

EXPERIMENT MANUAL

# SolarBots

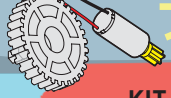
## COSMIC EXPLORERS



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

THAMES & KOSMOS



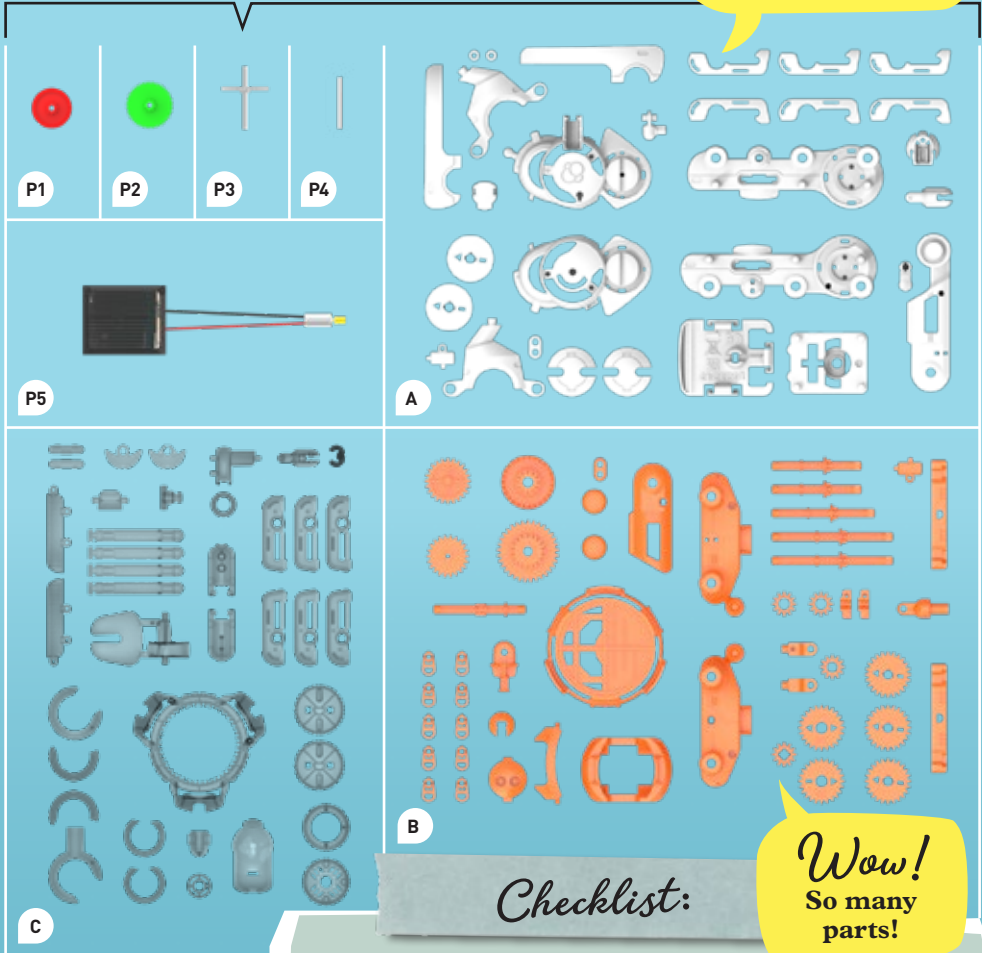


## KIT CONTENTS

*Good to know!*

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

What's inside your experiment kit:



*Wow!*  
So many parts!

### YOU WILL ALSO NEED:

- i** Diagonal cutter or scissors, nail file, incandescent or halogen lamp or bright direct sunlight

✓	No.	Description	Quantity	Part No.
○	P1	Gear, red	1	728349-1
○	P2	Gear, green	1	728349-2
○	P3	Gear with metal shaft	1	728349-3
○	P4	Round shaft	1	728349-4
○	P5	Solar panel and motor	1	728350
○	A	Frame A with parts A1 - A23	1	728346
○	B	Frame B with parts B1 - B32	1	728347
○	C	Frame C with parts C1 - C30	1	728348

**TABLE OF CONTENTS**

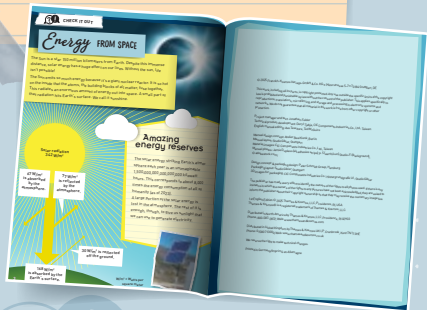
Kit Contents ..... **Inside front cover**  
 Table of Contents ..... **1**  
 Safety Information ..... **2**  
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**ASSEMBLY INSTRUCTIONS BEGIN ON PAGE 6**

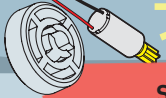
**Helio and Its Vehicles ..... 4**  
**Helio Assembly ..... 6**  
**Orbiting Platform Assembly ..... 15**  
**Trike Bot Assembly ..... 17**  
**Walking Bot Assembly ..... 20**  
**Bug Bot Assembly ..... 27**



**YOU WILL FIND  
 ADDITIONAL INFORMATION IN  
 THE CHECK IT OUT SECTIONS  
 ON PAGE 36.**



*Woohoo!*  
**Let's go!**



## SAFETY INFORMATION

### INFORMATION ON HANDLING THE ELECTRONIC COMPONENTS

Avoid contact with metallic objects and liquids of all kinds! Do not use any other energy source than the solar cell supplied.



**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 6 years, due to accessible electronic components. Instructions for parents or caregivers are included and shall be followed.

Warning. To be used under the direct supervision of an adult. Keep the toy out of reach of children under 6 years old.

Keep packaging and instructions as they contain important information.

Assembly must be performed under adult supervision.



### 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.

**IMPORTANT INFORMATION**

## Dear Parents and Supervising Adults,

Children want to be amazed, understand, and create new things. They want to try everything out and do it for themselves. They want to know! They can do all of this with Thames & Kosmos experiment kits. We hope you and your child have a lot of fun experimenting with SolarBots: Cosmic Explorers.

- Before building and experimenting, read the instructions together with your child and discuss the safety information together. Stand by to assist your child with any challenging steps of assembly or usage.
- If your child is working on a table top, give them something to work on to prevent damage to the furniture.
- Particular care must be taken when cutting the plastic parts out of the frames, as sharp points can be created. These can be removed with the help of diagonal cutters or scissors and a nail file. Please supervise your child whenever they are using scissors or diagonal cutters until you feel they are ready to use the tools independently.

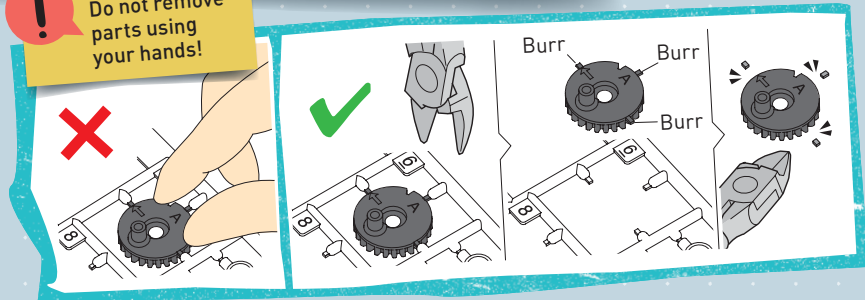
And most importantly: Have fun with your SolarBots: Cosmic Explorers!

**TIP****IMPORTANT:**

REMOVE THE PARTS FROM THE FRAMES ONLY WHEN THEY ARE NEEDED. REMOVE EXCESS MATERIAL (BURRS) BEFORE ASSEMBLY USING A DIAGONAL CUTTER OR A NAIL FILE.



Do not remove parts using your hands!





## THE SOLARBOTS



# Hi!

My name is Helio. I'm a SolarBot who lives in Sun City, where the sun shines almost every day. That gives me the energy to go on lots of adventures to explore the cosmos.

I need the right vehicle for every situation. Let me introduce them to you here!

### Orbiting Platform

When the sun goes down in Sun City, I like to rest in my Orbiting Platform. Then, when the sun comes up, I'm awoken gently by its slow rotations. It also stops me from accidentally rolling away.

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15

### Walking Bot

This two-legged bot is perfect for exploring. I have a great view from the higher vantage point.

And I can safely explore unpaved paths, thanks to its two sturdy legs.

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### Trike Bot

I can roll around even without a bot, but with this speedy trike, I'm a lot faster. Plus, the steering is great.

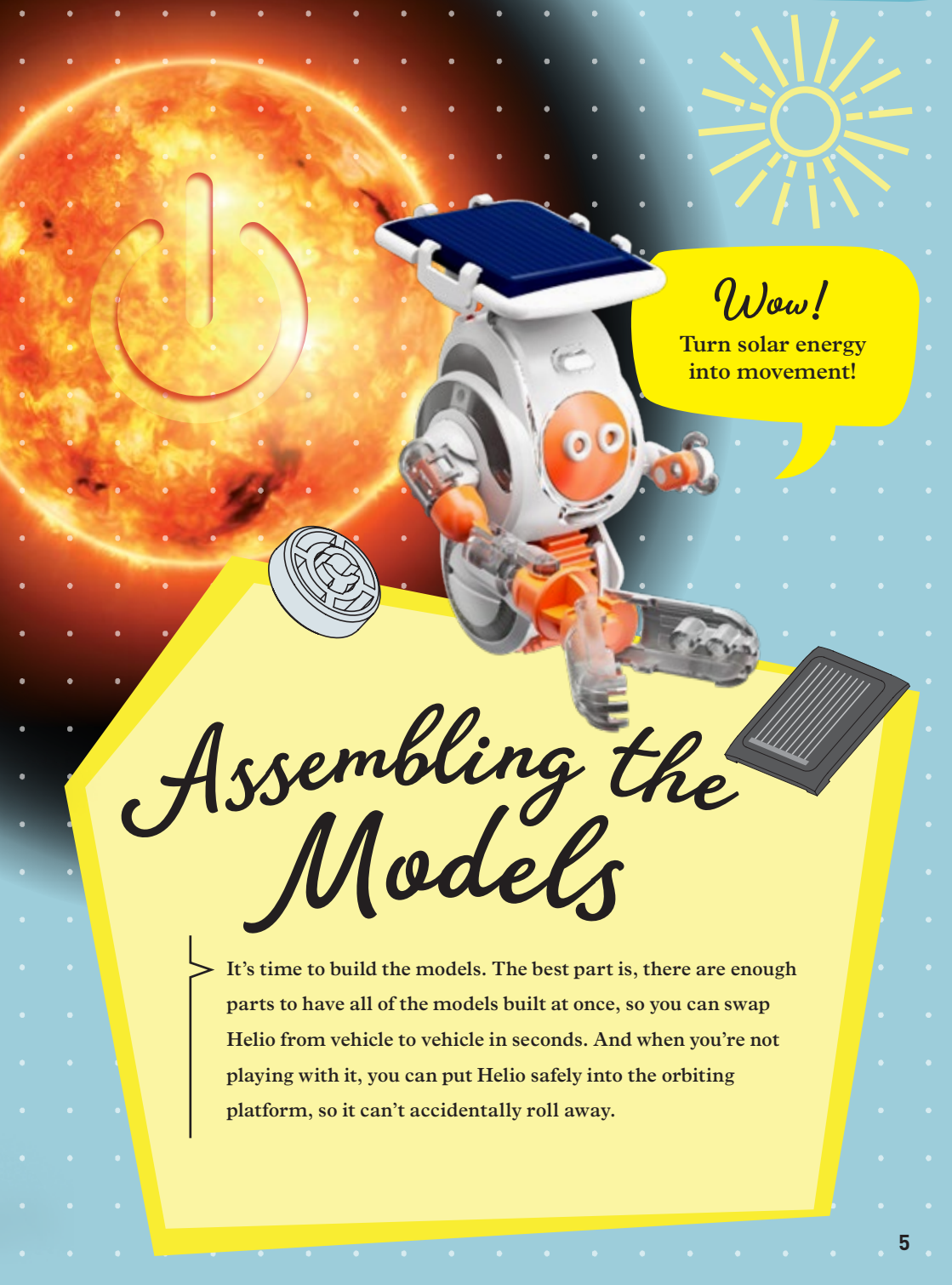
In this vehicle, I can really zip around the surface of Sun City!

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### Bug Bot

This six-legged bot is perfect for rough terrain. With its beetle-like motion, I have incredible stability and traction, even on loose soil and other surfaces.

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27



*Wow!*  
Turn solar energy  
into movement!

# Assembling the Models

It's time to build the models. The best part is, there are enough parts to have all of the models built at once, so you can swap Helio from vehicle to vehicle in seconds. And when you're not playing with it, you can put Helio safely into the orbiting platform, so it can't accidentally roll away.

**1**

A5 C7 Click

Support wheel

**2**

A17 A11 C30

B28 Short arm

**3**

B10 A7 C8

Remove all burrs.

C8

Pull to extend

**4**

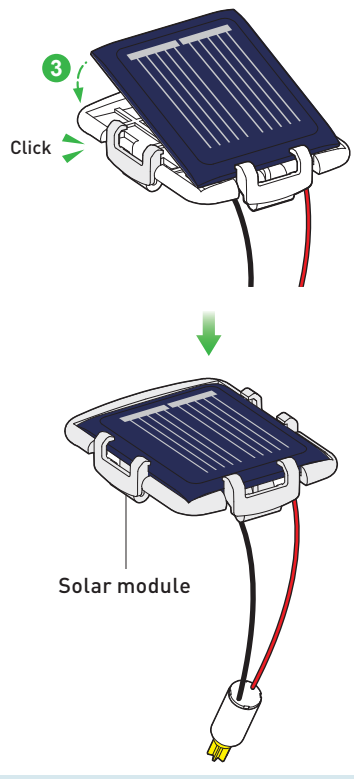
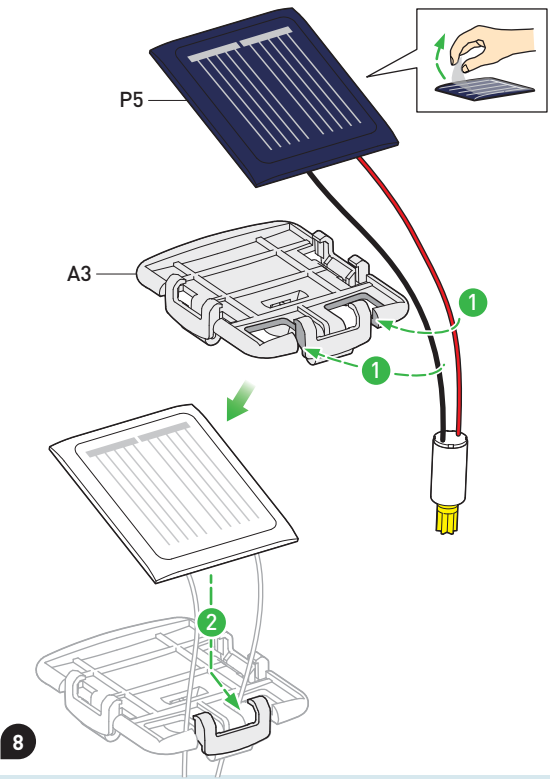
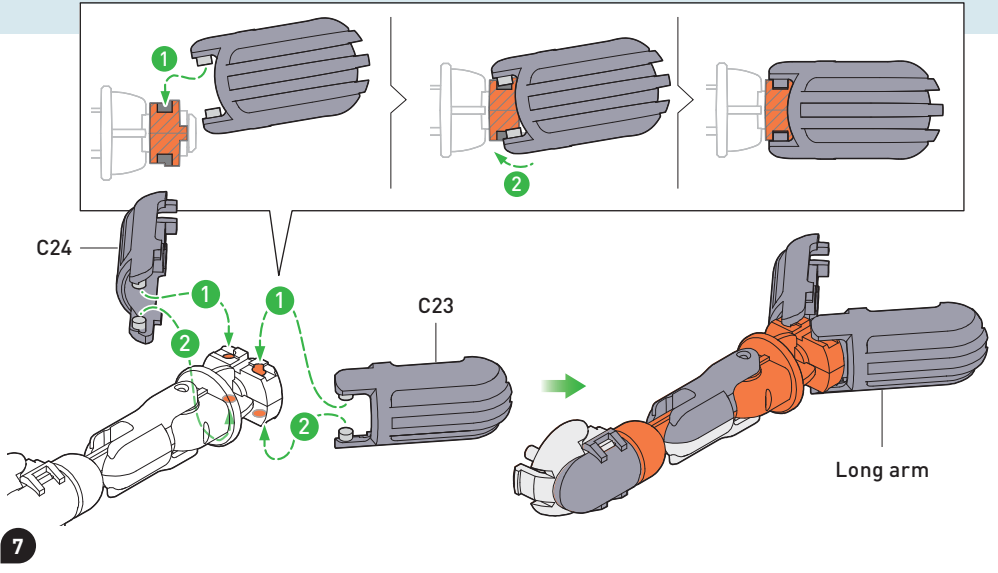
B23 A6 C29

**6**

B11 B11

**5**



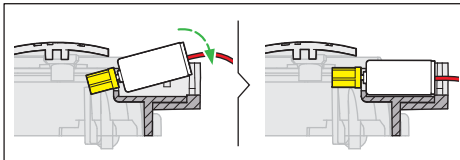
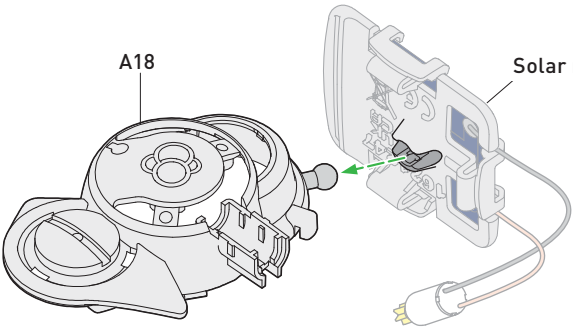




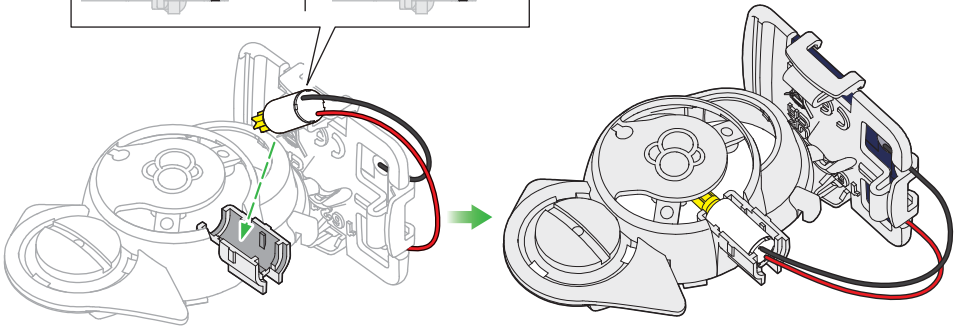
A18

Solar module

9



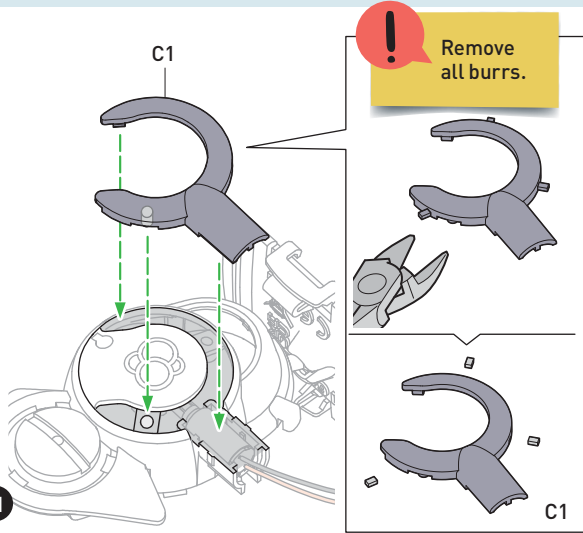
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C1

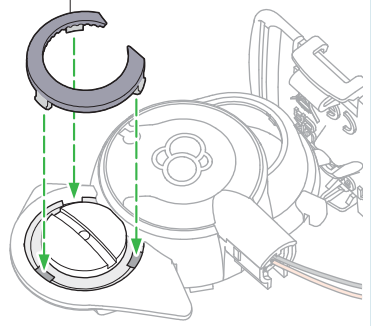
**!** Remove all burrs.

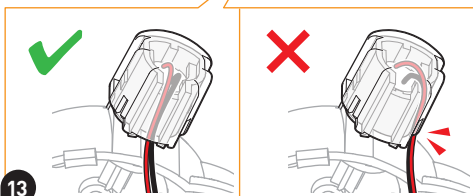
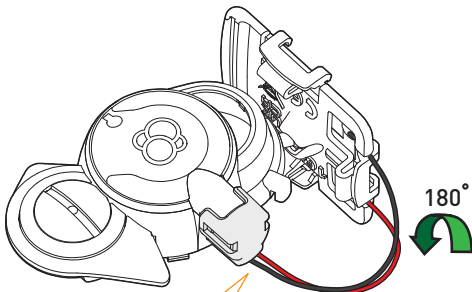
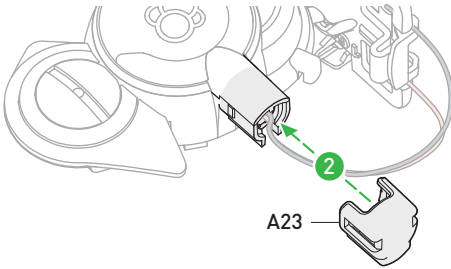
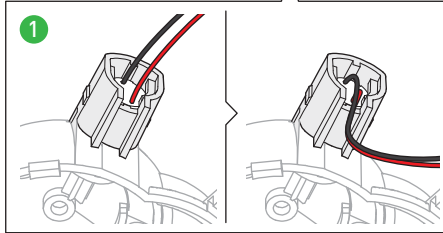
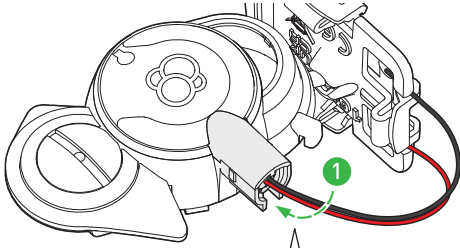
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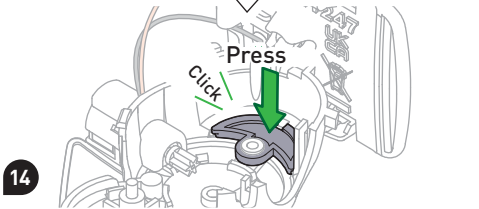
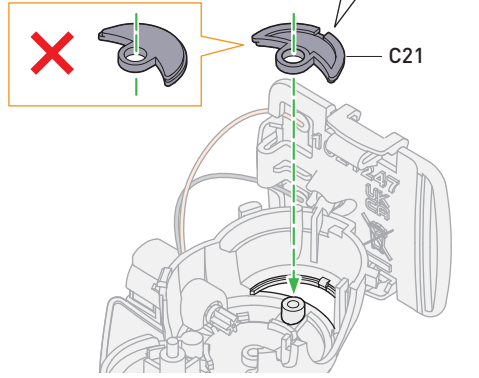
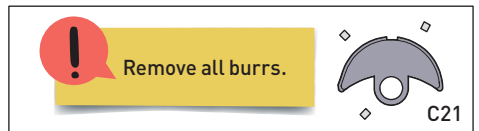
C6

12

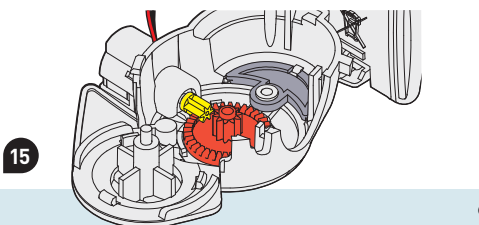
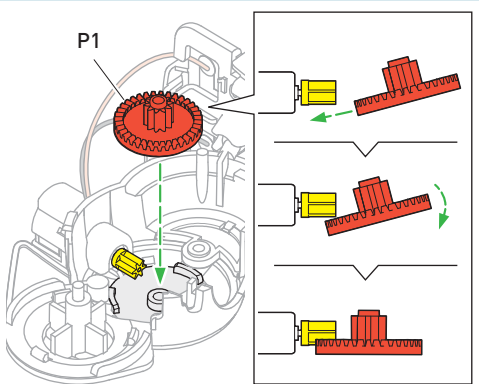




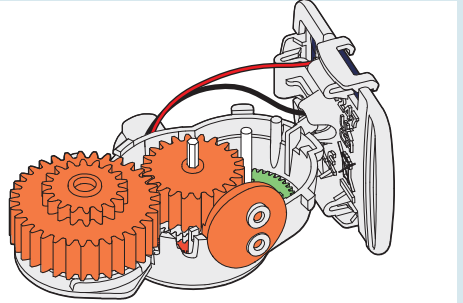
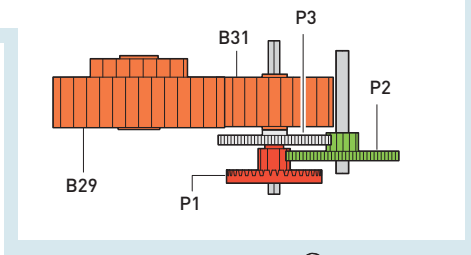
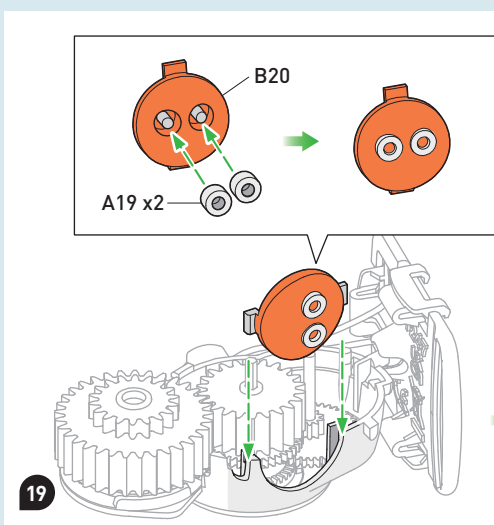
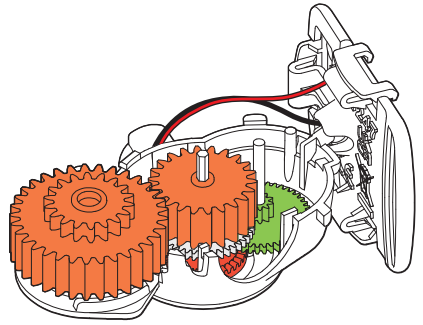
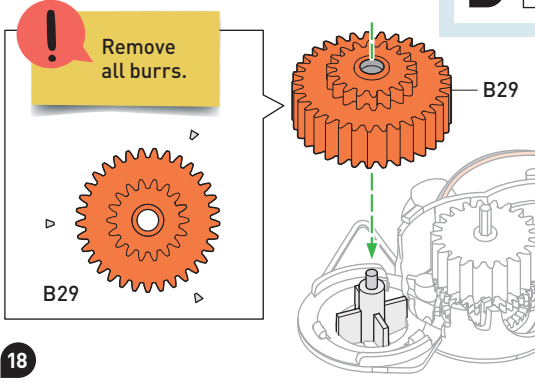
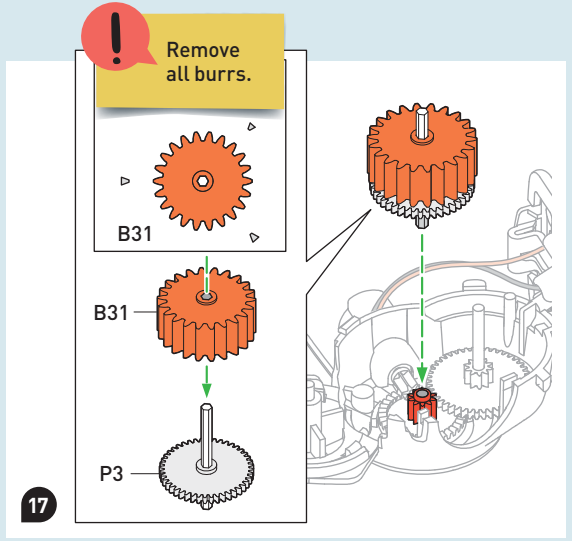
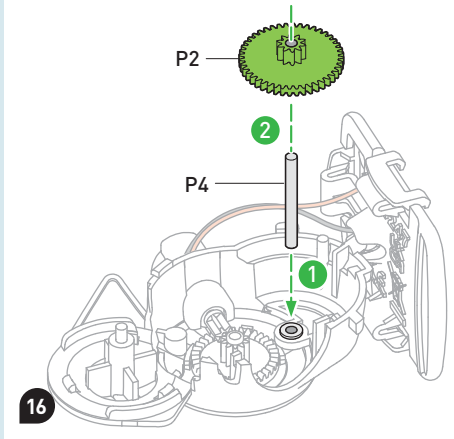
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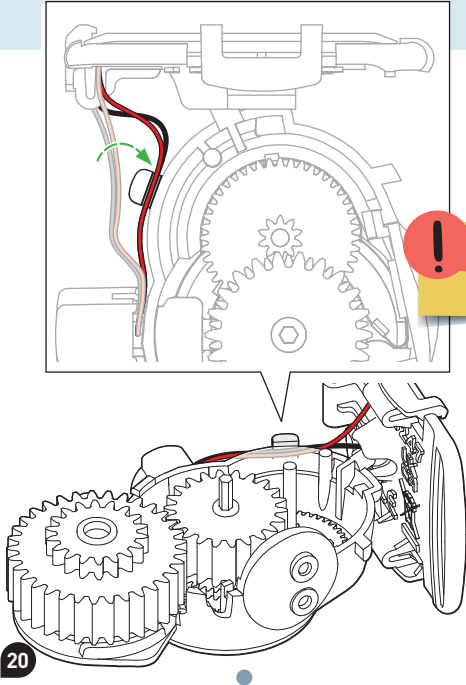


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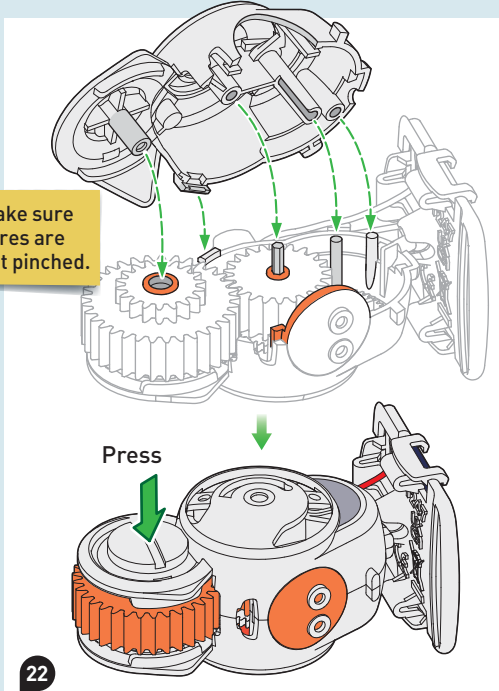


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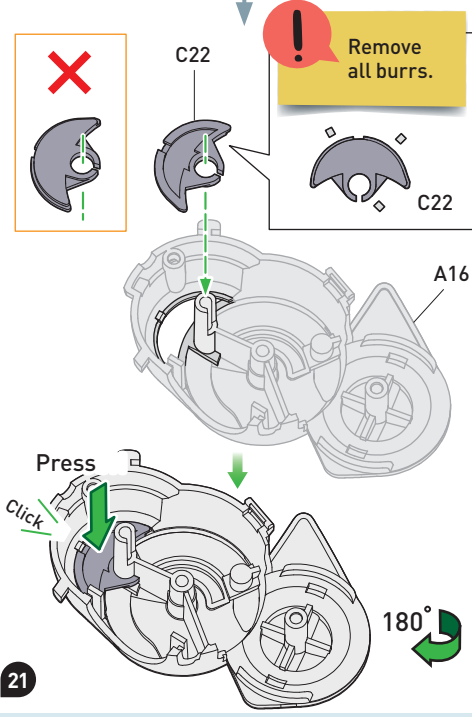




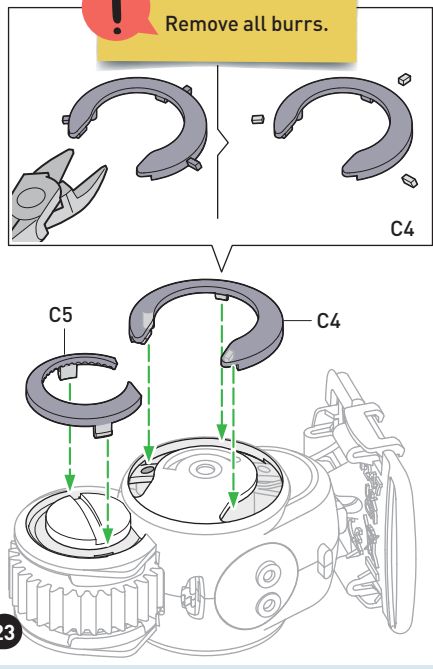
! Make sure wires are not pinched.



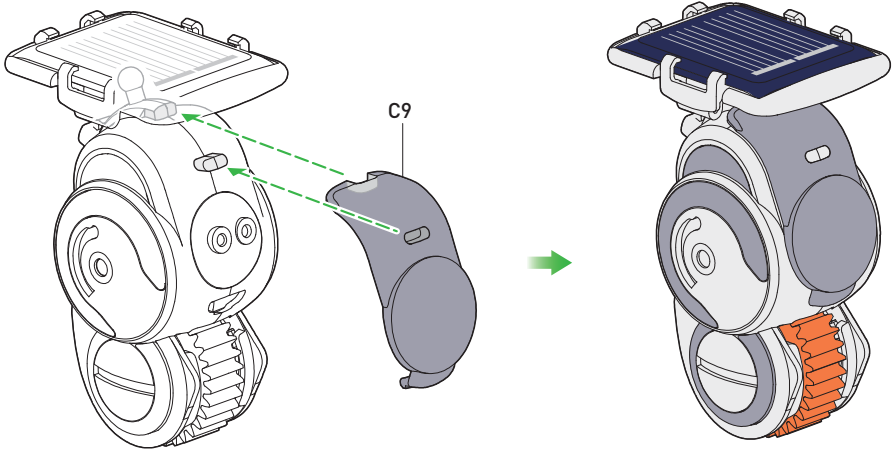
! Remove all burrs.



! Remove all burrs.

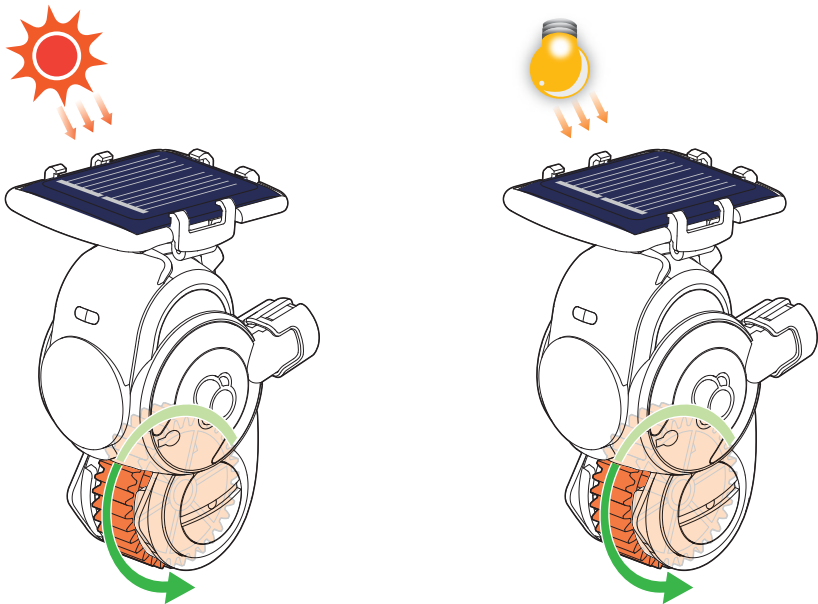


! Remove all burrs.



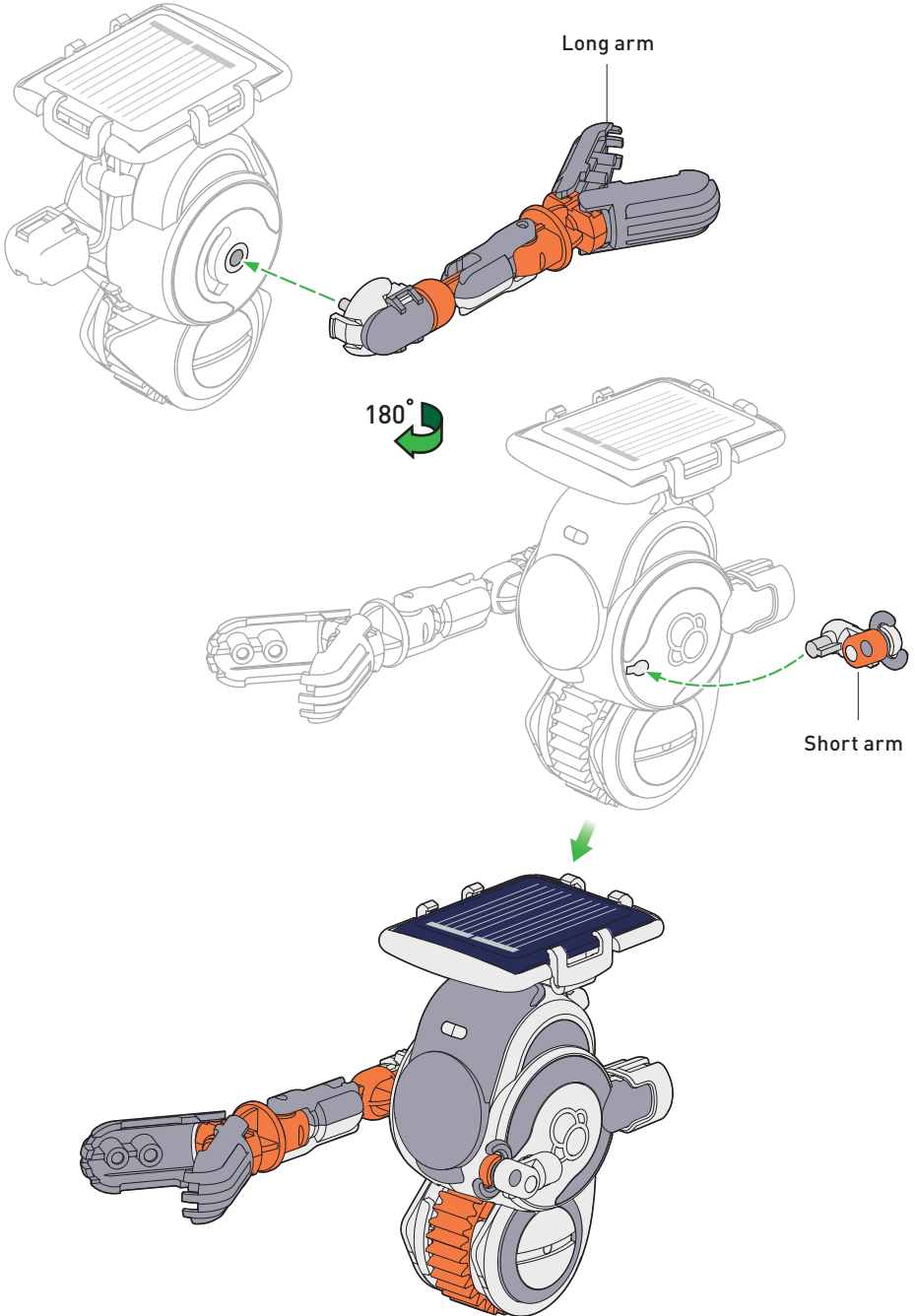
24

Test Helio under bright direct sunlight or with a light source of 50 Watts or more (ex: a halogen lamp or incandescent bulb). Helio will not work on cloudy days, in shade, in indirect sunlight, or with weak artificial light (ex: LED bulbs).



25

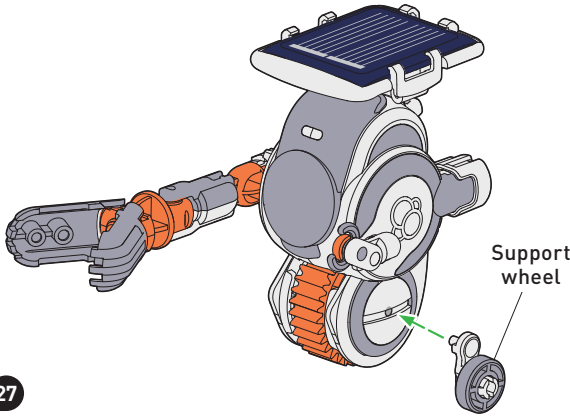
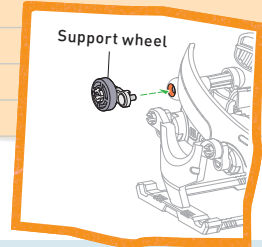
If the gears do not turn, double check that the gears were assembled correctly (page 10).





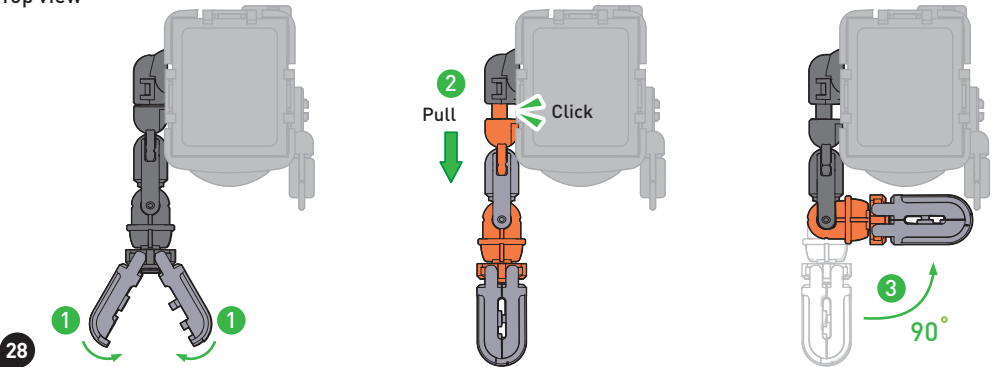
## TIP

WHEN THE SUPPORT WHEEL ISN'T BEING USED, IT CAN BE STORED ON THE WALKING BOT. THAT WAY IT WON'T GET LOST (SEE PAGE 25, STEP 14).



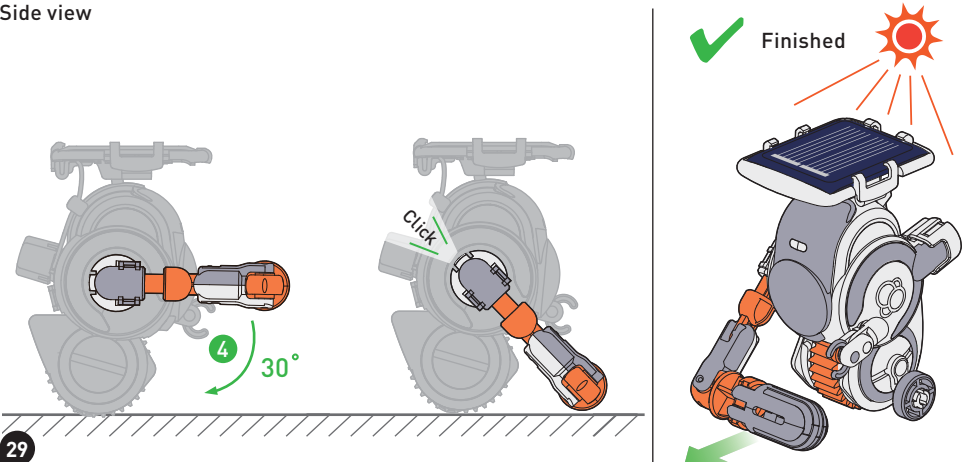
27

Top view



28

Side view

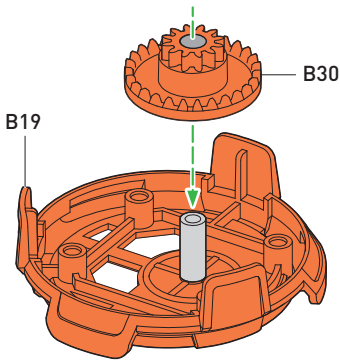


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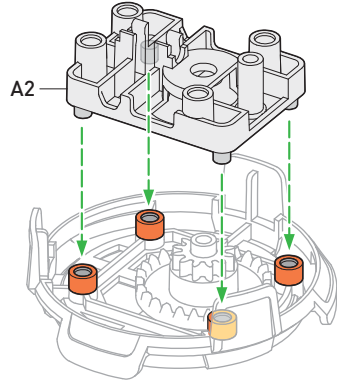


**ASSEMBLING THE ORBITING PLATFORM**

1



2



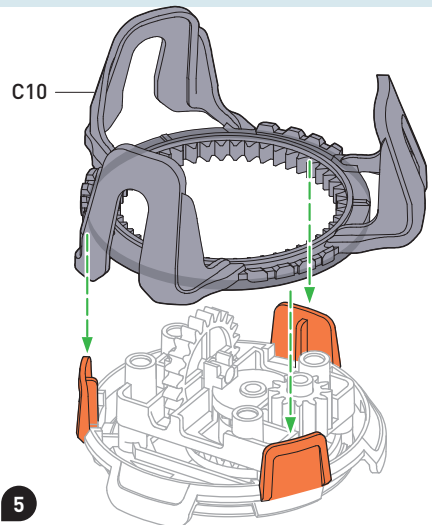
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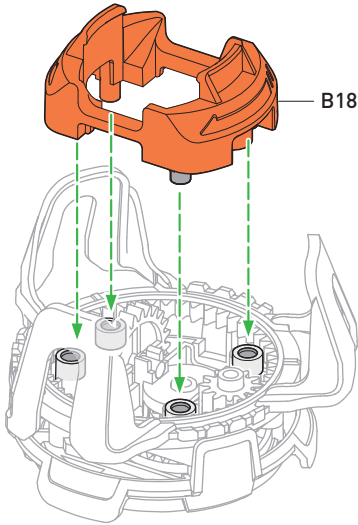
**Remove all burrs.**

4

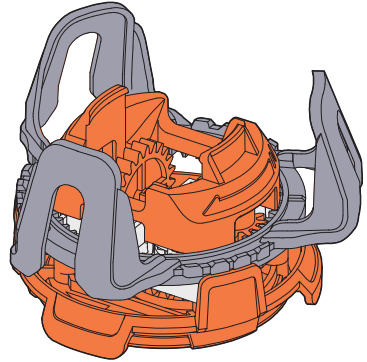
**Remove all burrs.**

5





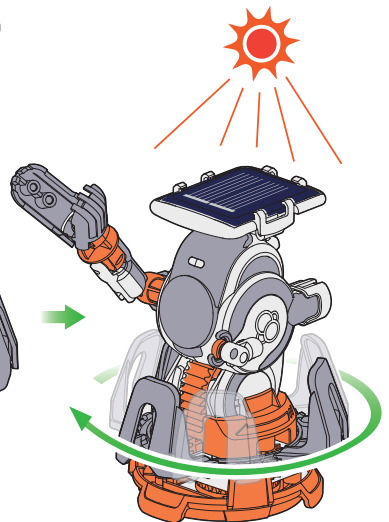
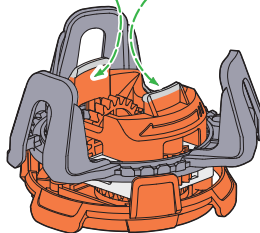
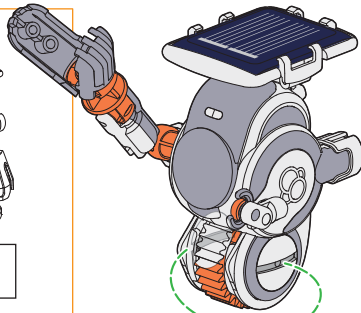
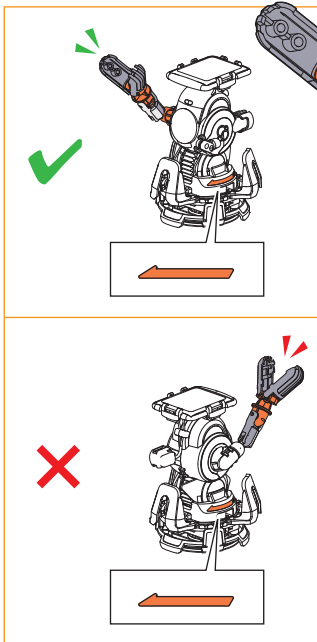
B18



Finished

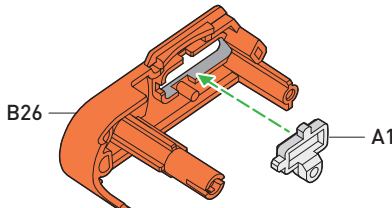
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## HERE'S HOW



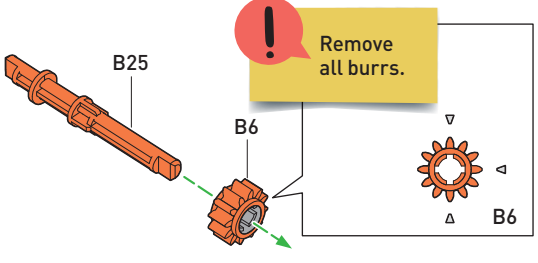
**ASSEMBLING THE TRIKE BOT**

**1**



B26 A14

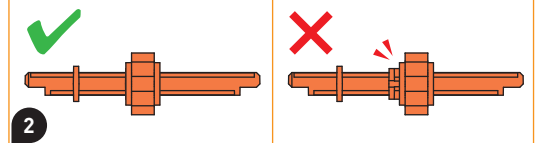
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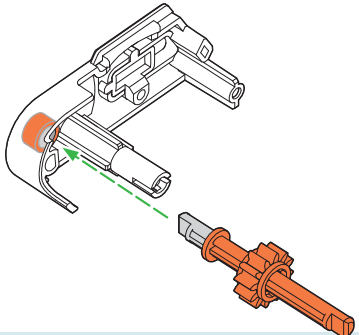
B25 B6 B6

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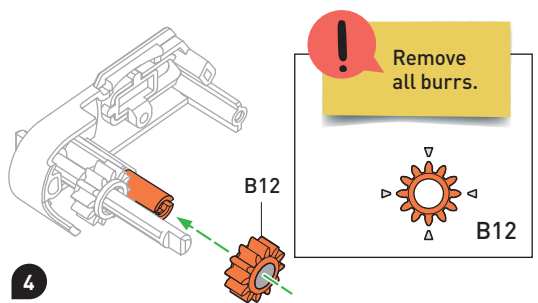
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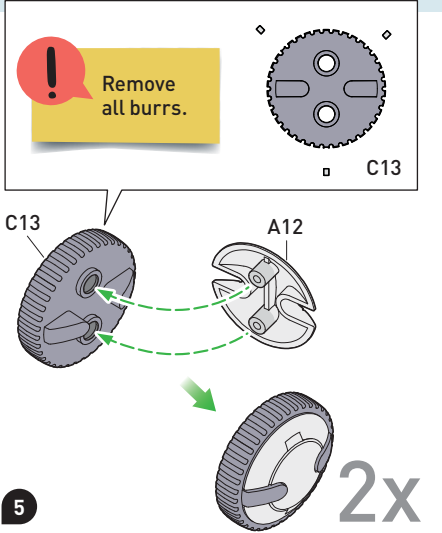
**4**



B12 B12

Remove all burrs.

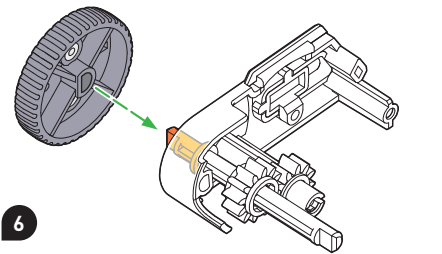
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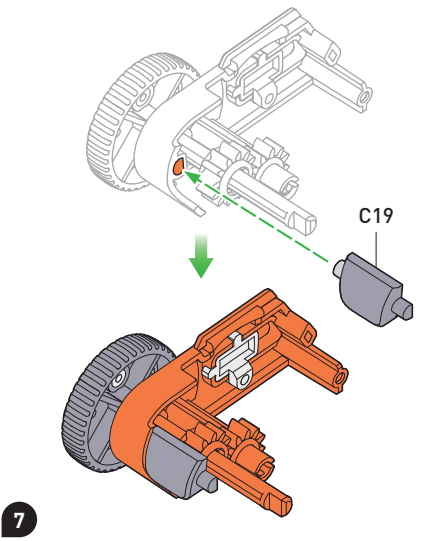
Remove all burrs.

C13 A12 C13 2x

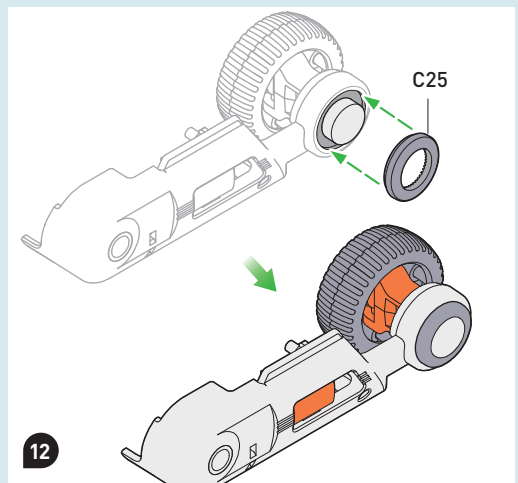
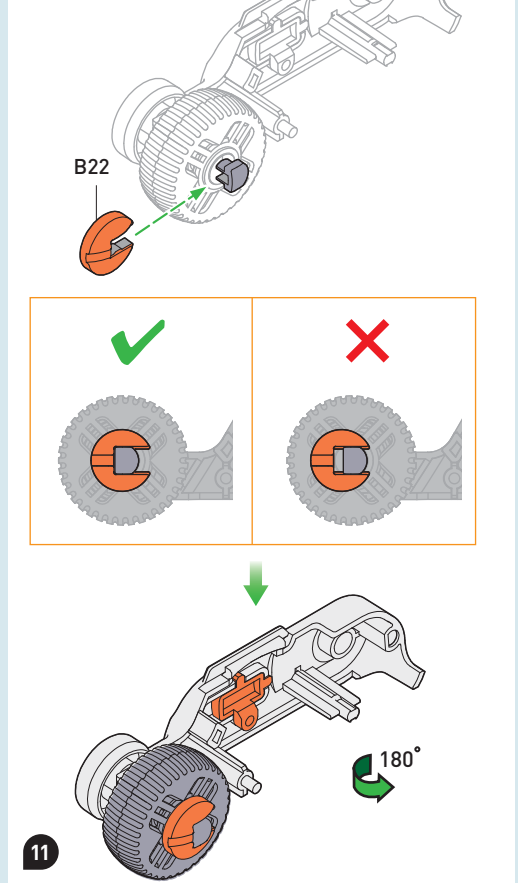
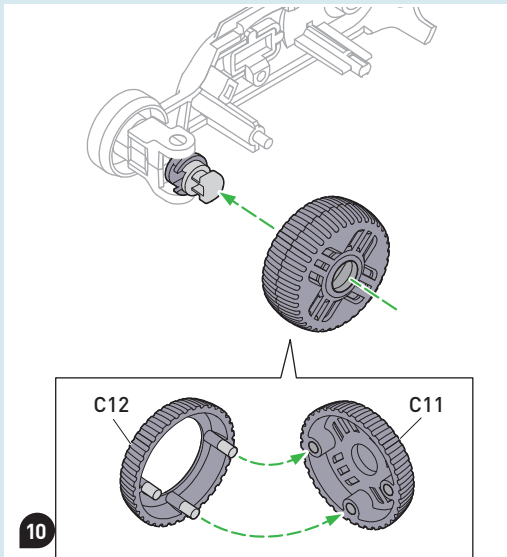
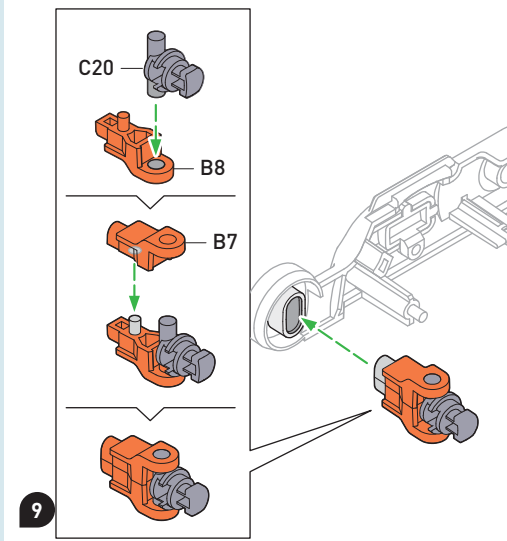
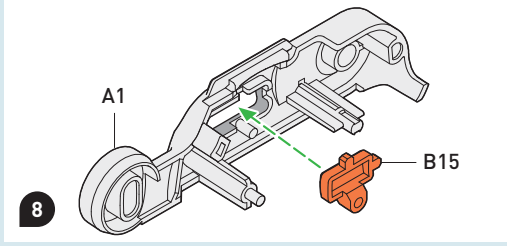
**6**



**7**

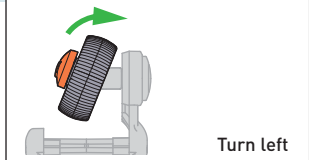
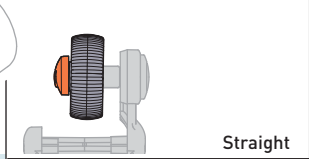
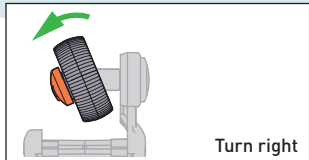
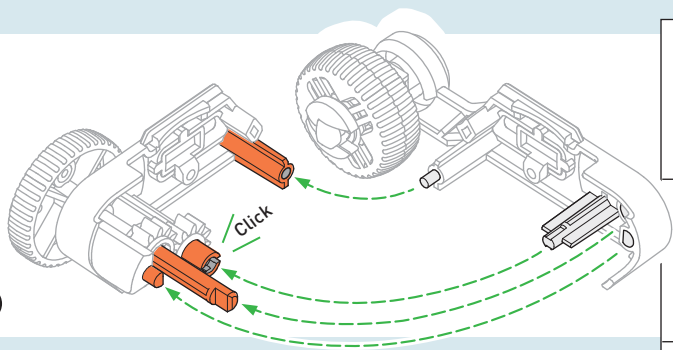


C19

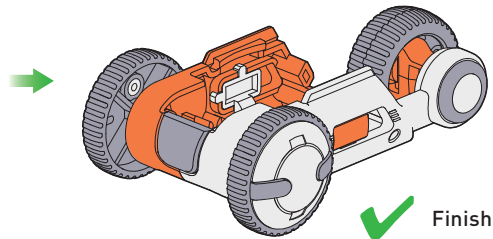
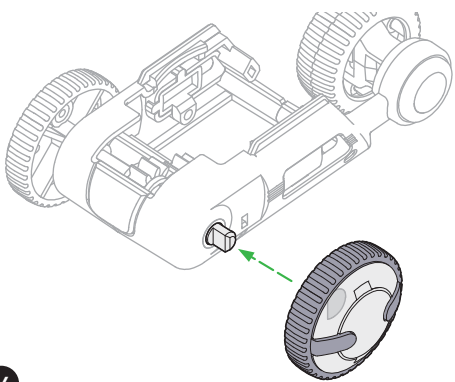




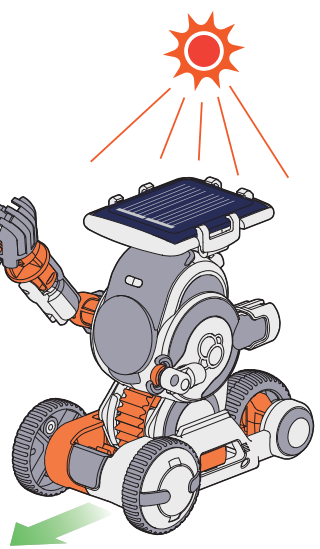
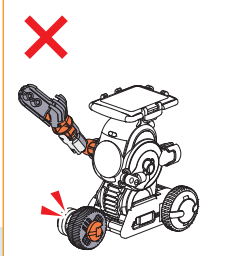
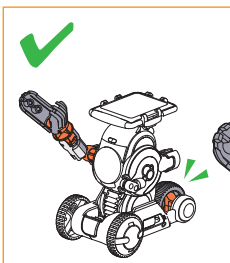
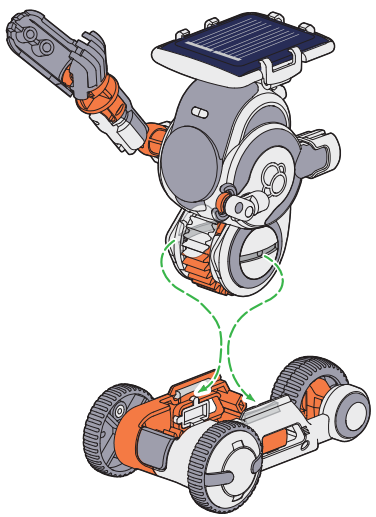
13



14

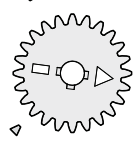


### HERE'S HOW



1

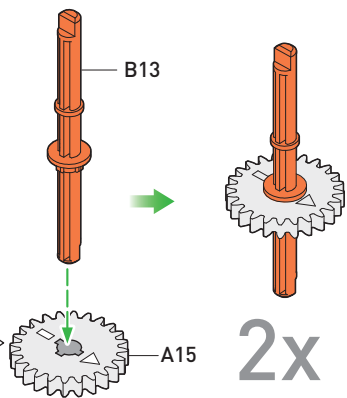
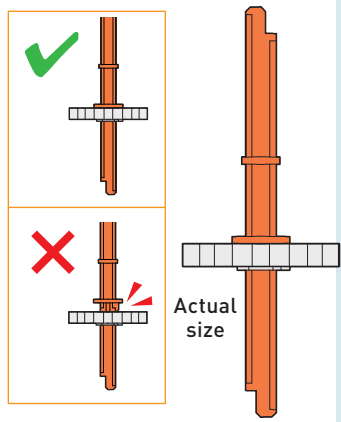
**!** Remove all burrs.



B13

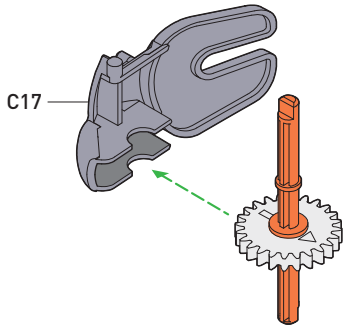
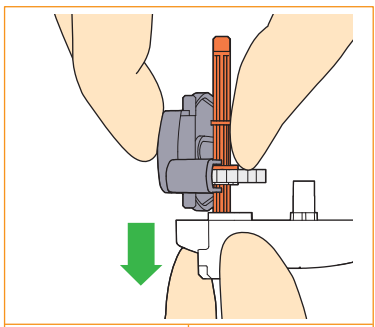
A15

2x

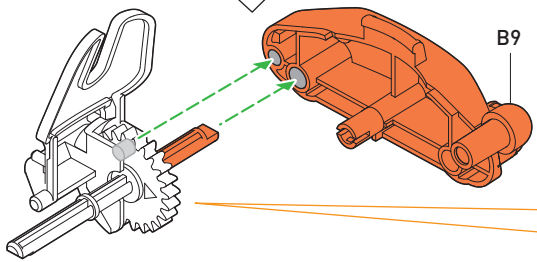
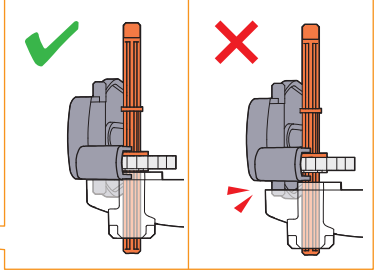



Actual size

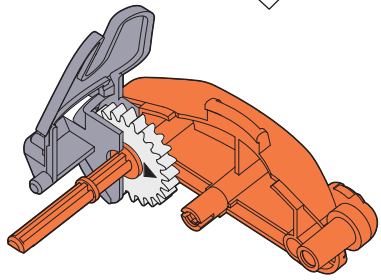
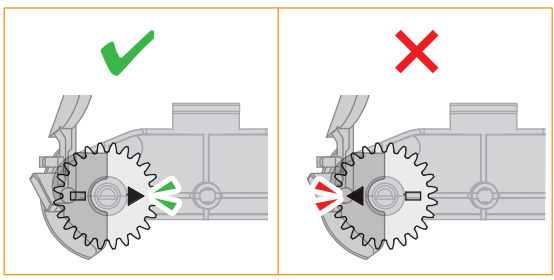
C17

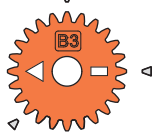
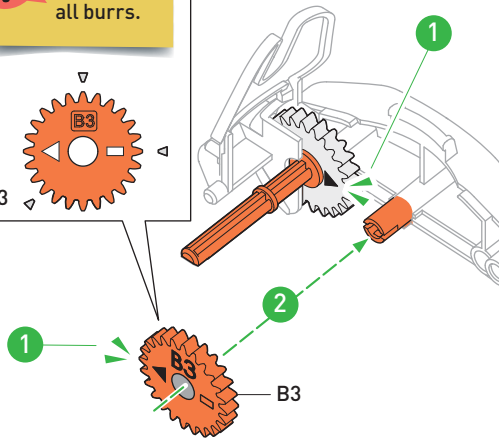
B9

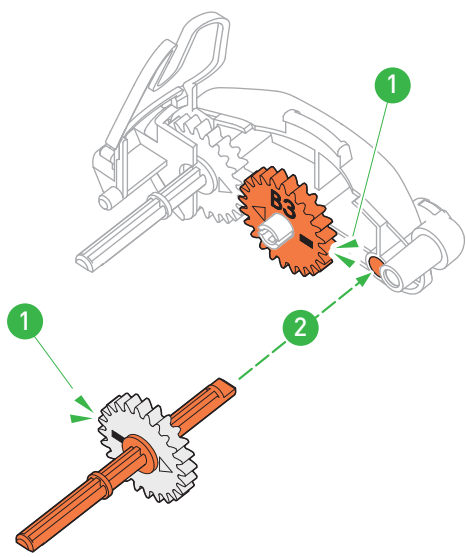
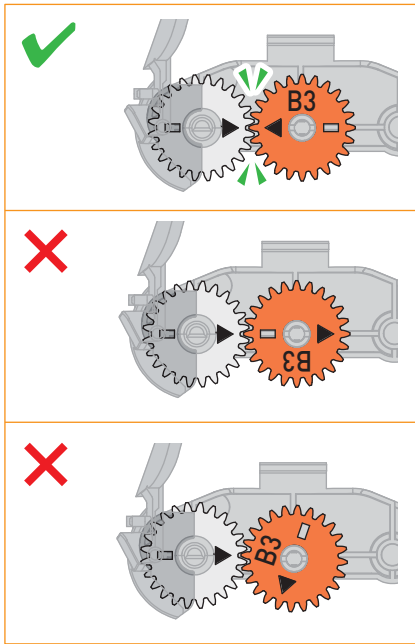
2

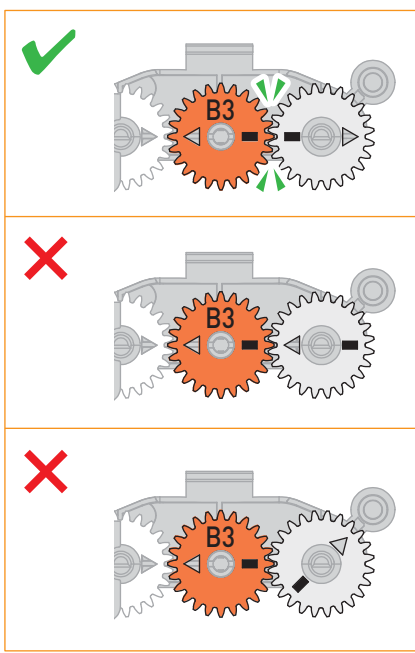
**!** Remove all burrs.

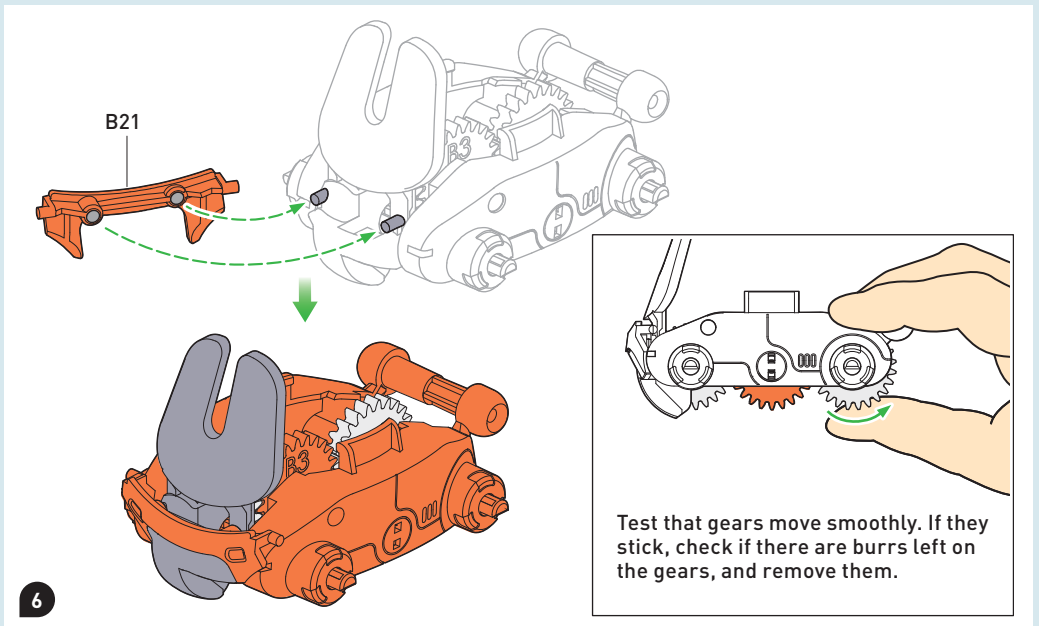
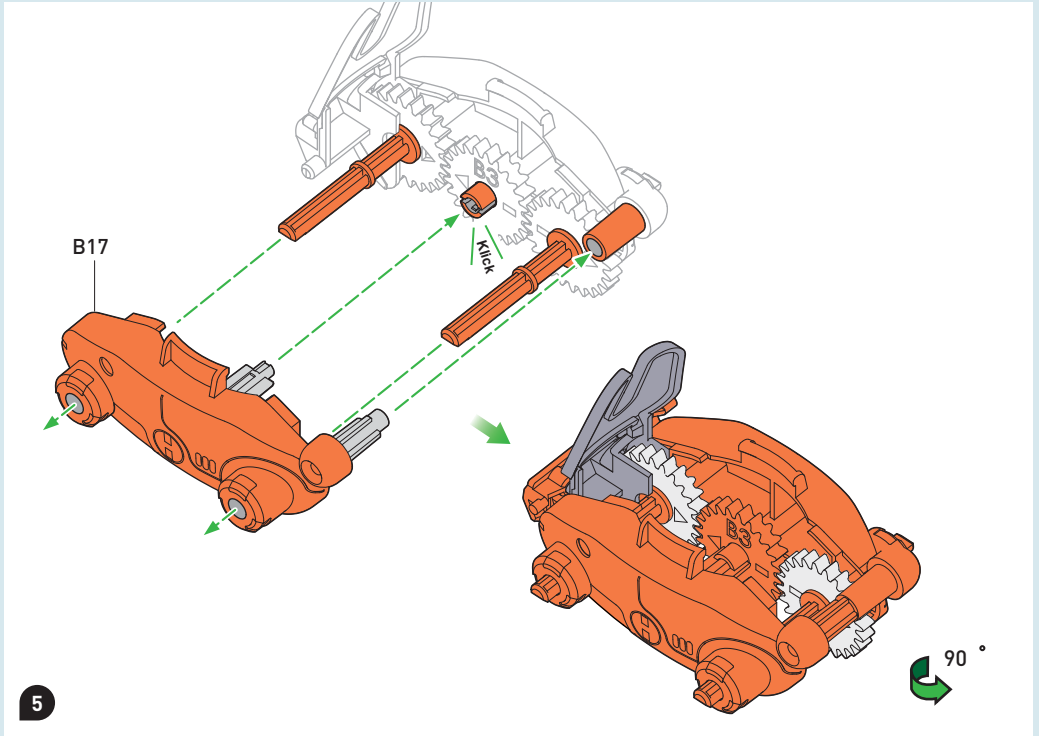



3

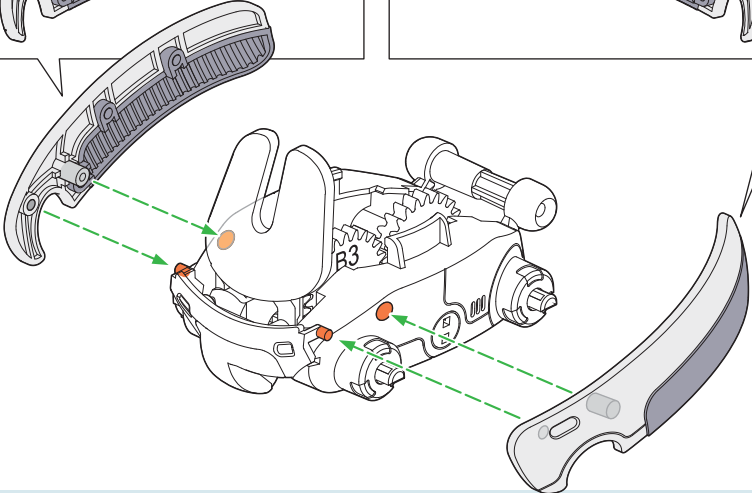
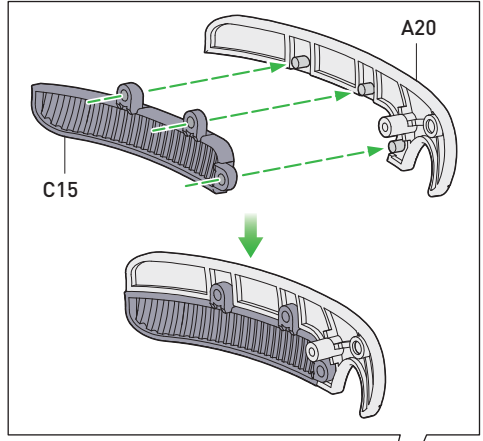
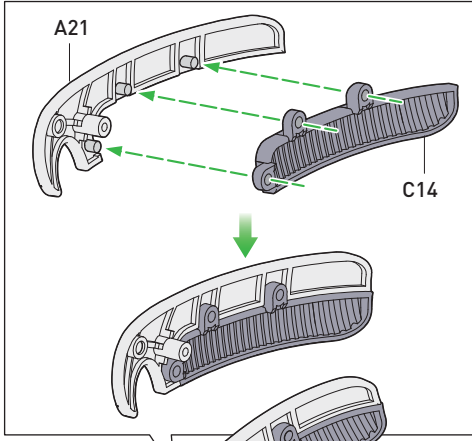


4

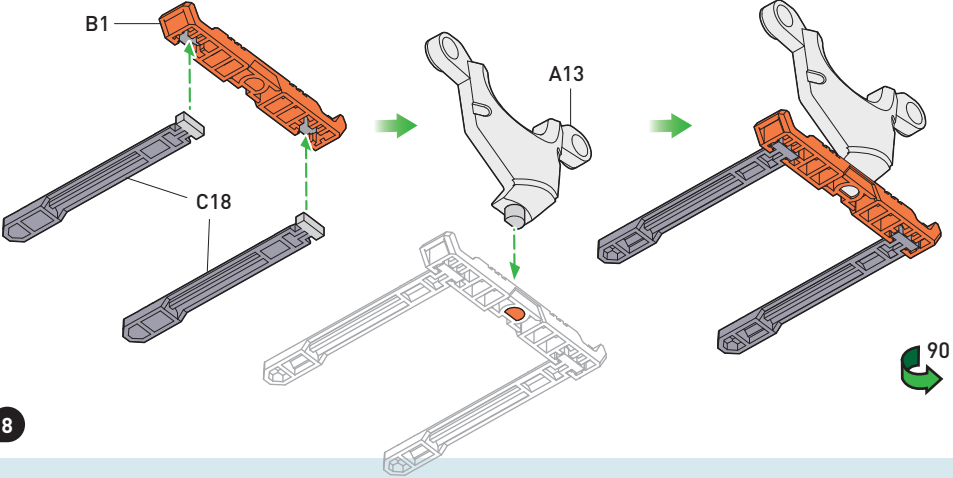




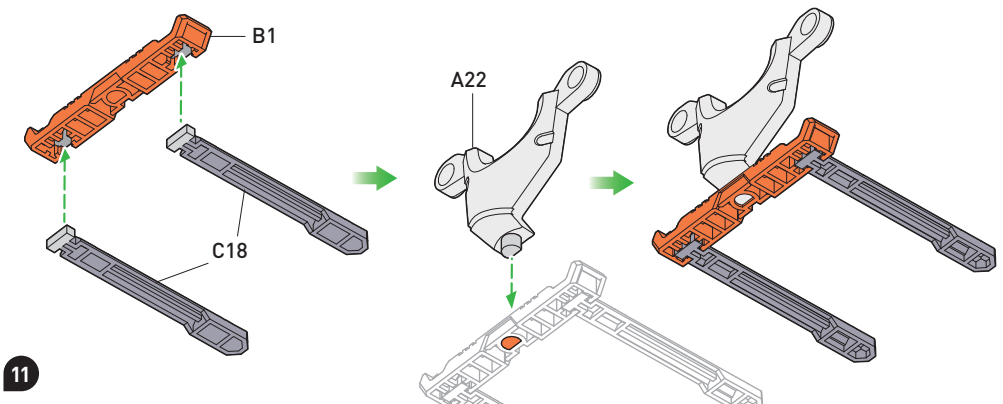
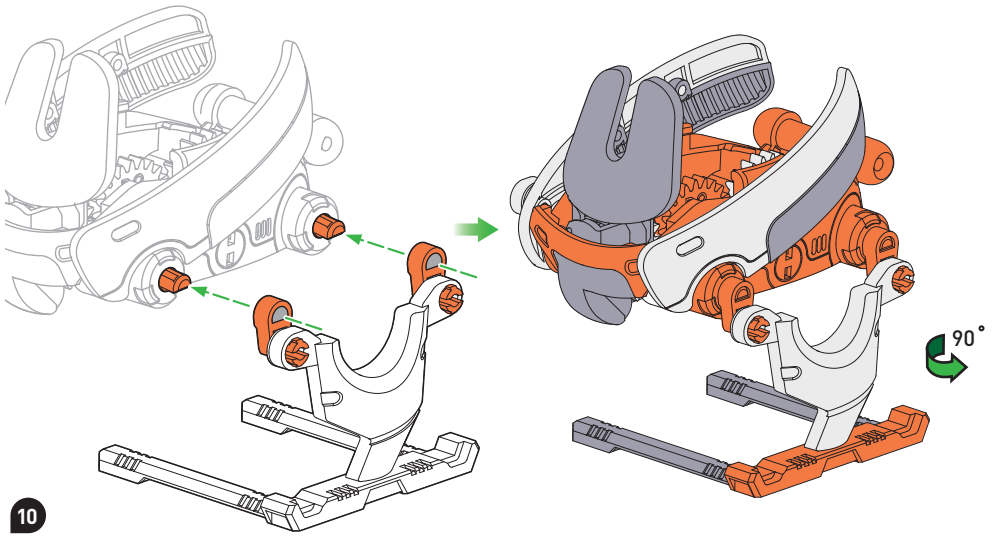
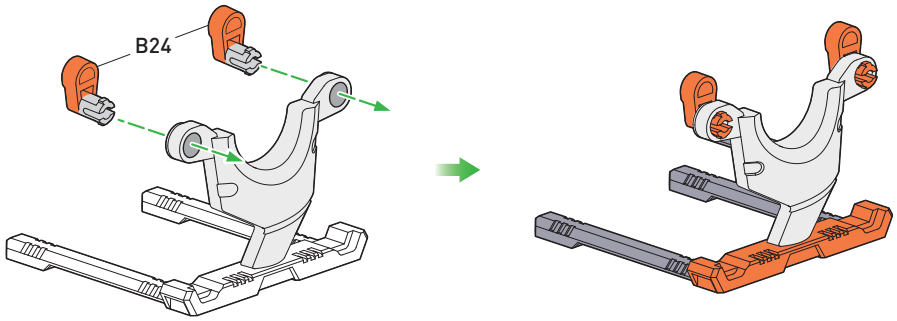


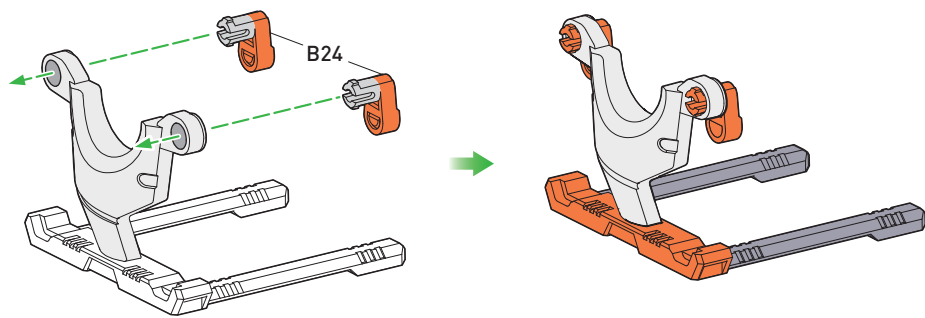


7

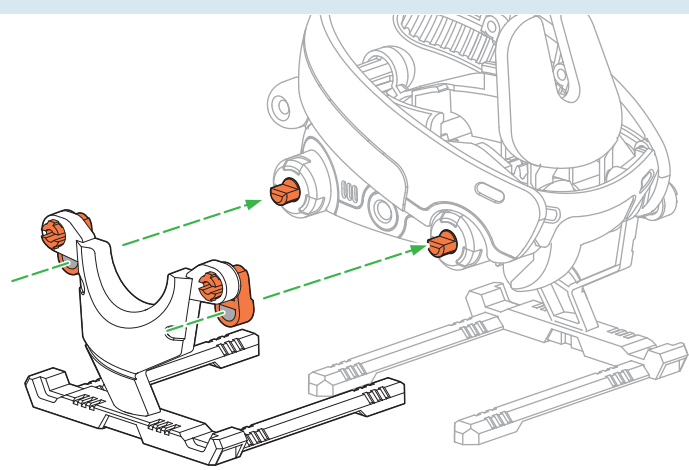


8

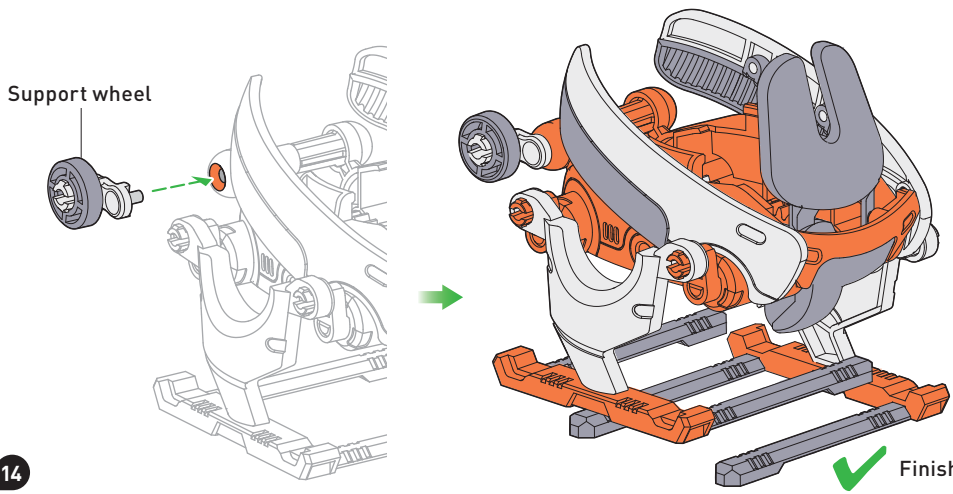




12



13

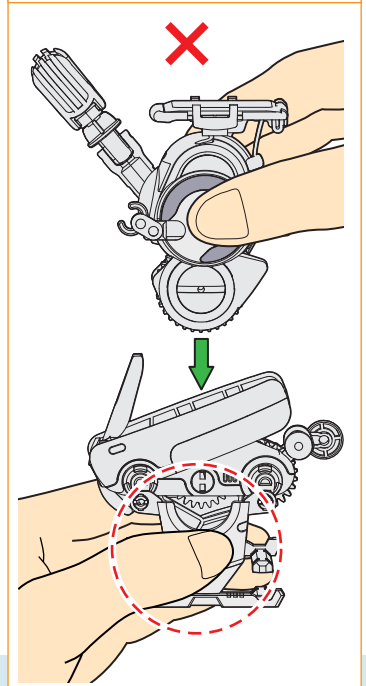
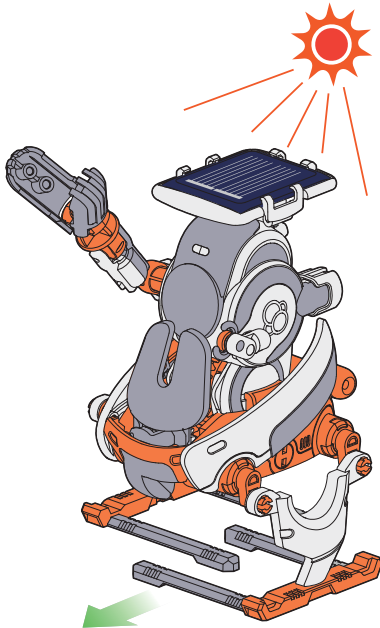
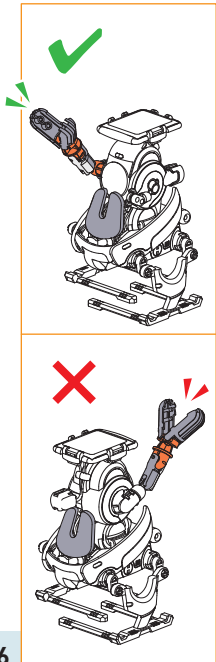
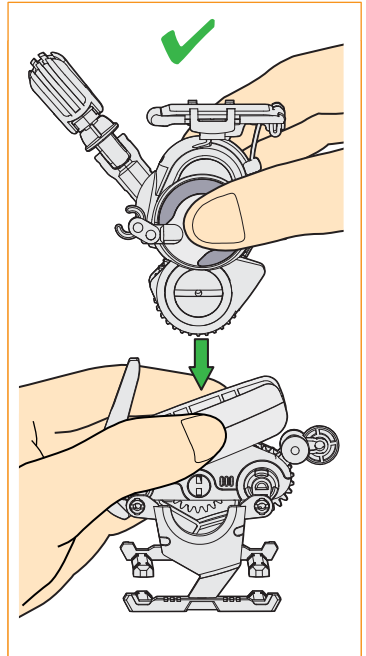
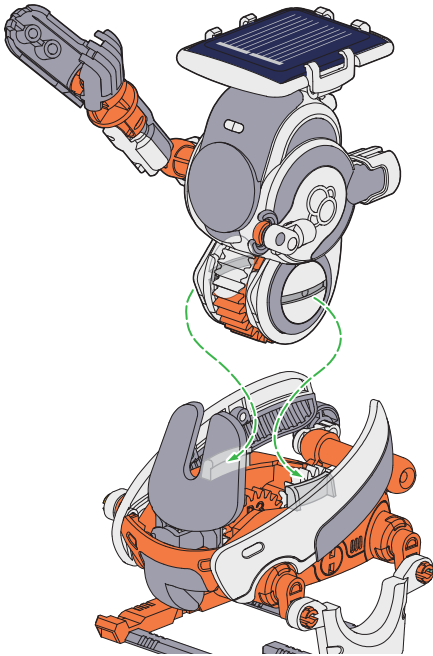


14

Finished

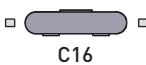


## HERE'S HOW

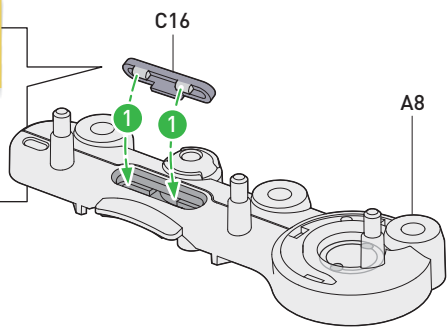


**ASSEMBLING THE BUG BOT**

**!** Remove all burrs.



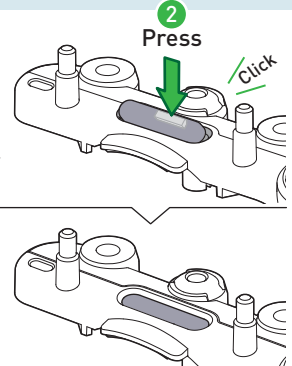
C16



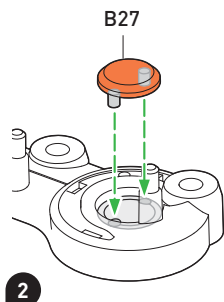
A8

**2** Press

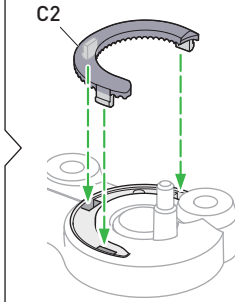
Click

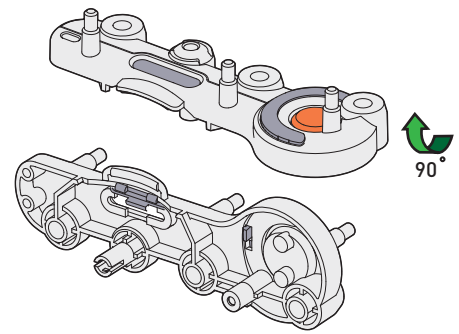


B27



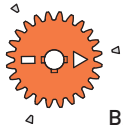
C2





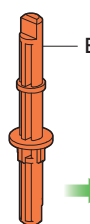
90°

**!** Remove all burrs.



B2

B16

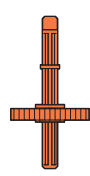


B2

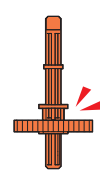
Actual size

**2x**

✓

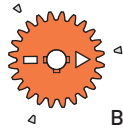


✗



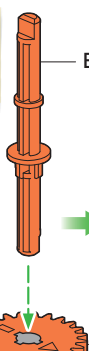
**3**

**!** Remove all burrs.



B2

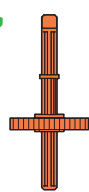
B14



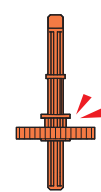
B2

Actual size

✓



✗

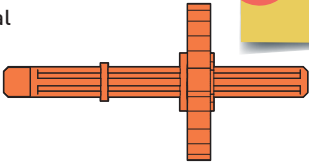


**4**

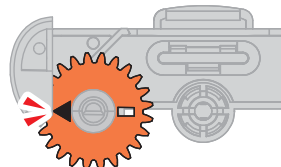
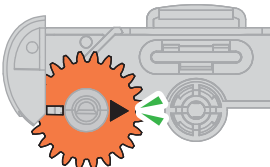
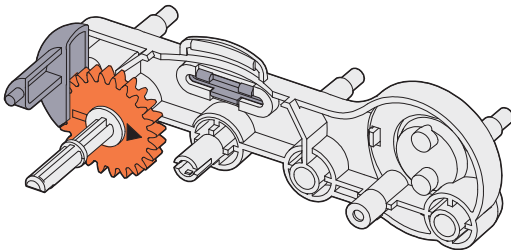
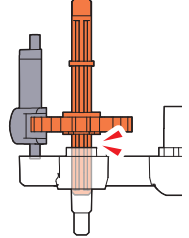
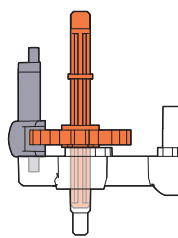
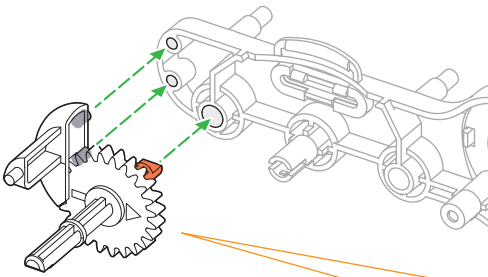
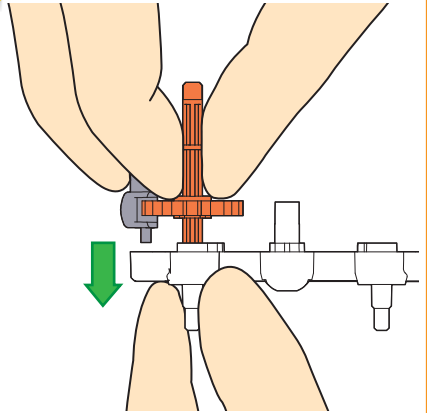
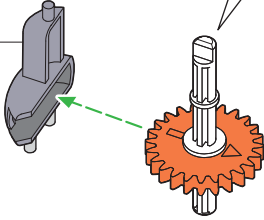


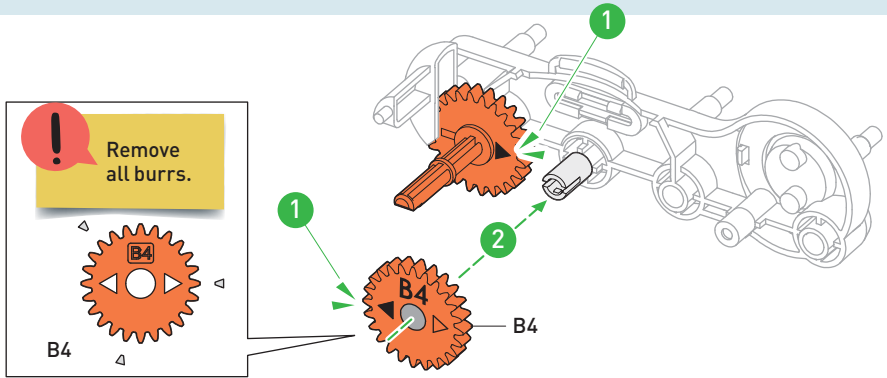
**!** Note: This is the shorter gear/axel combination

Actual size

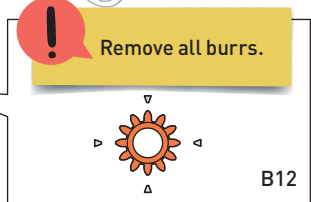
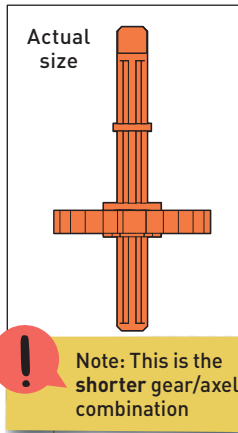
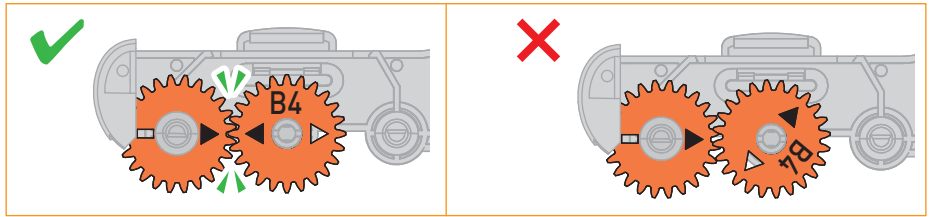


C26

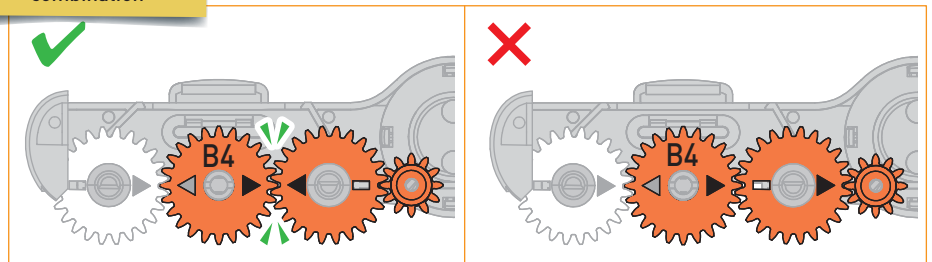




6

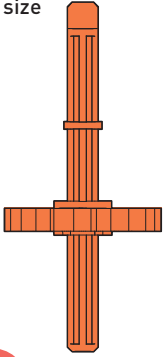


7

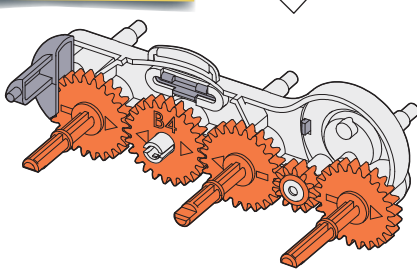
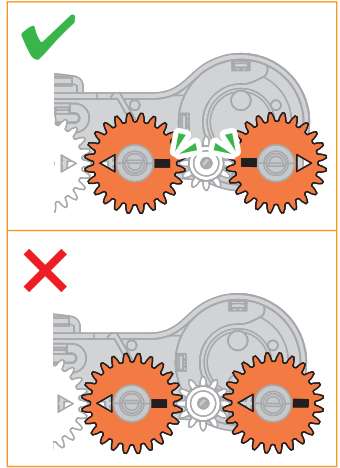
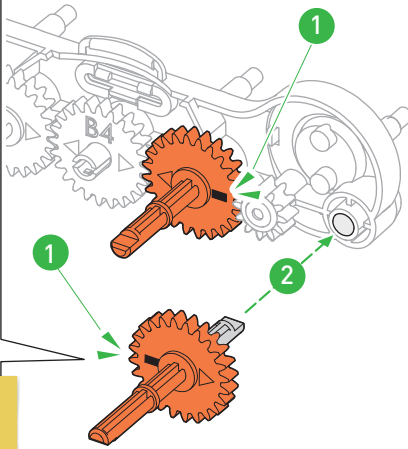




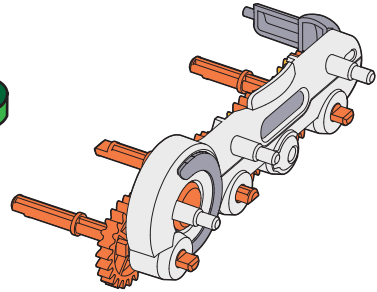
Actual size



**!** Note: This is the longer gear/axel combination



90°



8

**!** Remove all burrs.

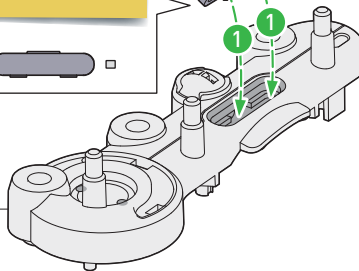
C16



C16



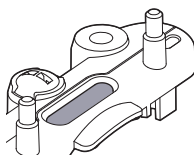
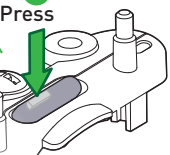
A4



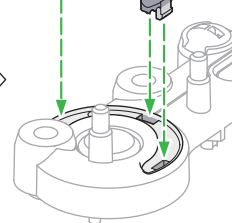
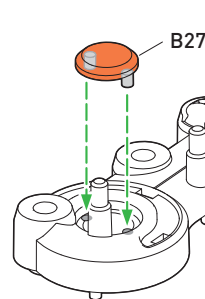
2

Press

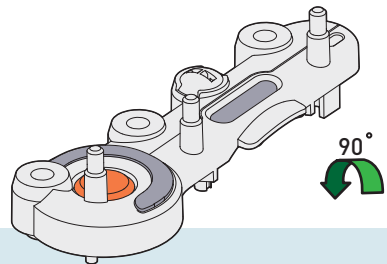
Click



9

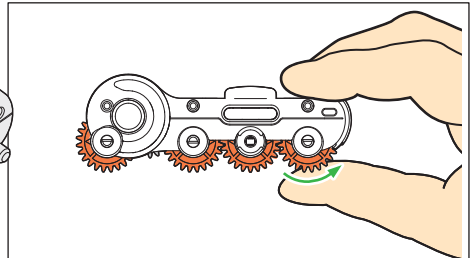
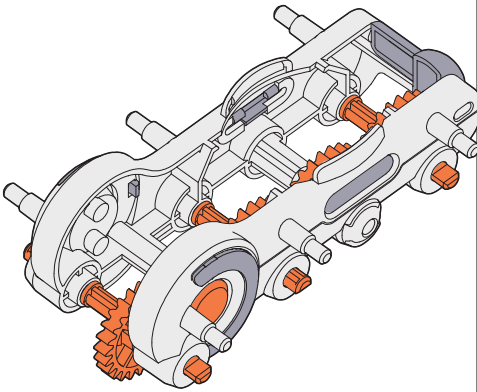
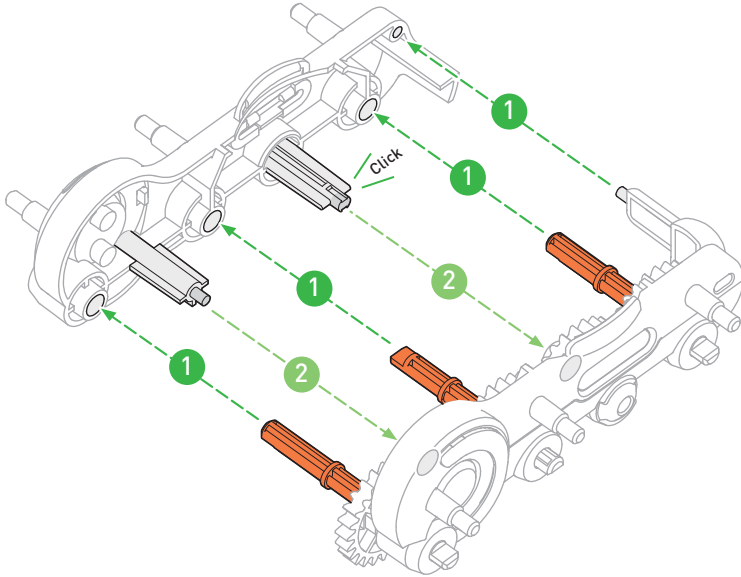


10

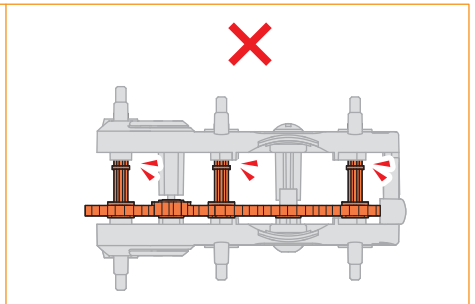
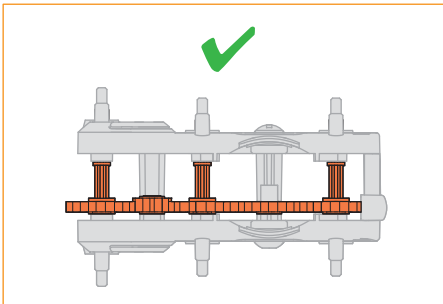


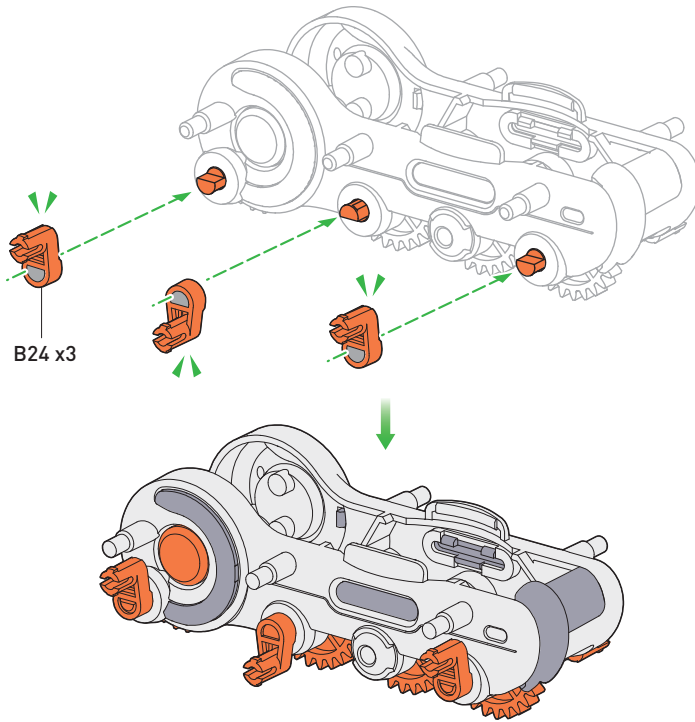
90°



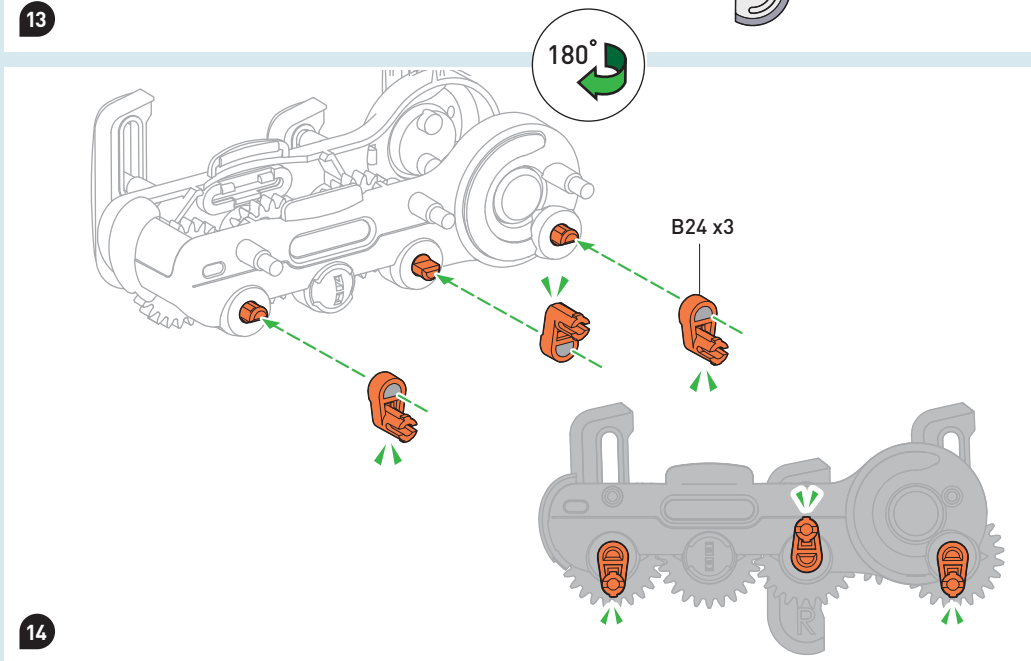
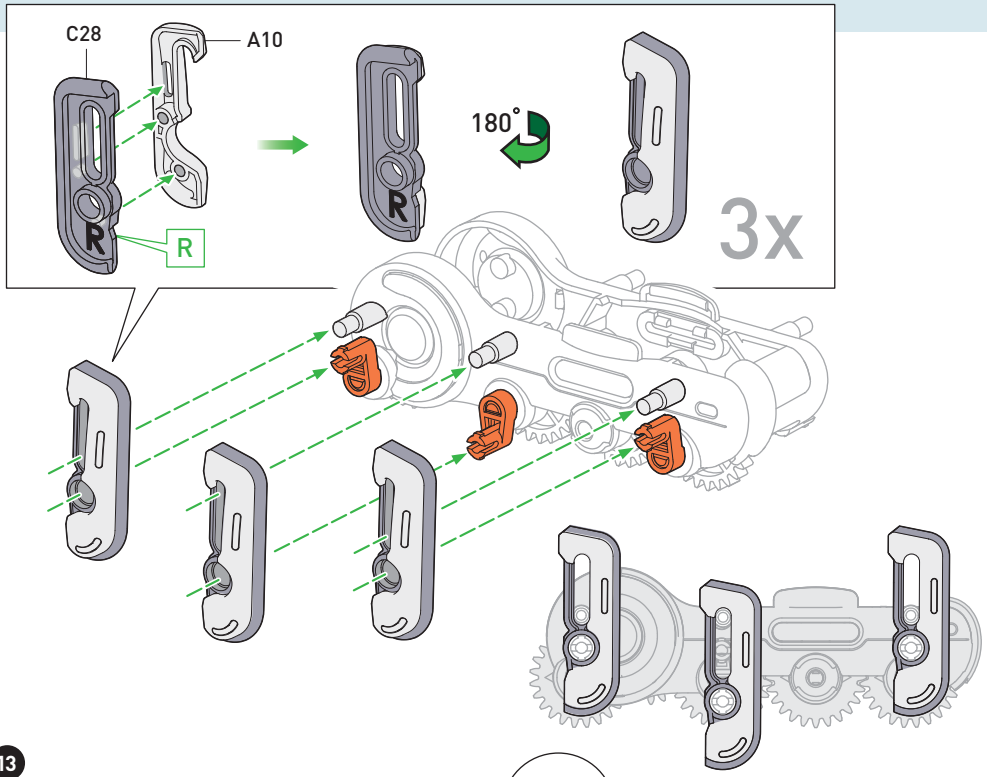


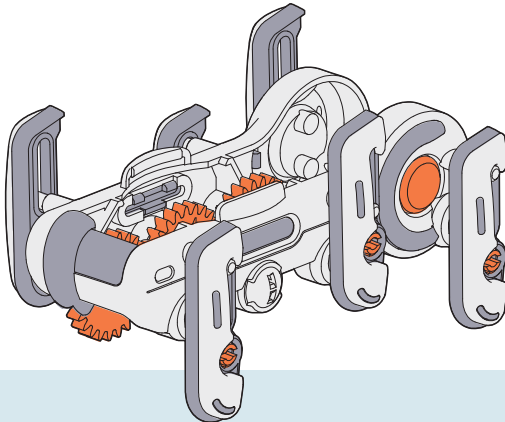
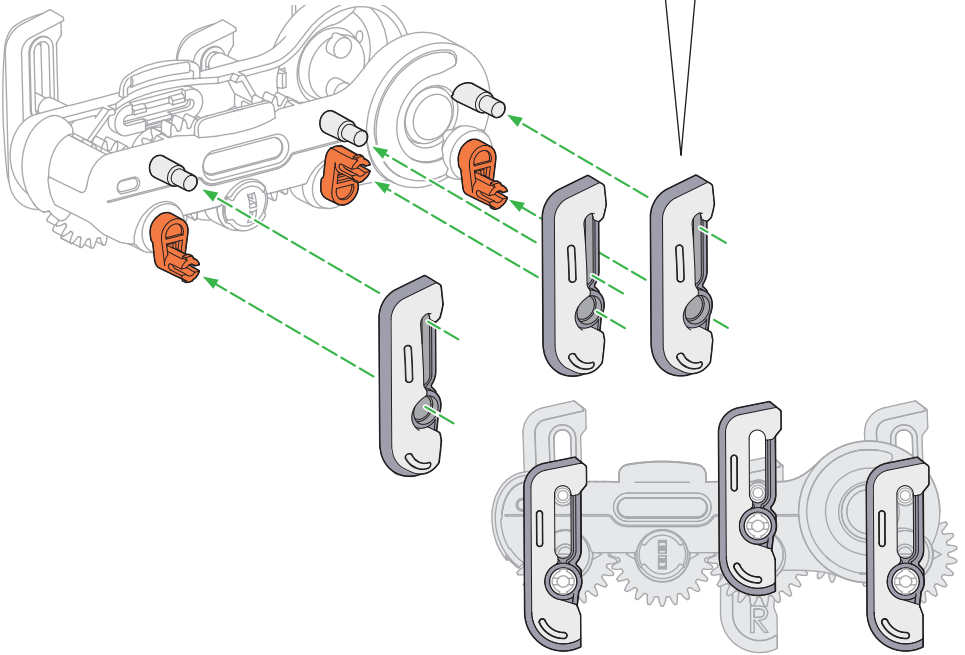
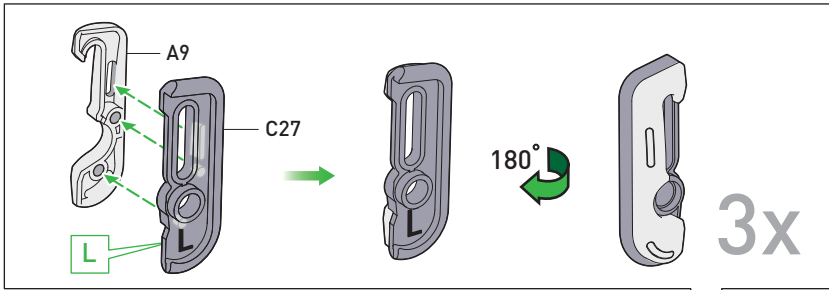
Test that gears move smoothly. If they stick, check if there are burrs left on the gears, and remove them.





	<p>Place the B24 parts exactly as shown. If you cannot orient the pieces this way, double check the assembly steps on pages 28 – 30.</p>

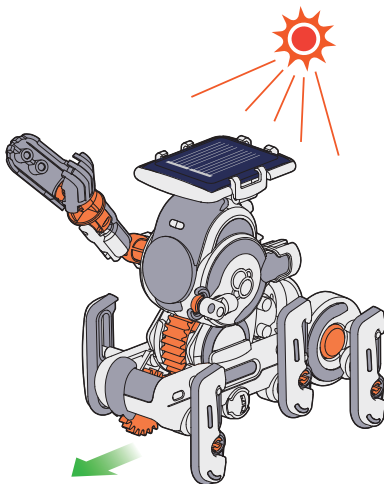
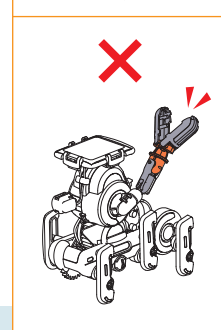
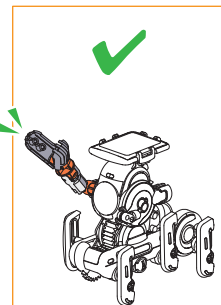
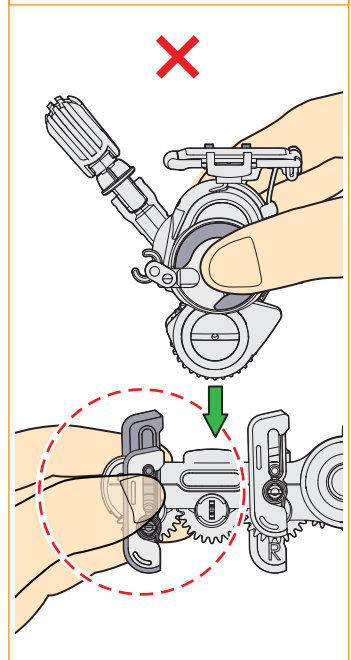
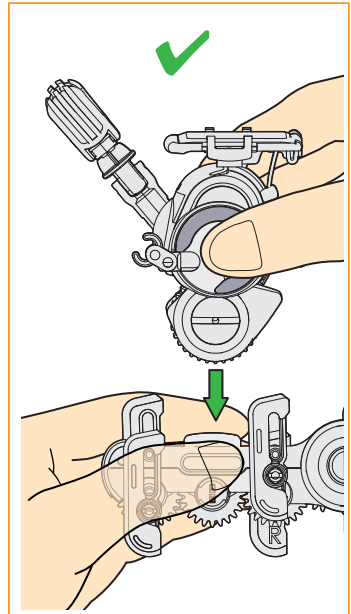
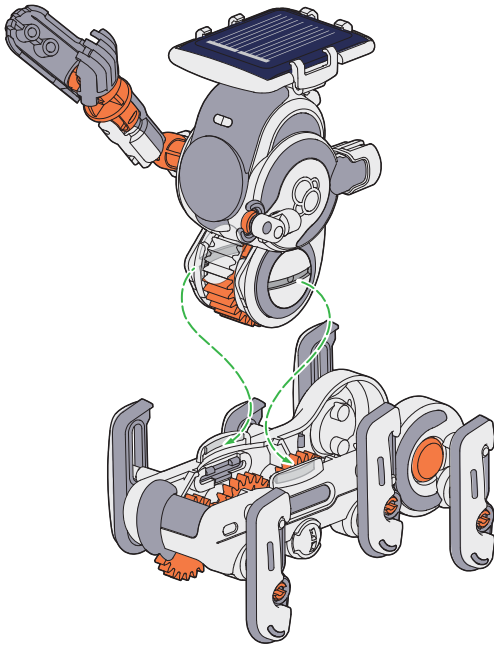




✓ Finished



### HERE'S HOW





## CHECK IT OUT

# Energy FROM SPACE

The Sun is a star 150 million kilometers from Earth. Despite this immense distance, solar energy has a huge effect on our lives. Without the sun, life on our planet would not exist!

The Sun emits so much energy because it's a giant nuclear reactor. It is so hot on the inside that its atoms — the building blocks of all matter — fuse together. This radiates an enormous amount of energy out into space. A small part of this radiation hits Earth's surface. We call it sunshine.

## Amazing 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 8,000 times the energy consumption of all of humanity (as of 2023).

A large portion of the solar energy is reflected or absorbed by the atmosphere. The rest of this sunlight hits Earth's surface and can be used to generate electricity.

Solar radiation  
342 W/m<sup>2</sup>

67 W/m<sup>2</sup>  
is absorbed  
by the  
atmosphere.

77 W/m<sup>2</sup>  
is reflected  
by the  
atmosphere.

30 W/m<sup>2</sup> is reflected  
off the ground.

168 W/m<sup>2</sup>  
is absorbed by the  
Earth's surface.

W/m<sup>2</sup> = Watts per  
square meter



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