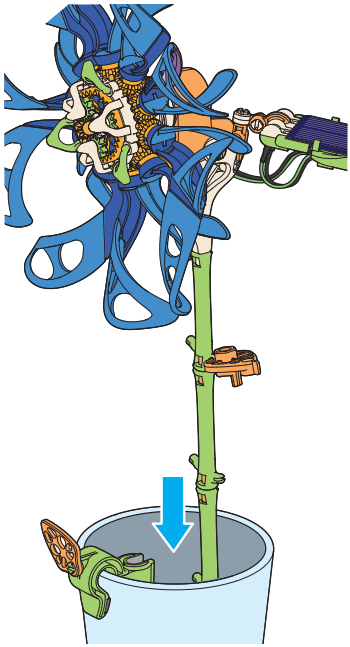
Your SolarFlower won't operate on cloudy days, in the shade, in indirect sunlight, or with weak lights (e.g., LED lamps or LED bulbs).

SETUP 1

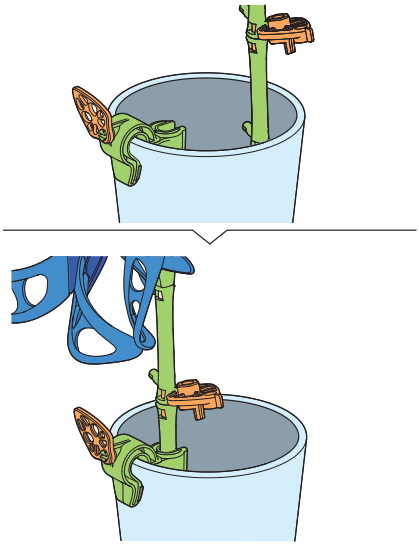
1 Position the solar panel so that it faces the sun. This will allow it to receive more sunlight.

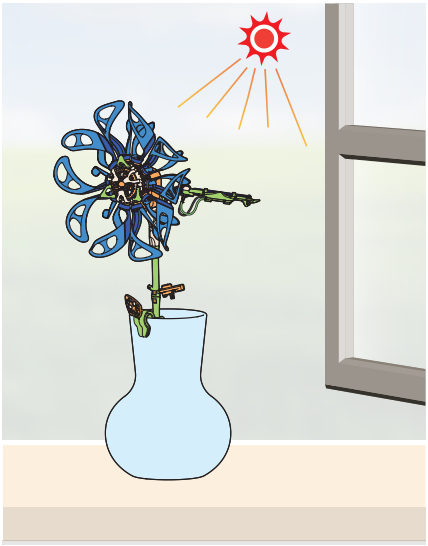


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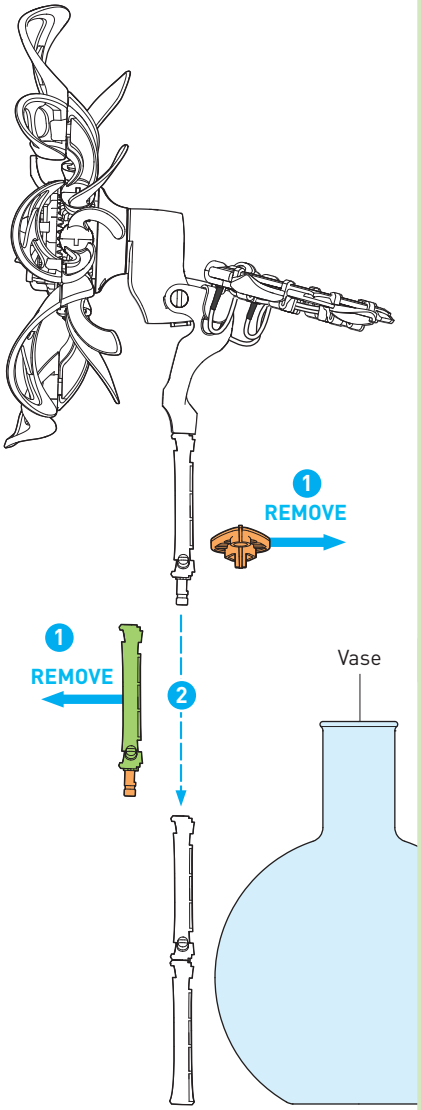
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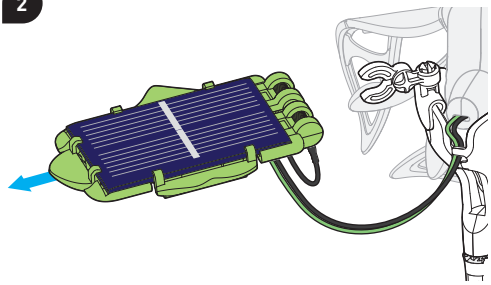


SETUP 2

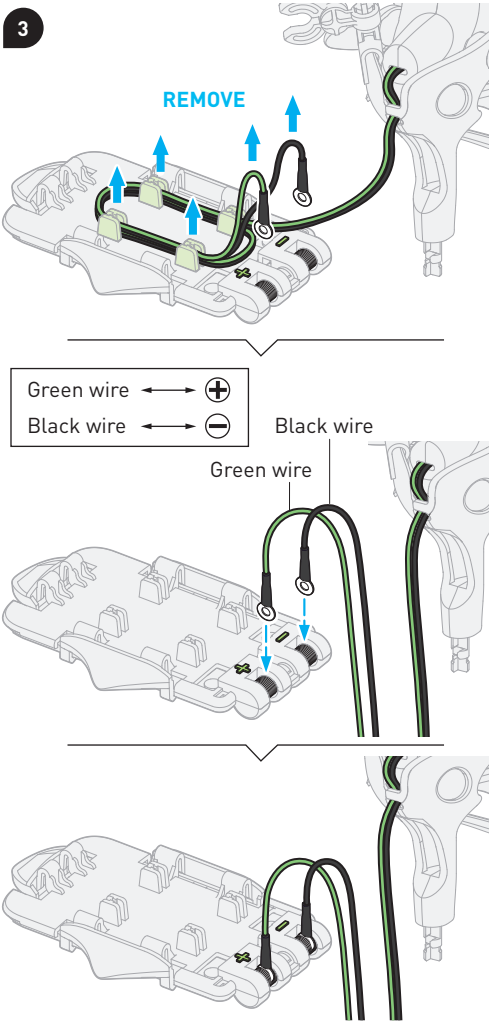
1 Adjust the length of the flower stem to the height of the vase.



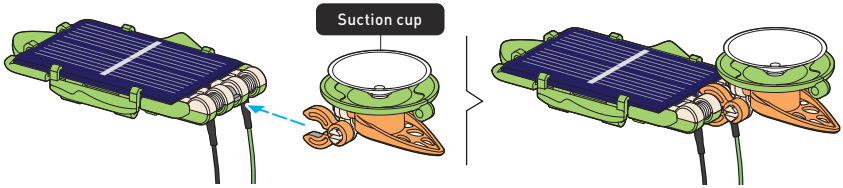
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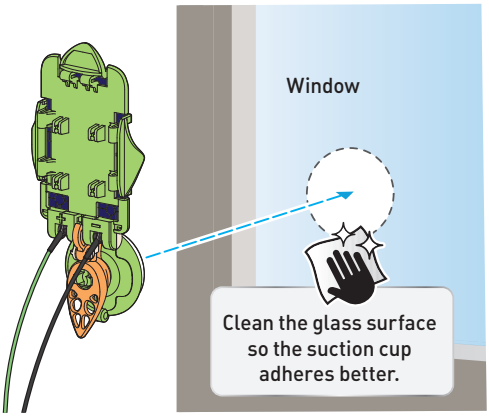
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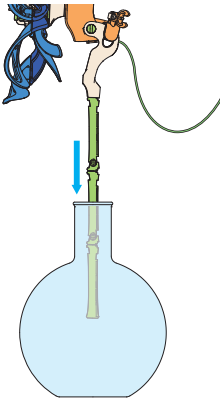
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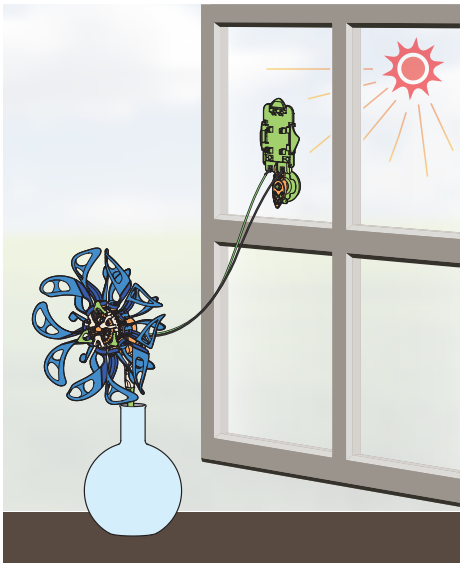
5



6

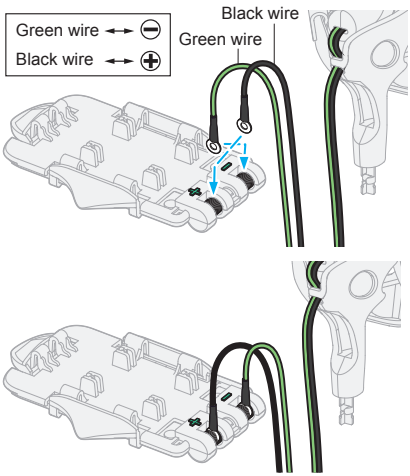


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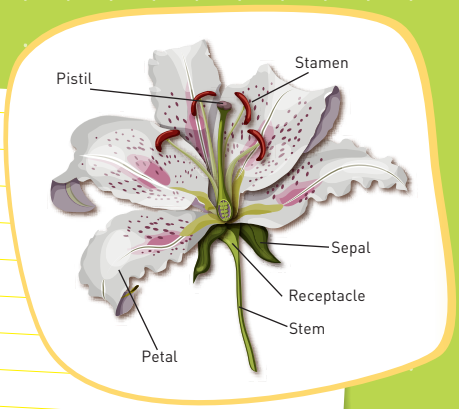
EXPERIMENT

1. Look closely at the directions the petals are spinning.
2. Switch the wires as shown below.
3. Observe the direction the petals spin now.



FLOWERS

When we talk about flowers, we usually mean colorful plants like roses, tulips, or daisies. These plants have beautiful colored parts called flowers. Flowers are therefore only a part of the whole plant! The flower is responsible for the plant's reproduction through pollination. Some flowers self-pollinate and others need insects or birds to bring pollen to them from other flowers and to spread their own pollen in turn. They often have colors and shapes that are designed to attract these pollinators.



Plants are living things

A flower, as you just learned, is part of a plant. But what exactly are plants? The title says it all: Plants are living things. This means they fulfill the seven **characteristics of life:** homeostasis, growth and development, response to stimuli, reproduction, adaptation, and organization.



HOMEOSTASIS

Homeostasis is the process by which living organisms maintain an internal balance of things like temperature and hydration. For example, a sunflower's head moves toward the sun throughout the day to maintain an optimal intake of energy from the sunshine.

GROWTH

Plants also grow, just like people. Small sprouts can grow into flowering plants, or even into enormous trees!



RESPONSE TO STIMULI

Plants can perceive stimuli a lot like other living things can. The mimosa pudica, for example, retracts its leaves when touched. Leaves also react to sunlight and orient themselves accordingly.



You might be familiar with pollen — it can cause some people to sneeze.

REPRODUCTION

Most plants reproduce by creating seeds. Many plants have flowers that produce pollen, which is carried by the wind or insects to other flowers. When pollen touches the flower of another plant of the same species, its DNA — a kind of blueprint — combines with that of the other plant. This creates a seed from which a new plant grows — sometimes with a different color or shape than either of its parents.

ORGANIZATION

Plants, like all living things, are made of tiny building blocks called cells, which can only be seen with a microscope. Everything the plant needs to live takes place in the cells, including growing, breathing, and feeding. That's right, plants breathe!



ADAPTATION

Like humans, plant species change over many years. These changes occur randomly and are selected by nature. If a change helps them survive better, it is preserved. This is how new species arise. When this happens naturally, it's called **evolution.** Humans can also influence this process by breeding plants selectively. Many of the different types of grain we eat were selectively bred to be better food sources.

METABOLISM

Metabolism is the process by which living organisms convert food into the energy needed for survival. Plants absorb water, light, and air and convert them into energy, which they need to grow and live. An important part of this is a special process called photosynthesis, which takes place in their leaves.



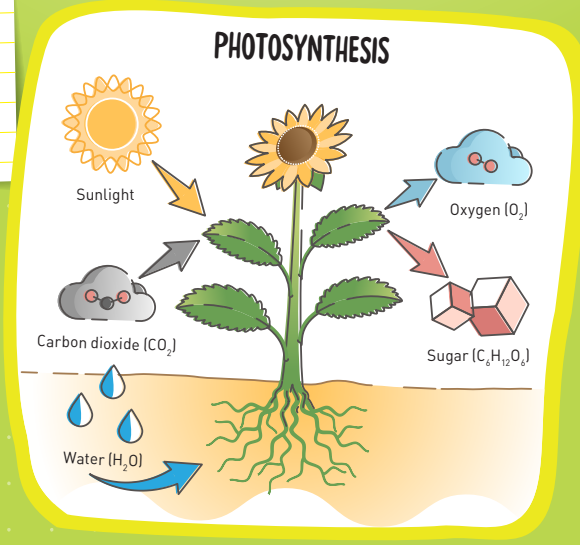
CHECK IT OUT

Photosynthesis

One special thing about plants is that most of them perform photosynthesis. Their leaves contain structures called chloroplasts, which convert the energy from the sun's light into chemical energy.

Using energy from sunlight, a plant converts carbon dioxide (CO_2) and water (H_2O) into sugar ($C_6H_{12}O_6$) and oxygen (O_2). Plants use the sugar to nourish themselves and grow. They don't need the oxygen they produce this way, so they release it into their environment. This is extremely important for humans and animals, since plants are responsible for all of the oxygen we breathe.

FUN FACT:
THE PIGMENT **CHLOROPHYLL** INSIDE **CHLOROPLASTS** IS WHAT MAKES LEAVES LOOK **GREEN**.



BY THE WAY:

Even though your SolarFlower cannot perform photosynthesis, it still uses energy from sunlight thanks to its solar cell. It captures the sunlight and converts the light energy into electricity. This is how your SolarFlower moves!

PLANETARY GEARS

Of course, your SolarFlower is not photosynthesizing in order to grow. Instead, its movement is driven by a planetary gear system. The motor drives the sun gear in the middle, which drives the planet gears around the stationary inner ring gear. The planets are connected to an outer ring gear, which drives the bevel-shaped gears connected to the petals.
Look closely at the petals and you will see that adjacent petals spin in opposite directions!

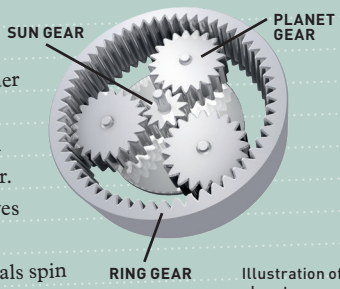


Illustration of a planetary gear



TITAN ARUM

Flowers smell. But they don't always smell good. The titan arum smells strongly of rotting meat. This is a tactic to attract insects, which in turn serve as pollinators by picking up and spreading pollen. But it's not just its stench that makes it special. Although it looks like a giant flower (the largest reached a height of over 3 meters), what you see is actually a specialized type of leaf wrapped around thousands of tiny flowers. When a titan arum blooms, the flower can only be seen (and smelled) briefly. After a few days, it begins to wilt.

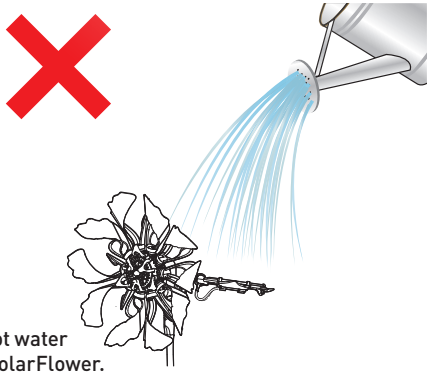
Funky Flowers



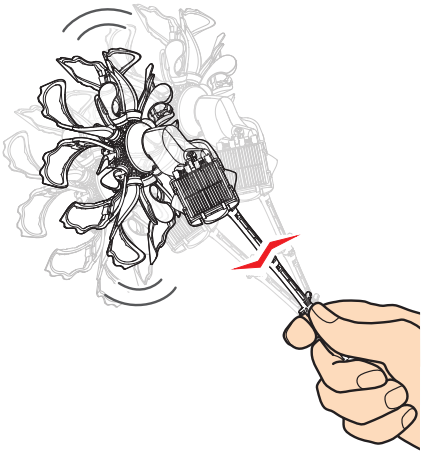
CORPSE FLOWER

But even though the titan arum is enormous, the biggest flower belongs to the corpse flower — Rafflesia arnoldii. The corpse flower, as you might have guessed, also stinks of rotting meat and is one of the most foul-smelling flowers in the world. It also doesn't photosynthesize. It's a parasite that grows and feeds on the Indian chestnut vine — which is also a parasite that often climbs up coffee trees!

IMPORTANT INFORMATION ON HANDLING



Do not water the SolarFlower.

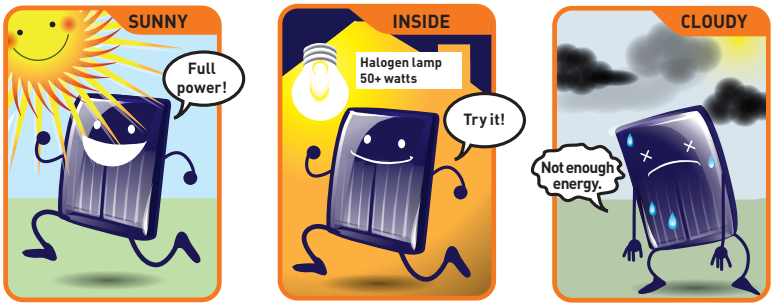


Do not shake the SolarFlower. It can break.



Do not let the SolarFlower get wet in the rain.

When does the solar cell function best?



1. Place the SolarFlower in direct sunlight on your windowsill or outside. It works best on a sunny day.
2. Indoors, you can also operate the SolarFlower with a halogen lamp of at least 50 watts. On cloudy days, in the shade, or in normal indoor light, the SolarFlower will not receive enough energy.

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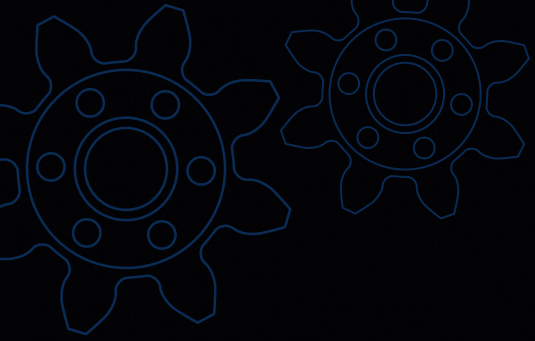
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