



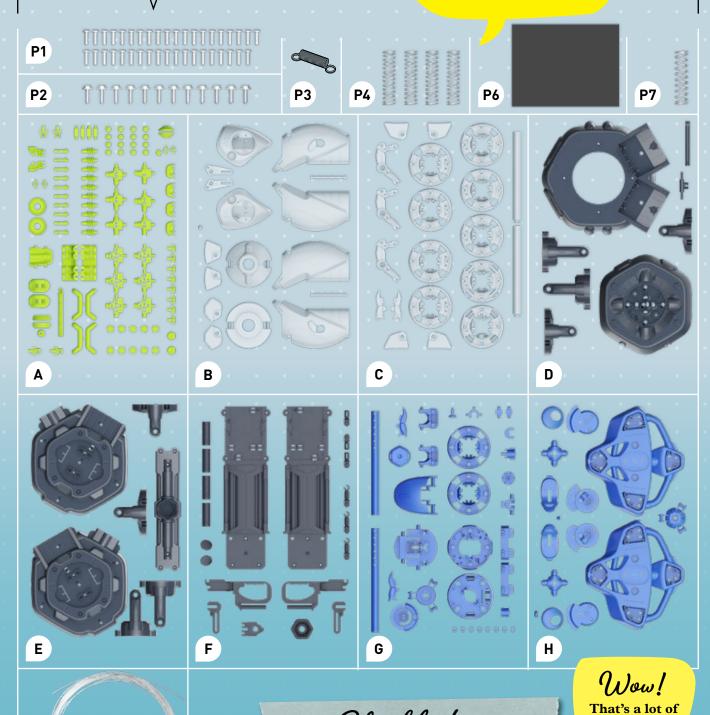
Scan this QR code for a full assembly video.



# Good to know!

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

### What's inside your experiment kit:





#### YOU WILL ALSO NEED:

Small Phillips-head screwdriver, diagonal cutter or scissors and nail file, pen, ruler (there is a ruler printed on the box)

:

# Checklist:

J	No.	Description	Quantity	Item No.
0	P1	Screw	39	728707
0	P2	Wide-headed screw	12	728707
0	Р3	Tension spring	1	728708
0	P4	Spring, stronger (14 coils)	4	728708
0	P5	Nylon cable (approx. 800 cm)	1	728706
0	P6	Sheet of foam pads	1	728708
0	P7	Spring, weaker (10 coils)	1	728708
0	Α	Frame A with parts A1 – A25	1	728698

parts!

Kit Contents

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#### USING THE BIONIC ROBOTIC ARM

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J	No.	Description	Quantity	Item No.
0	В	Frame B with parts B1 – B15	1	728702
0	С	Frame C with parts C1 – C10	1	728699
0	D	Frame D with parts D1 – D6	1	728700
0	Е	Frame E with parts E1 – E5	1	728703
0	F	Frame F with parts F1 – F13	1	728701
0	G	Frame G with parts G1 – G26	1	728704
0	Н	Frame H with parts H1 – H11	1	728705

#### **WARNING!**



WARNING. Not suitable for children under 3 years. Choking hazard — small parts may be swallowed or inhaled. Strangulation hazard — long cables may become wrapped around the neck.

Keep the packaging and instructions as they contain important information.

# HOW TO CORRECTLY TIGHTEN SCREWS

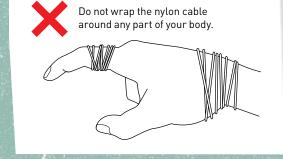
Use a screwdriver in the correct size (e.g. PH1). Pay attention to the following instructions in order to properly install the screws:

- Place the screwdriver in the head of the screw.
- Turn the screws clockwise.
- If you feel resistance, continue turning a bit further, until the screw is secure.

#### Always tighten screws completely!

If they are not securely tightened, pieces may come loose and the model may not function correctly.

# Do not use a blade to adjust or cut the nylon string. Use scissors or a diagonal cutter instead.



#### 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 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.



## **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 the safety instructions.

Support your child with advice and a helping hand, especially during tricky assembly steps or experiments. Some assembly steps require more strength, which you may need to provide.

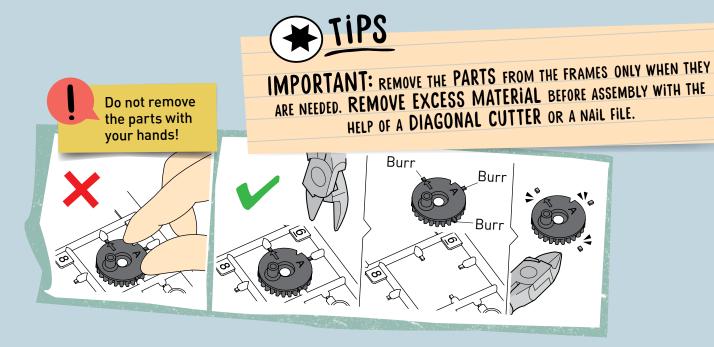
Building this model is an exciting and educational project that requires several hours to complete. Go slowly and take plenty of breaks. It's a good idea to break up the assembly over several days. It's best to work on the assembly somewhere where you can leave the materials out until it is completed, so that it won't need to be repeatedly moved or packed and unpacked.

To prevent damage to the work surface on which your child is building, provide them with a mat or other surface protection.

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 help with assembly, we have created videos of difficult assembly steps that can be viewed by scanning the respective QR codes with a mobile device (cell phone or tablet) with Internet access. With your permission, your children can use these videos to guide construction.

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





The Bionic Robot Arm can do lots of cool things completely without electricity! We've even prepared a little game for you! But before you can play, the Bionic Robotic Arm must be assembled.

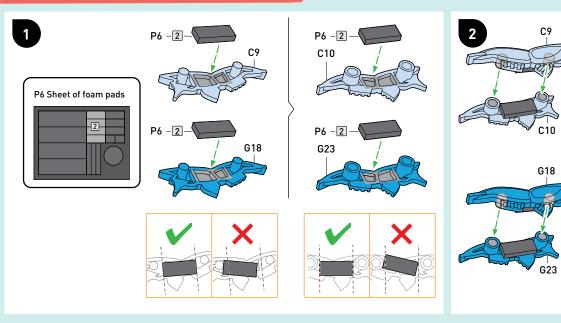
The Bionic Robotic Arm has a complex mechanical construction that requires patience and persistence to build. Assembly is exciting and takes several hours. Go through the steps carefully, take regular breaks, and get help from an adult when necessary so that everything works smoothly in the end!

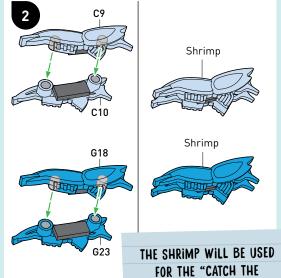
HOW LONG WILL THIS TAKE?						
Shrimp and adjustment tool	10-20 min	Eel head and claw	30-40 min			
Buckles	60-90 min	Upper body	60-90 min			
Right Joystick	60-90 min	Lower body	60-90 min			
Left Joystick	60-90 min	Final assembly and adjustment	60-90 min			





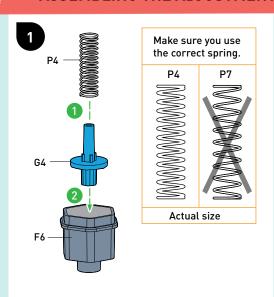
#### **ASSEMBLING THE SHRIMP**

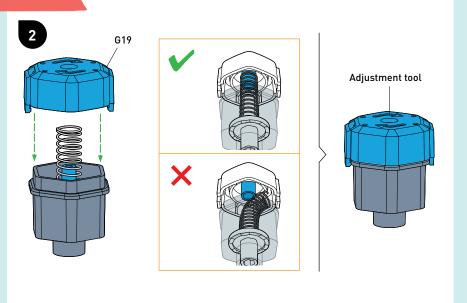




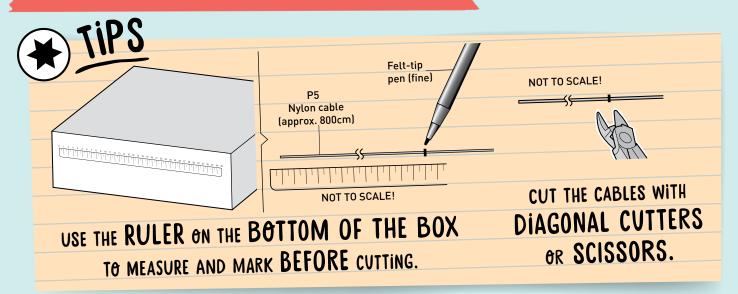
SHRIMP" GAME ON P. 60

#### **ASSEMBLING THE ADJUSTMENT TOOL**

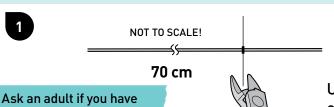




#### MEASURING AND CUTTING THE NYLON CABLE



#### **ASSEMBLING THE CABLE BUCKLES**



#### **CABLE BUCKLES**

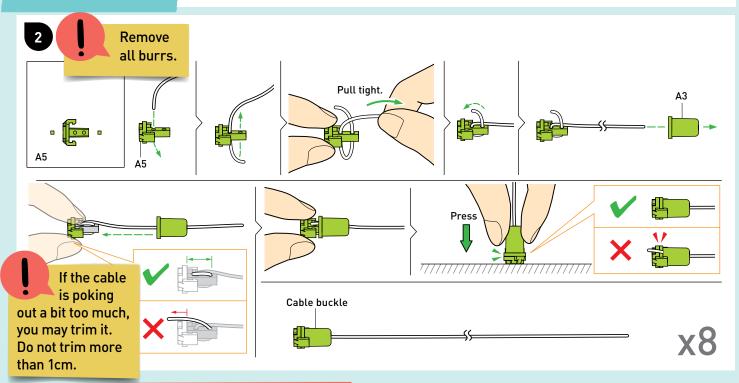
Scan this QR code to see a video of these steps.



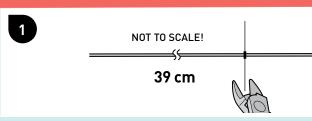
Ask an adult if you have trouble with these steps.

Using the ruler on the box, measure **70 cm** of the cable and cut.

**8**X



#### **ASSEMBLING THE GRIPPER BUCKLE**



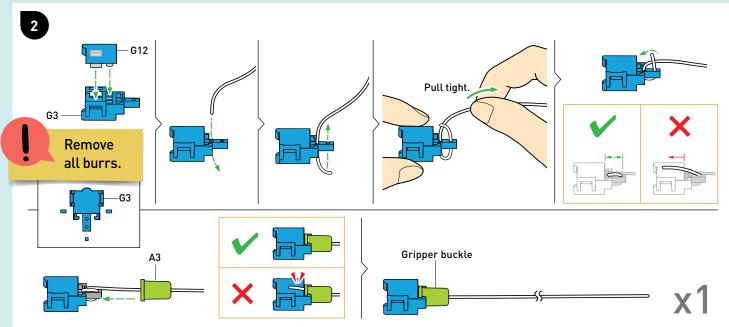
#### **GRIPPER BUCKLE**

Scan this QR code to see a video of these steps.



Using the ruler on the box, measure **39 cm** of the cable and cut.

x1





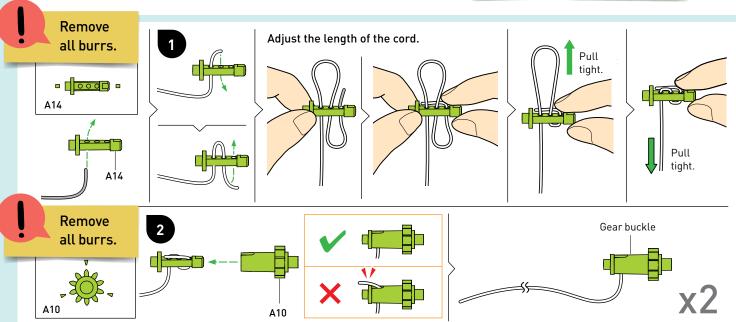
#### **ASSEMBLING THE GEAR BUCKLES**

Using the ruler on the box, measure 35 cm of the cable and cut.

x2

#### **GEAR BUCKLES** Scan this QR code to see a video of these steps.





#### **ASSEMBLING THE ROTARY BUCKLE**

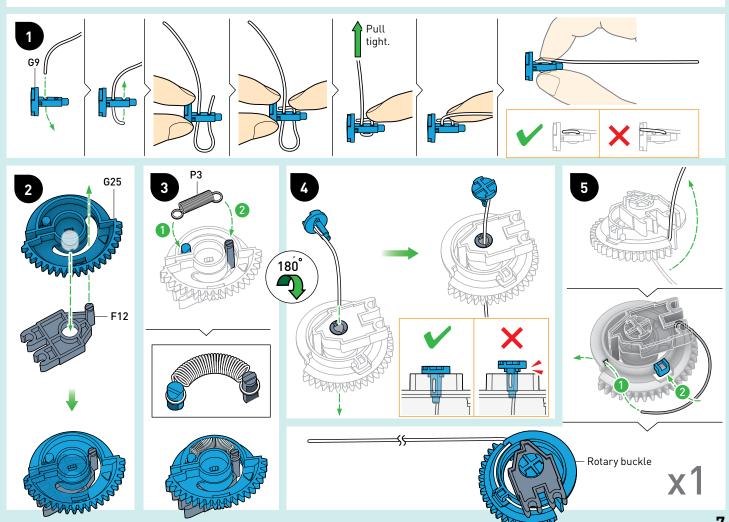
Using the ruler on the box, measure 47 cm of the cable and cut.

x1

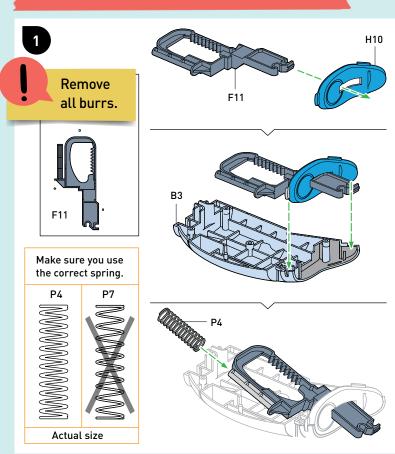
# **ROTARY BUCKLE**

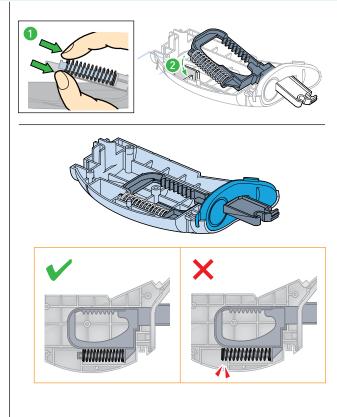
Scan this QR code to see a video of these steps.

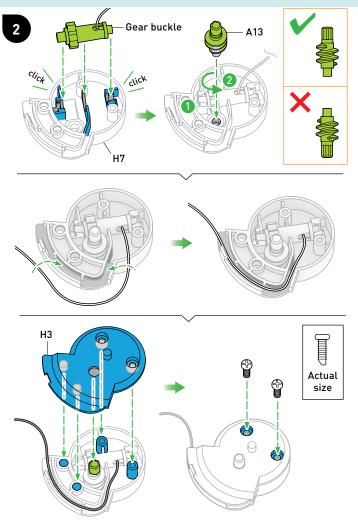


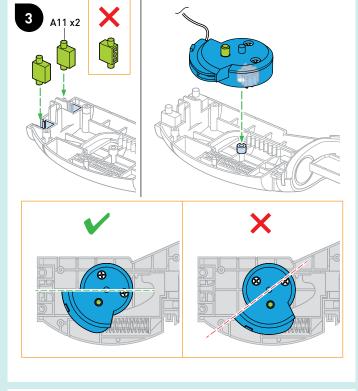


#### **ASSEMBLING THE RIGHT JOYSTICK**

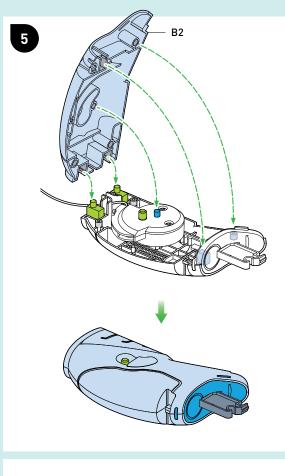


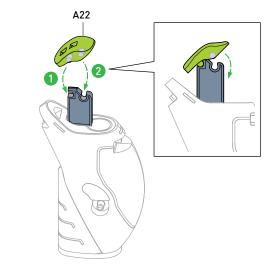


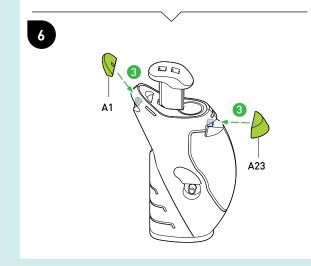


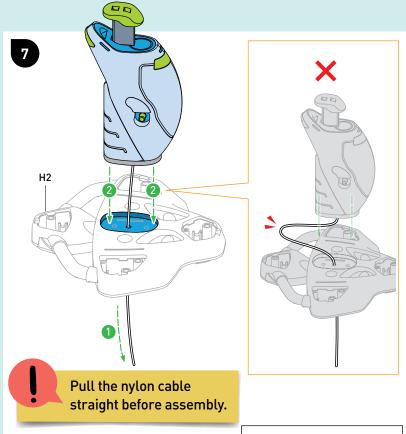


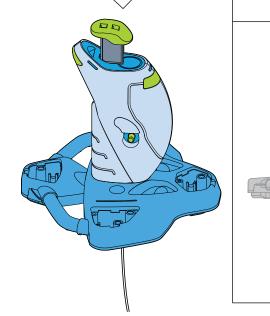


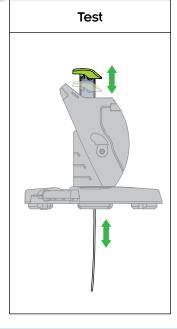


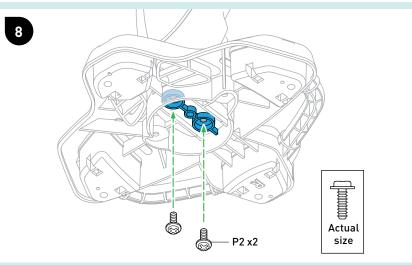


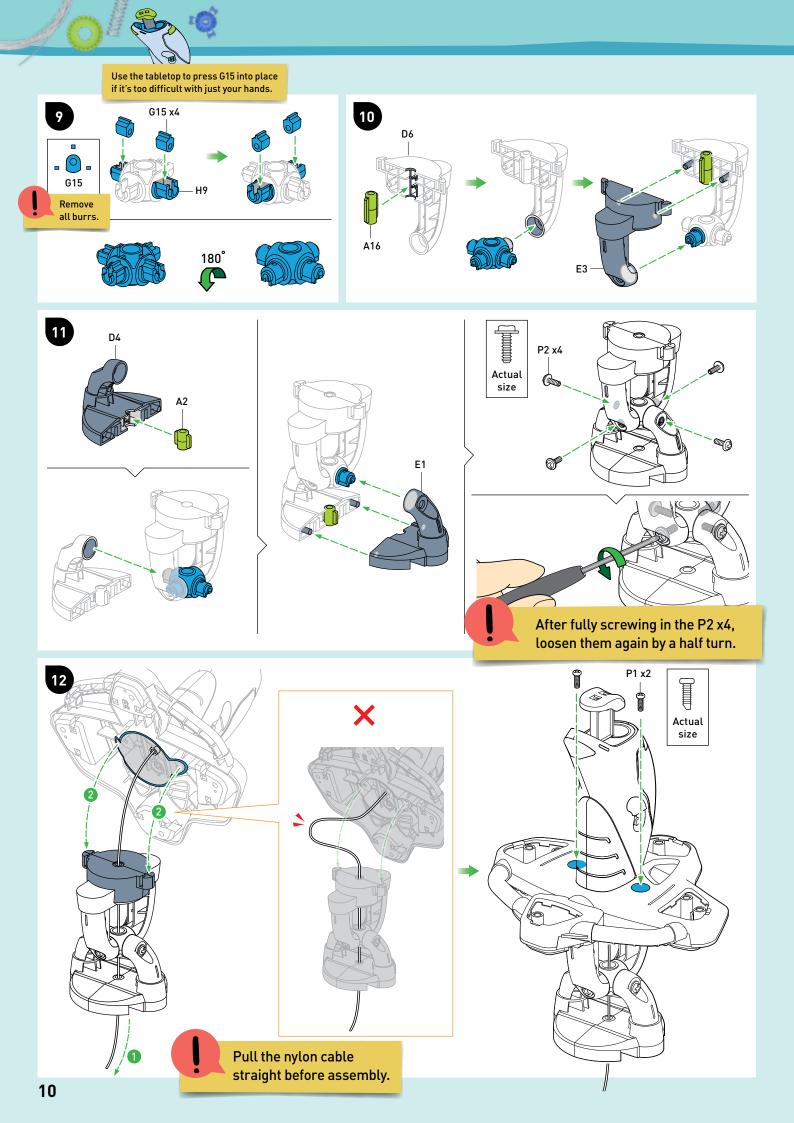




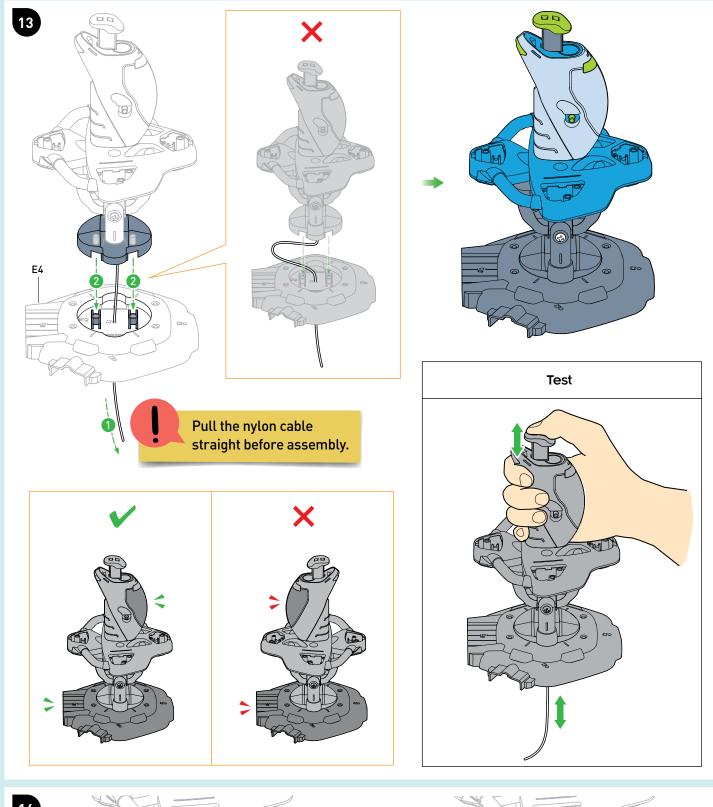


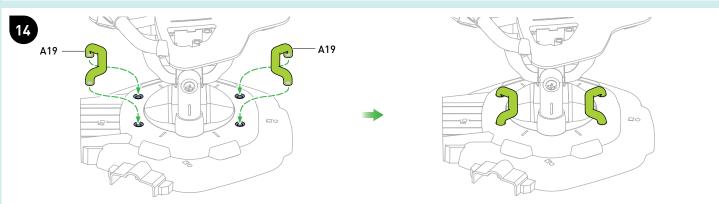




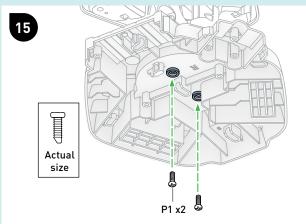


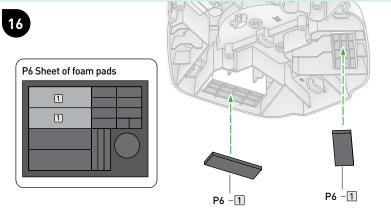


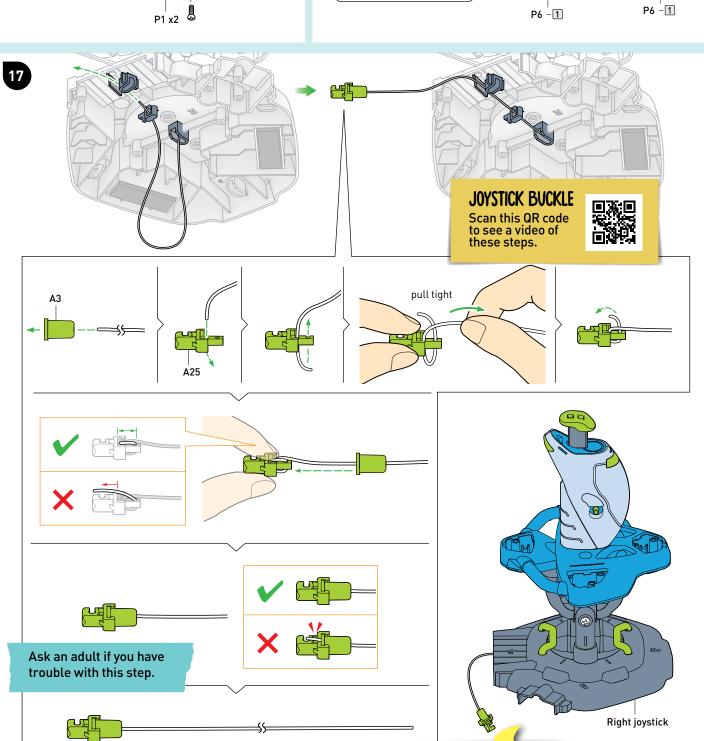










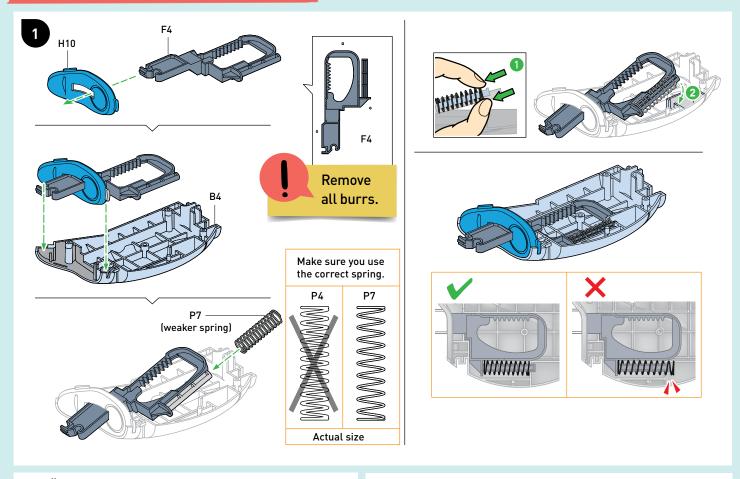


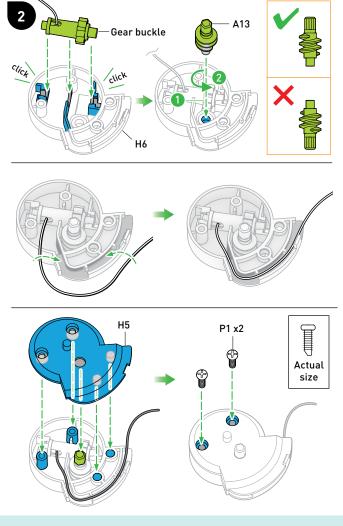
Nicely done!

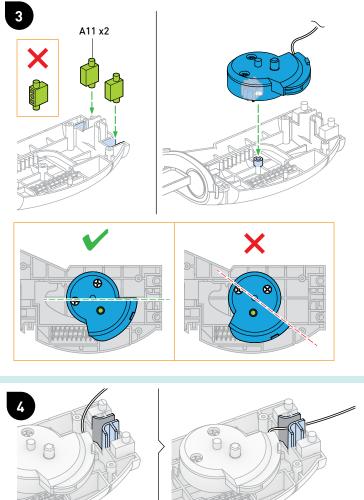
Consider taking a break before starting the next joystick.



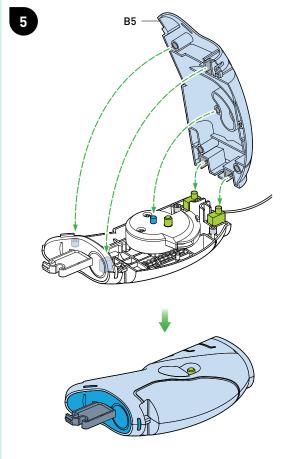
#### **ASSEMBLING THE LEFT JOYSTICK**

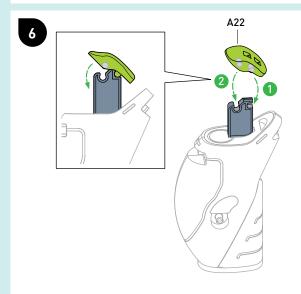




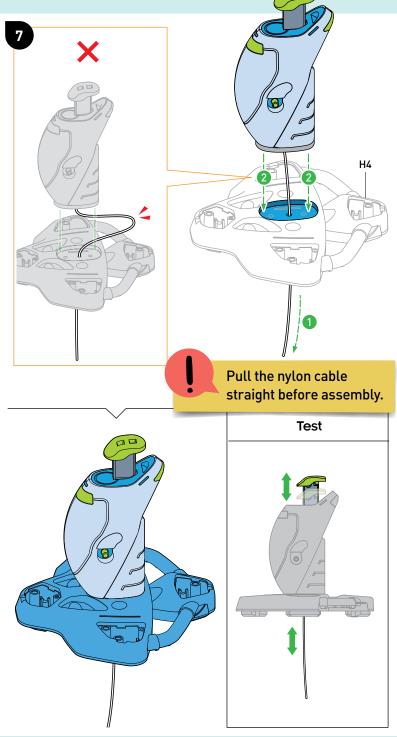


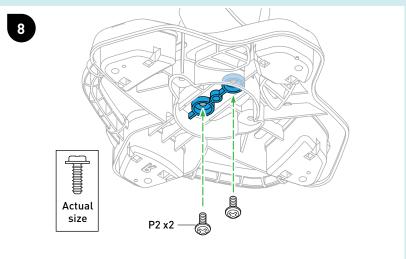




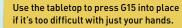


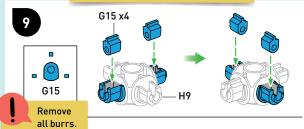


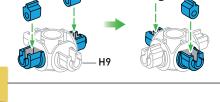








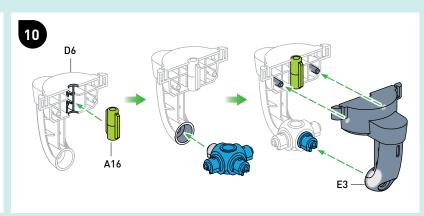


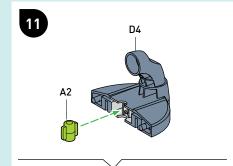


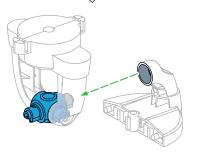


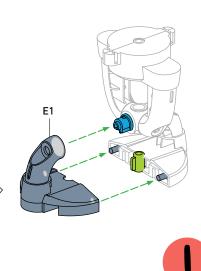


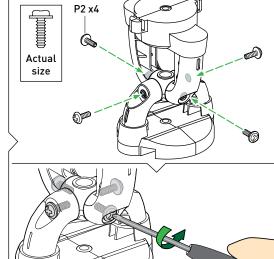




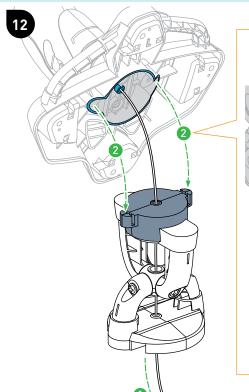


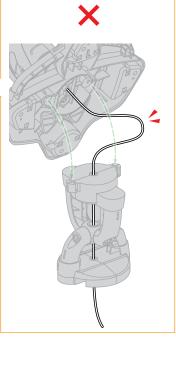


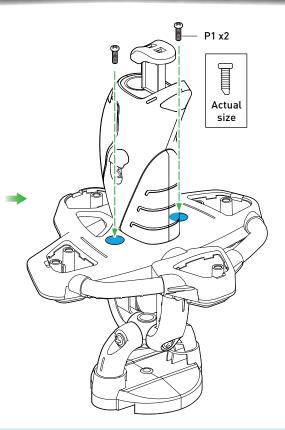




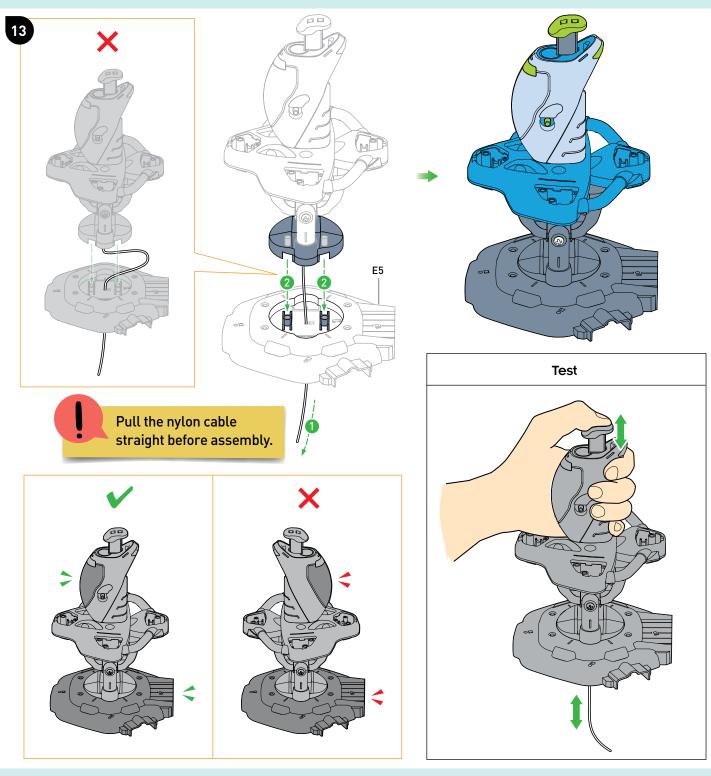
After fully screwing in the four P2s, loosen them again by a half turn.

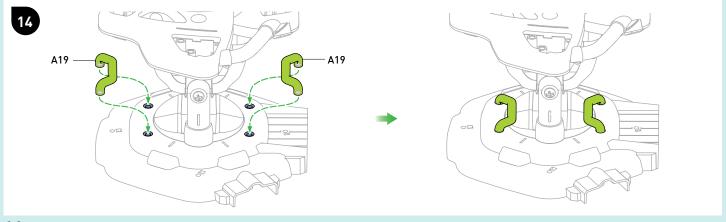


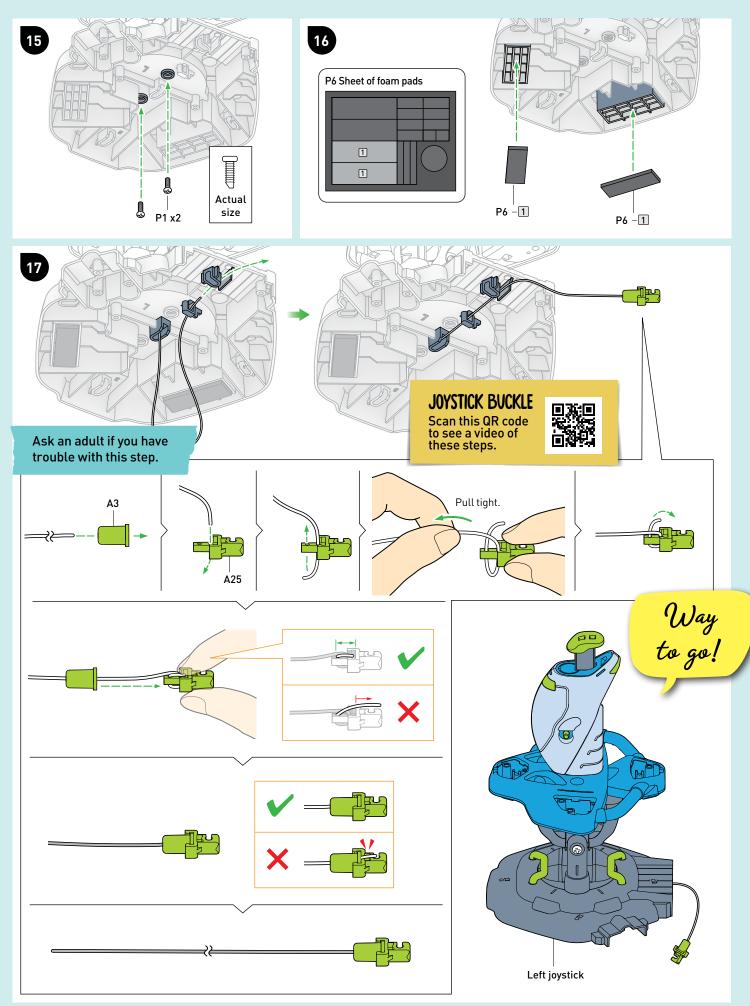




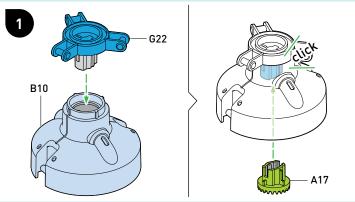


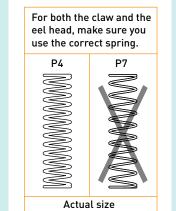


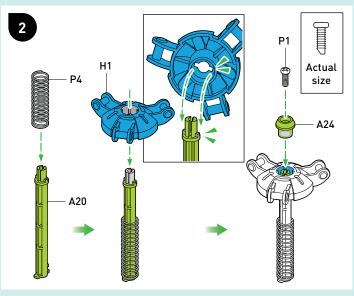


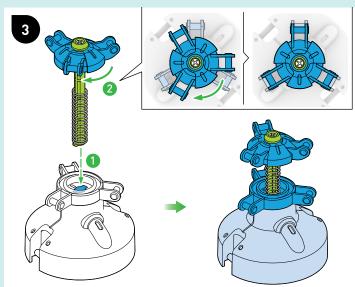


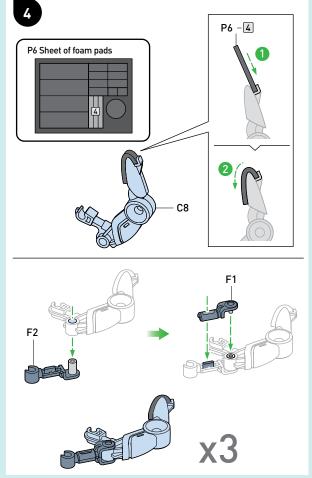
#### **ASSEMBLING THE CLAW**

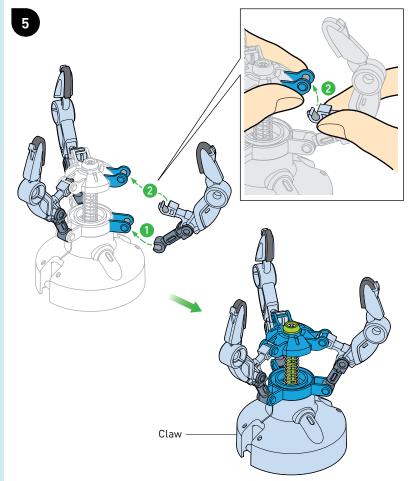






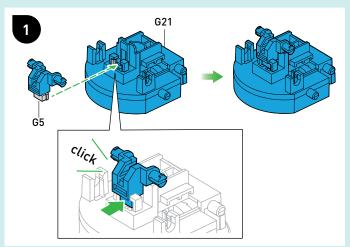


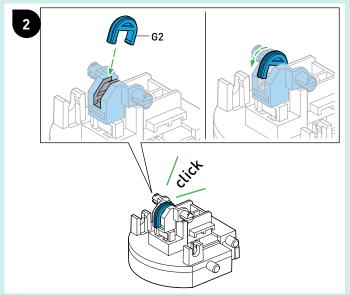


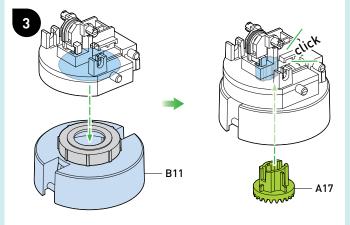


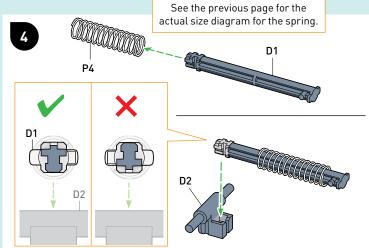


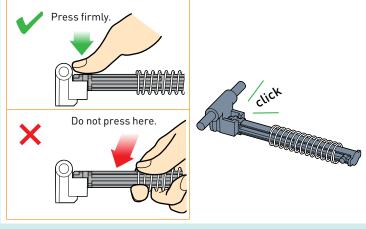
#### **ASSEMBLING THE GARDEN EEL HEAD**

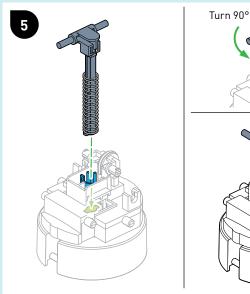


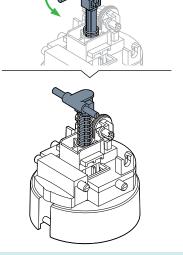


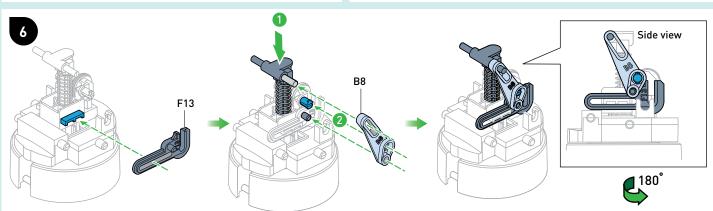




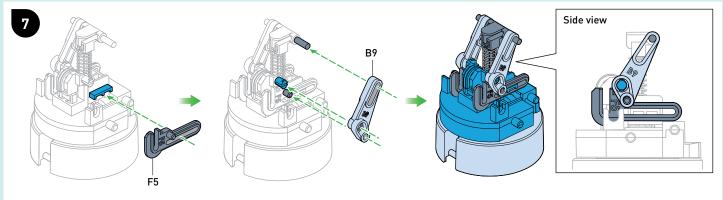


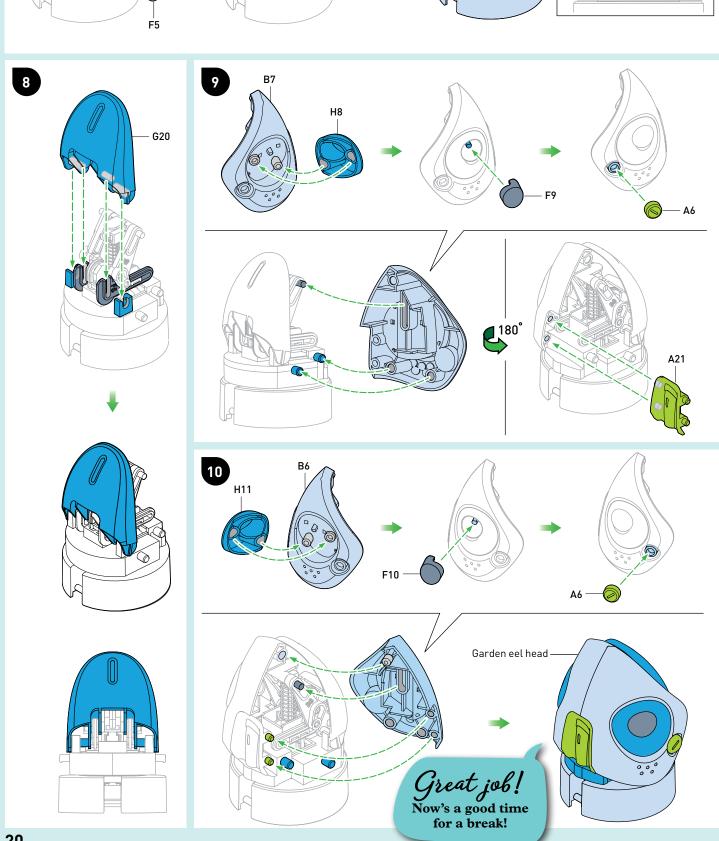




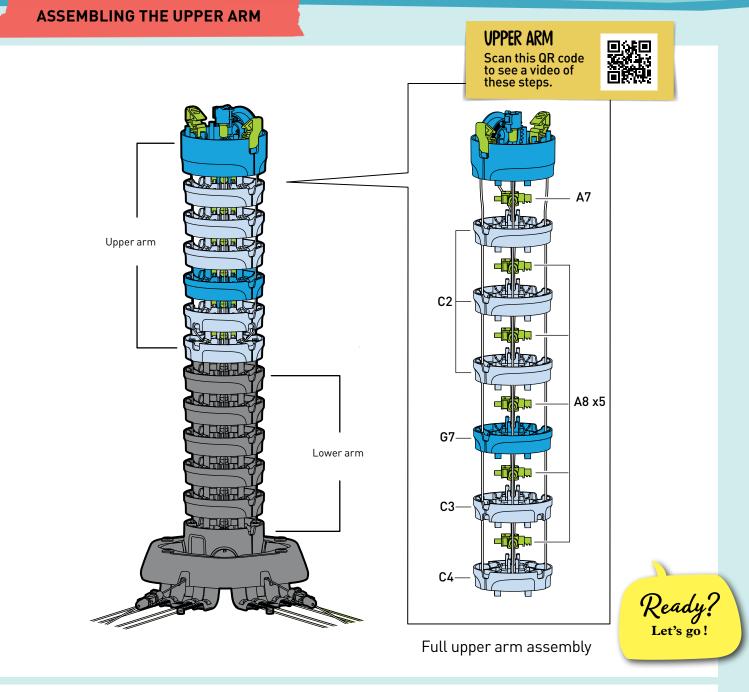


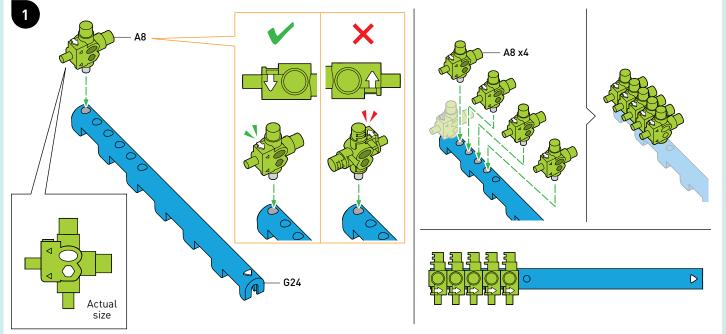




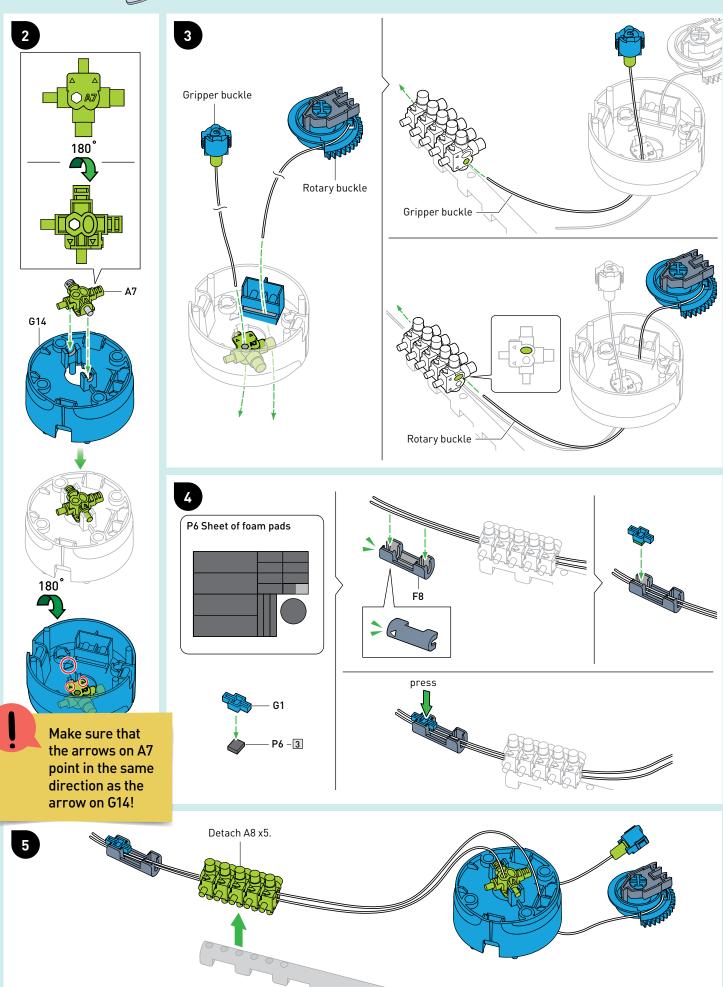




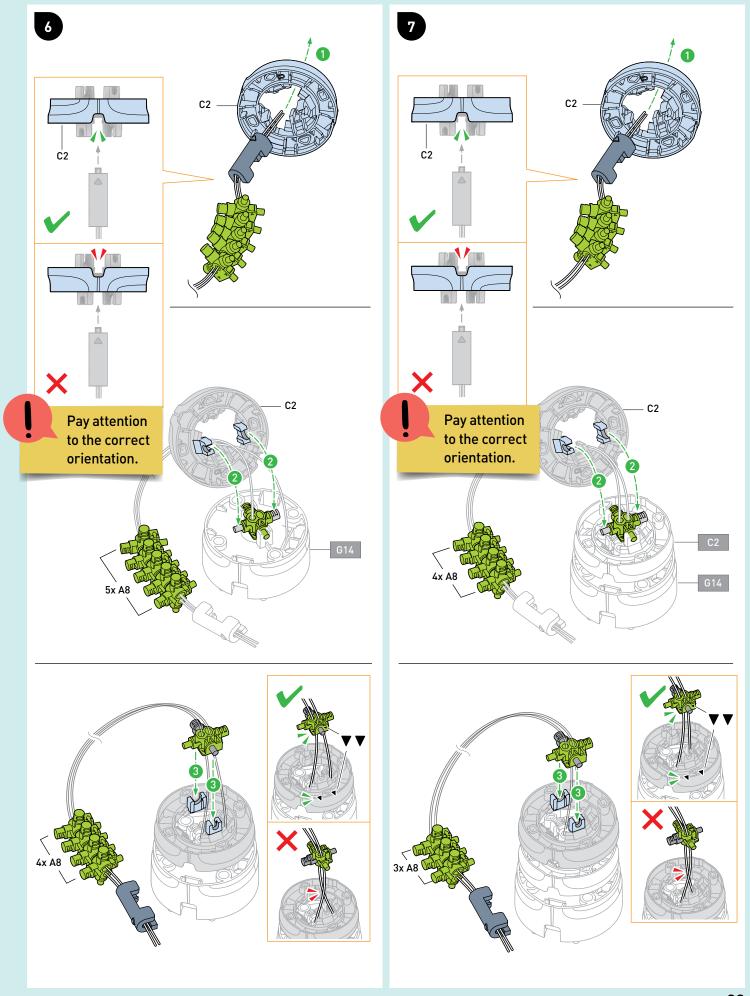




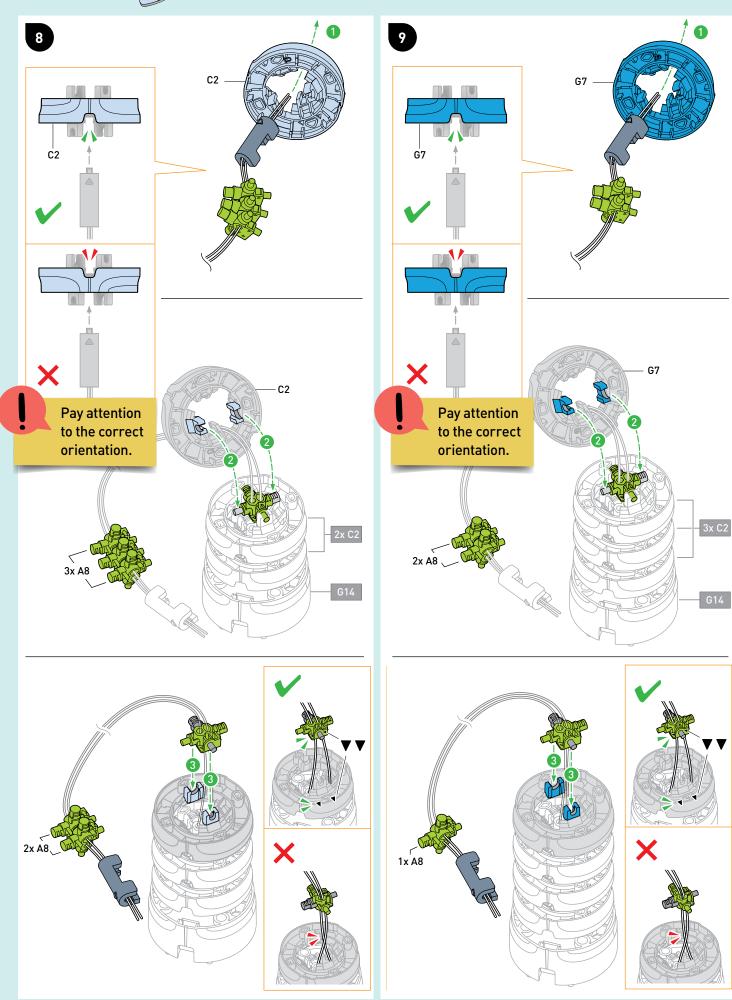




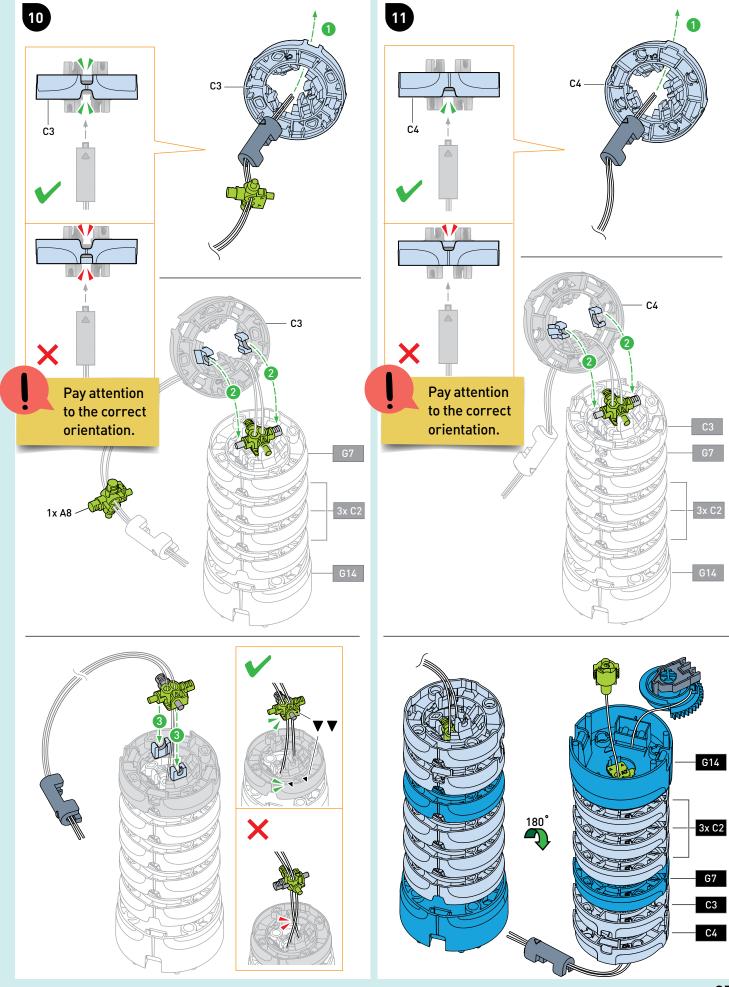




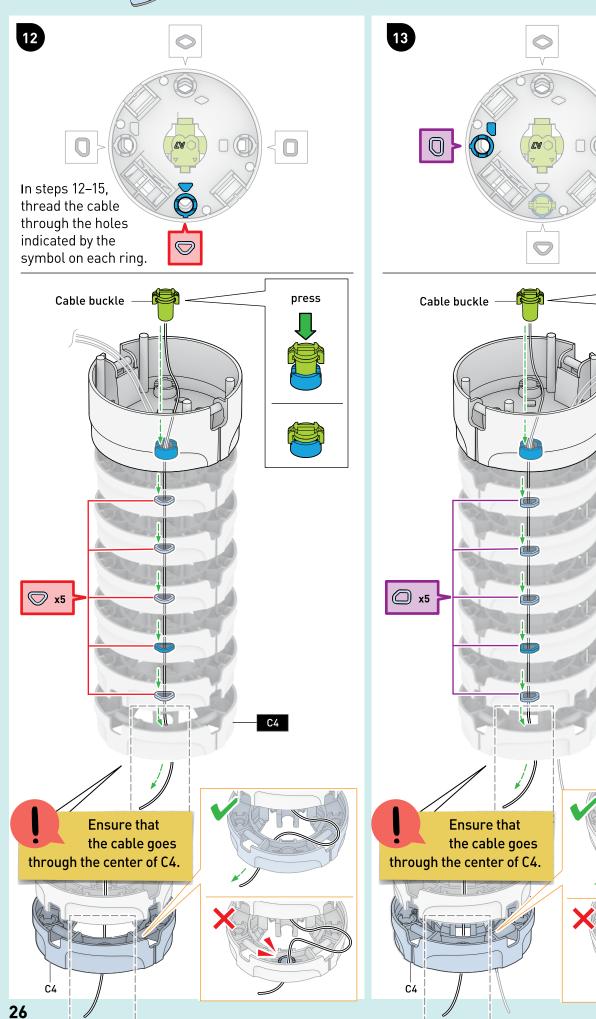






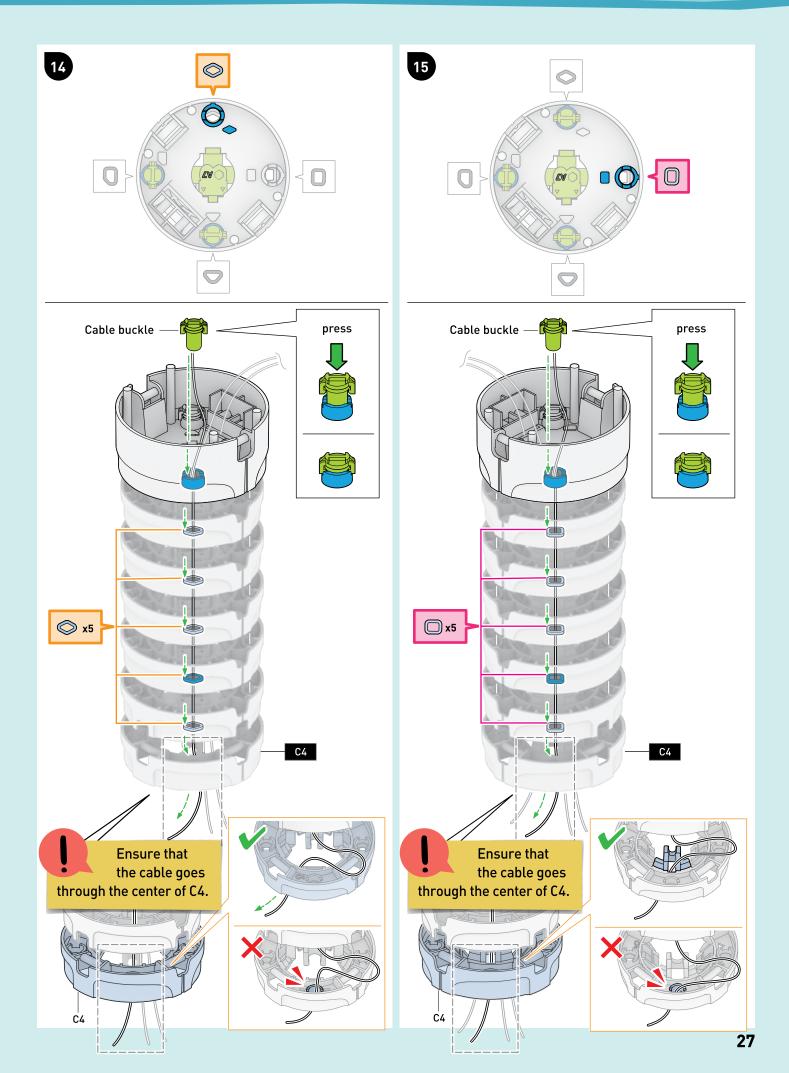




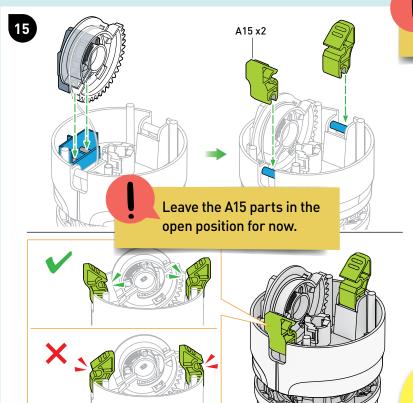


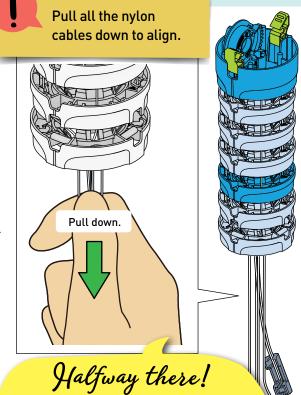
press

C4



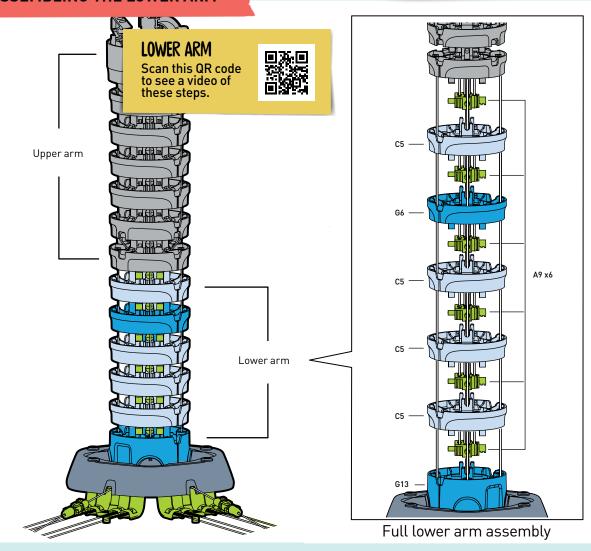




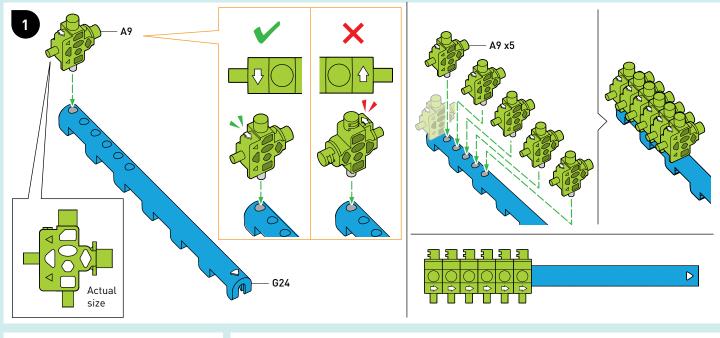


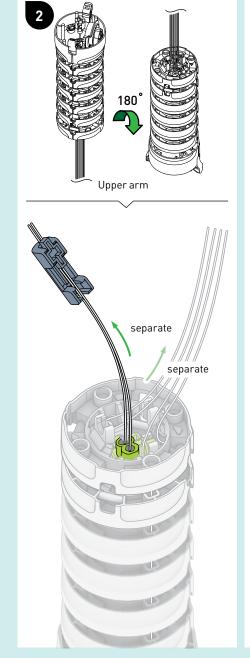
Consider taking a break before starting the lower arm.

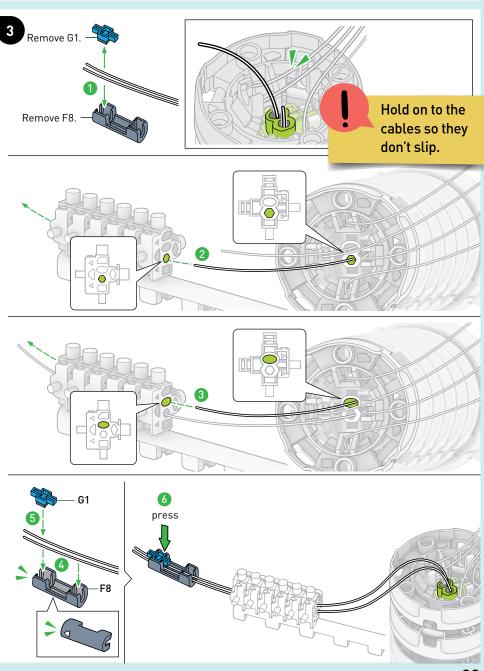
#### **ASSEMBLING THE LOWER ARM**

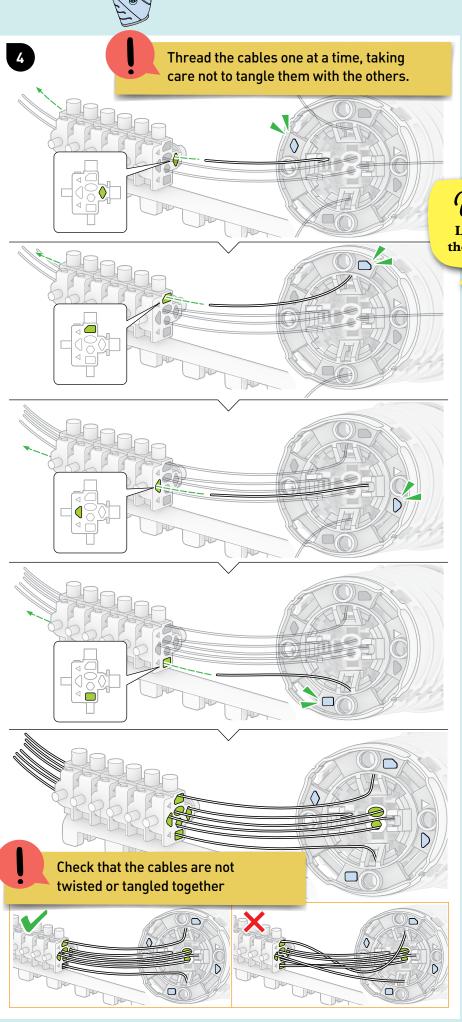


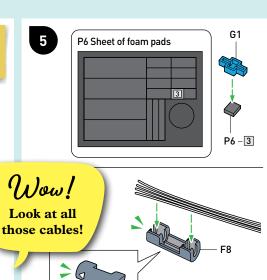




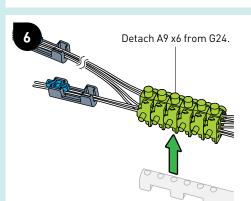


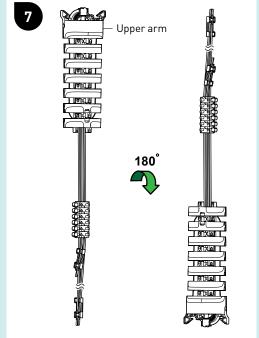




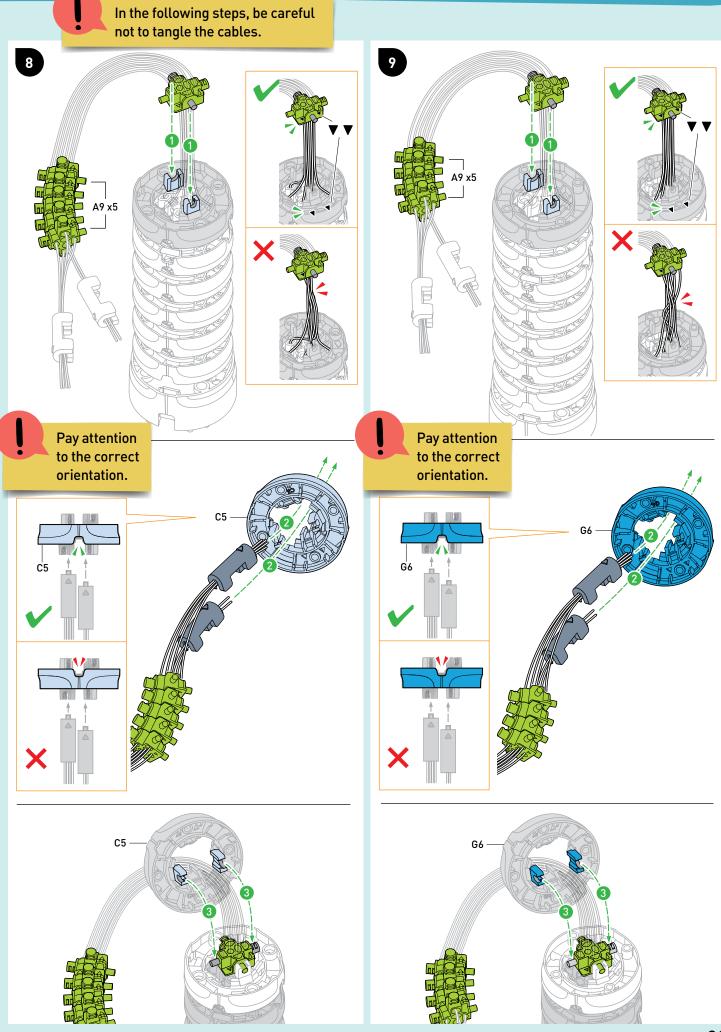


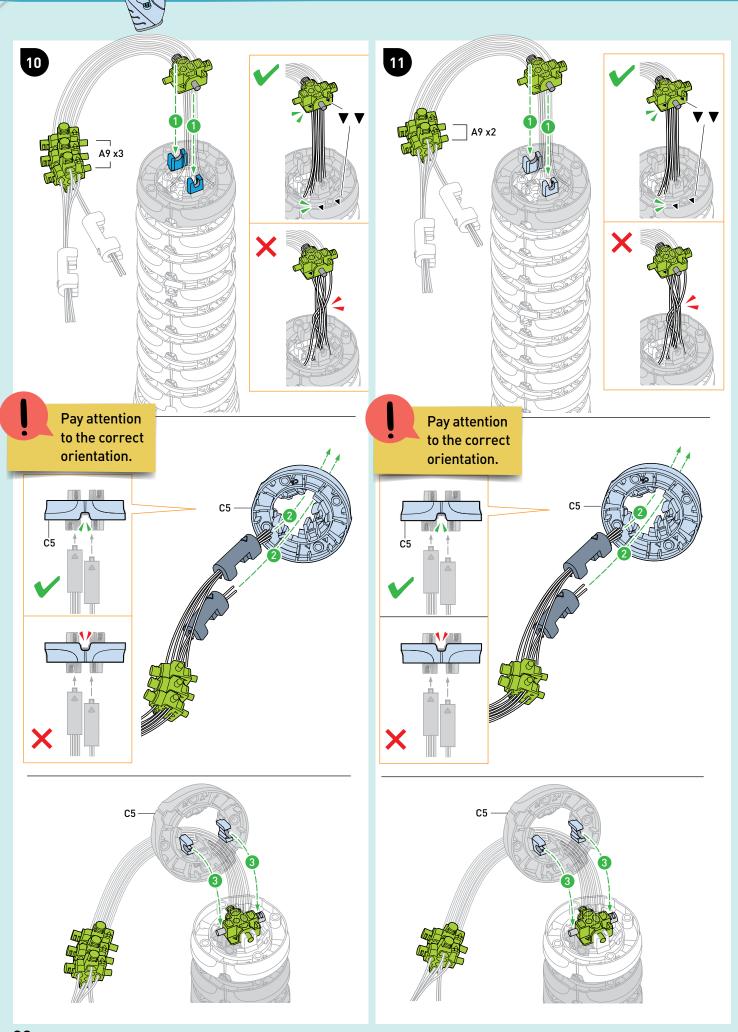
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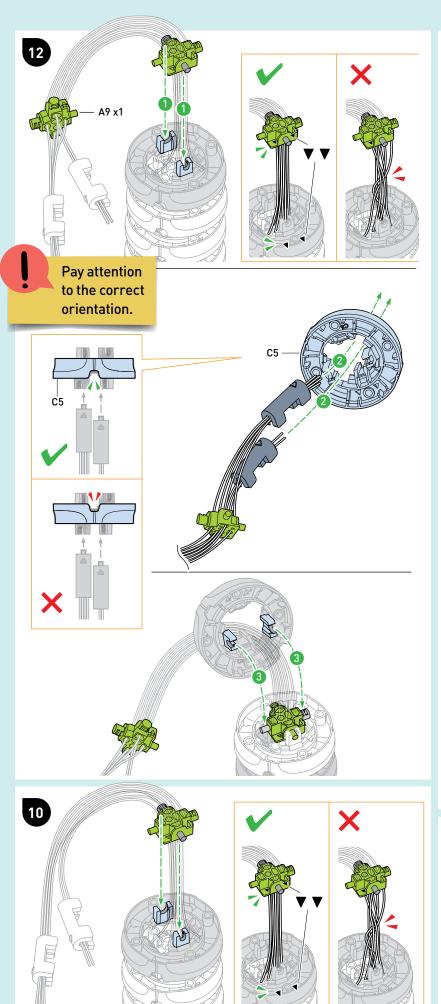


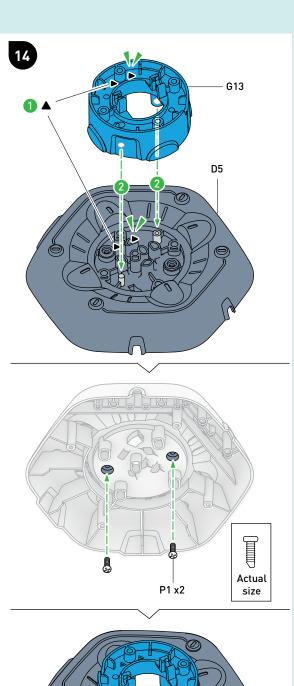


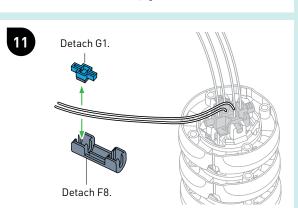






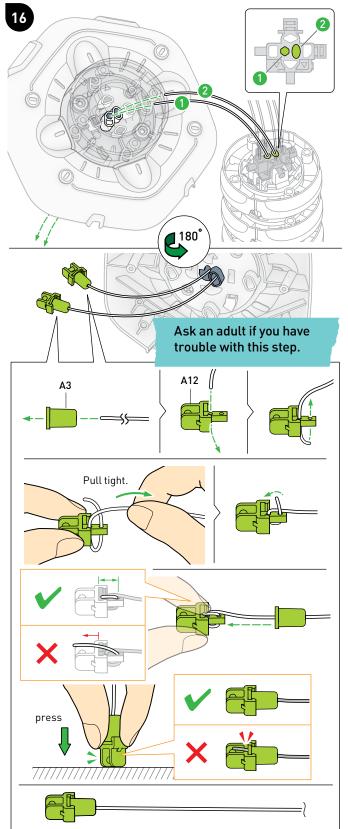


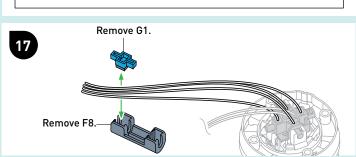


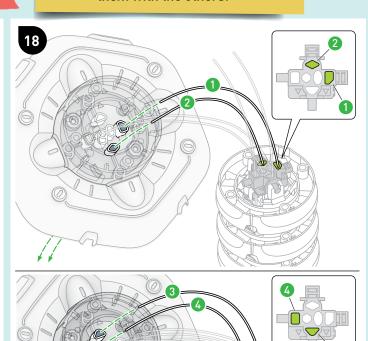


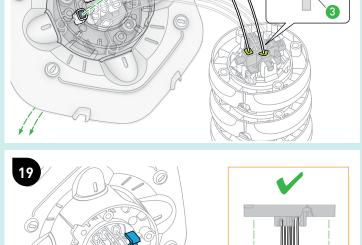
#### ATTACHING THE UPPER AND LOWER ARM

Thread the cables one at a time, taking care not to tangle them with the others.

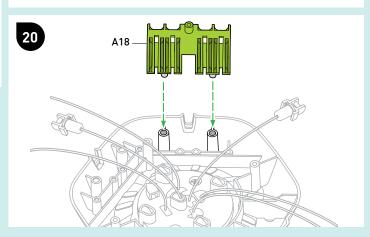


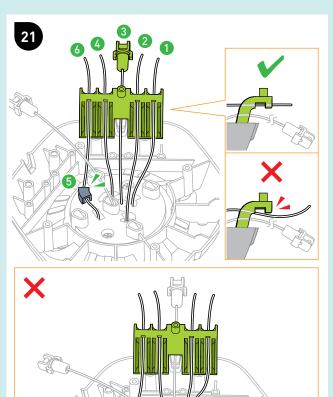


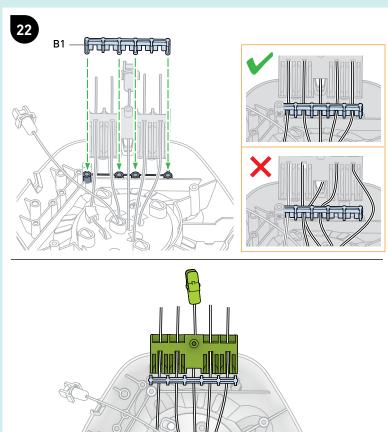


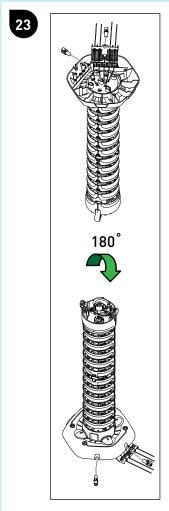


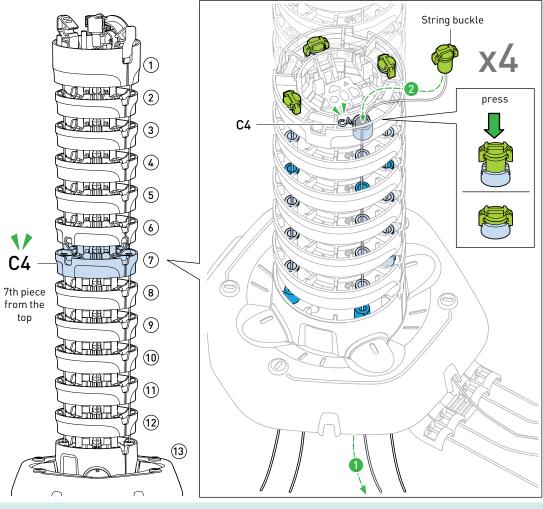
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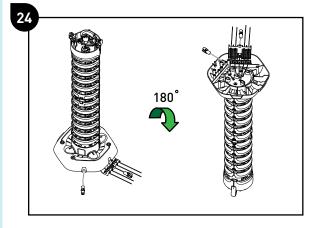


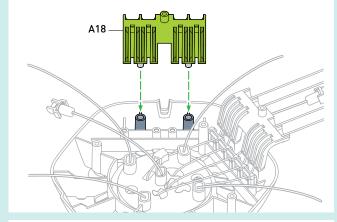


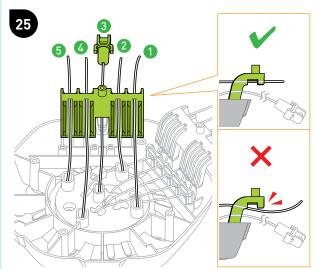


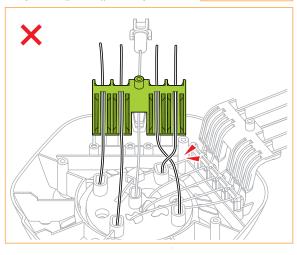


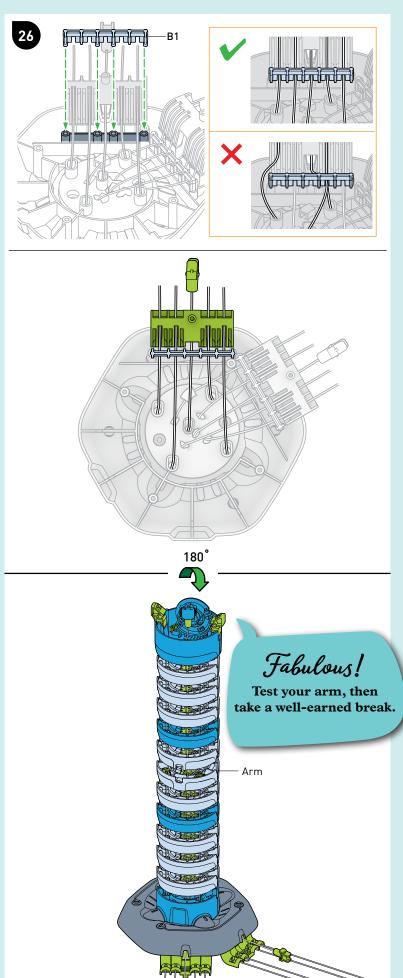












Lower arm

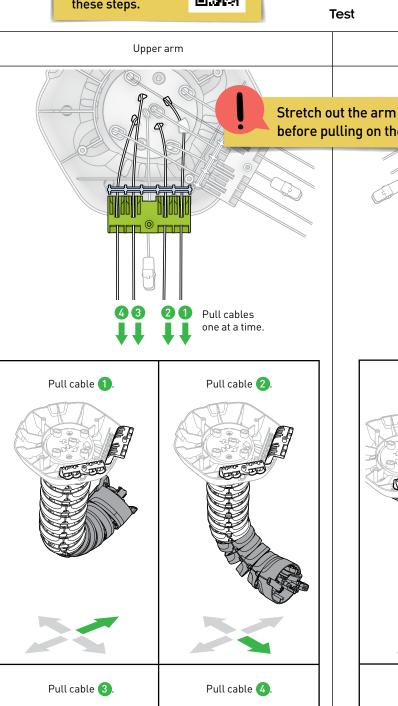


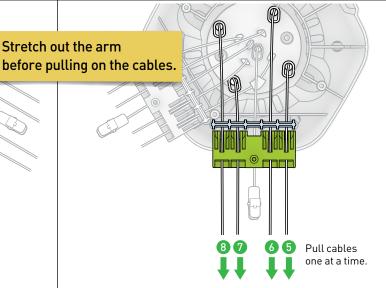


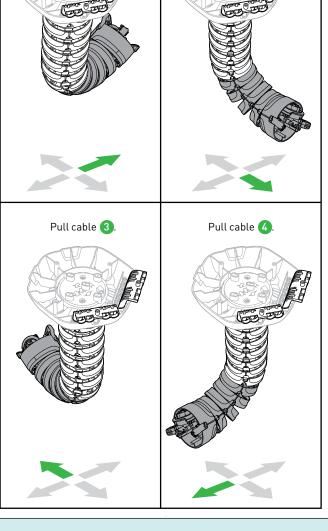
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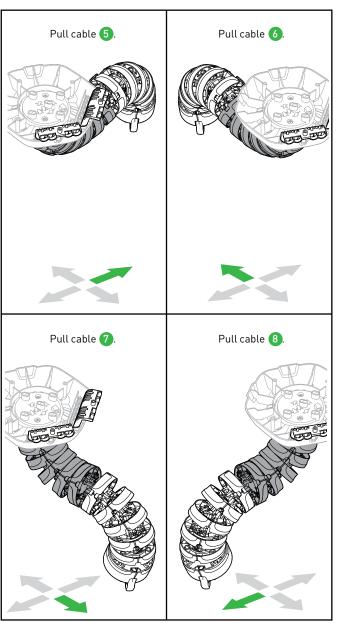




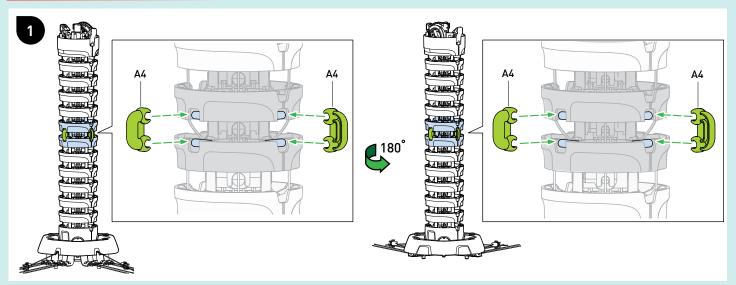


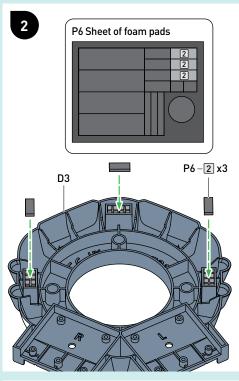


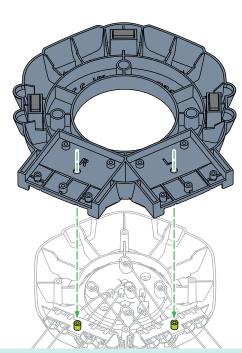


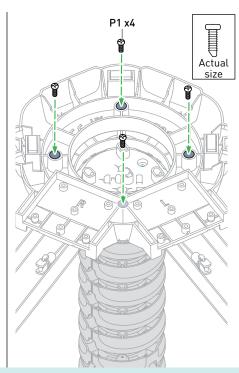


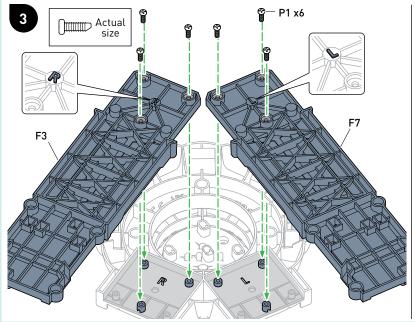
### **FINAL ASSEMBLY**

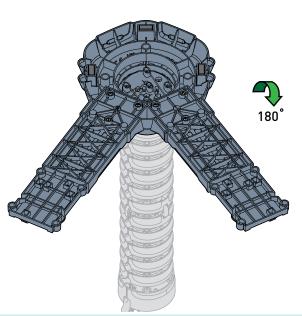




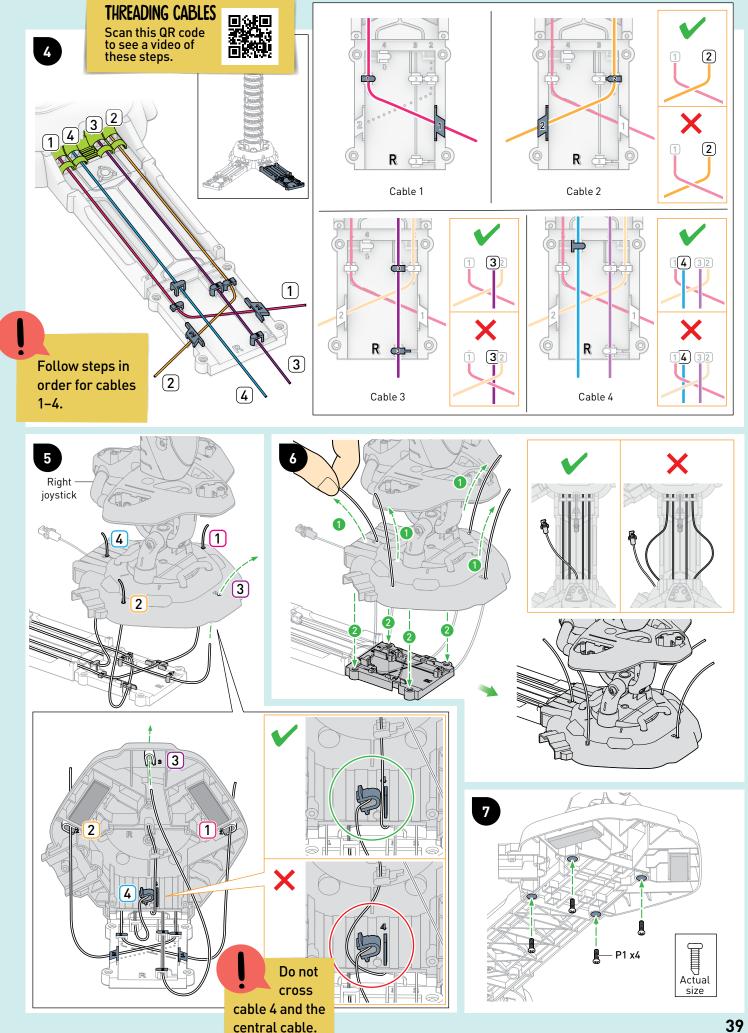


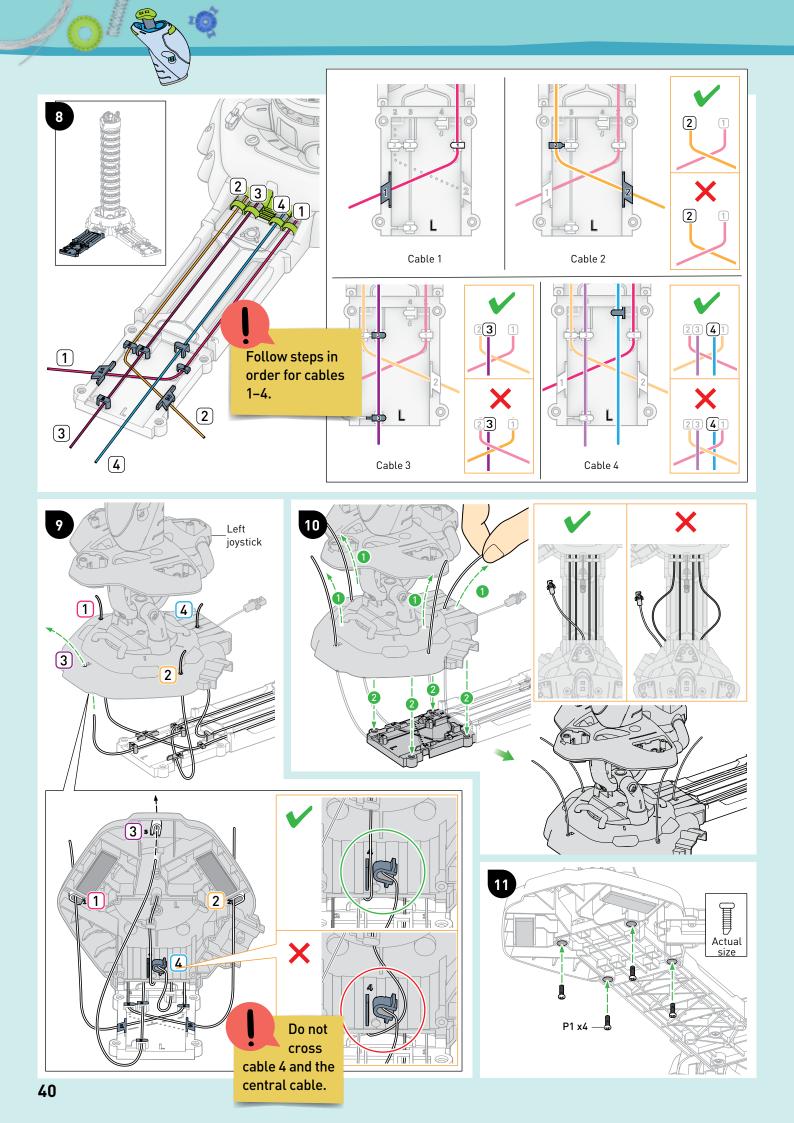




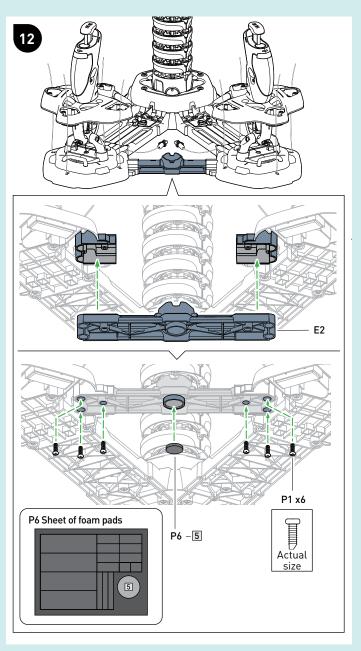


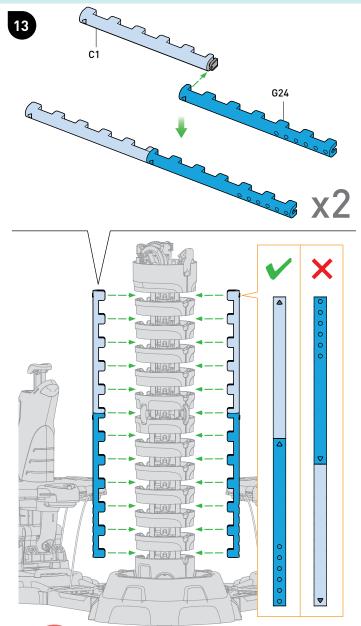


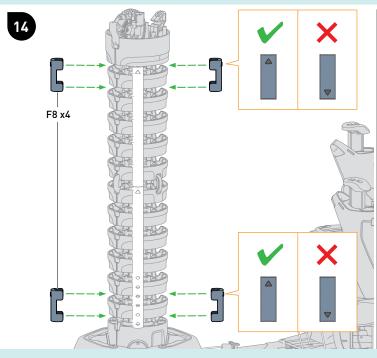


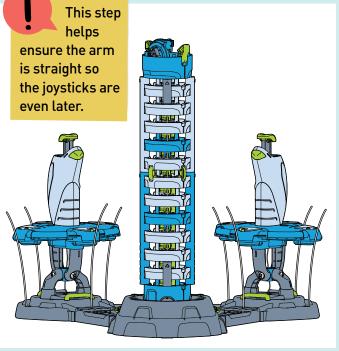


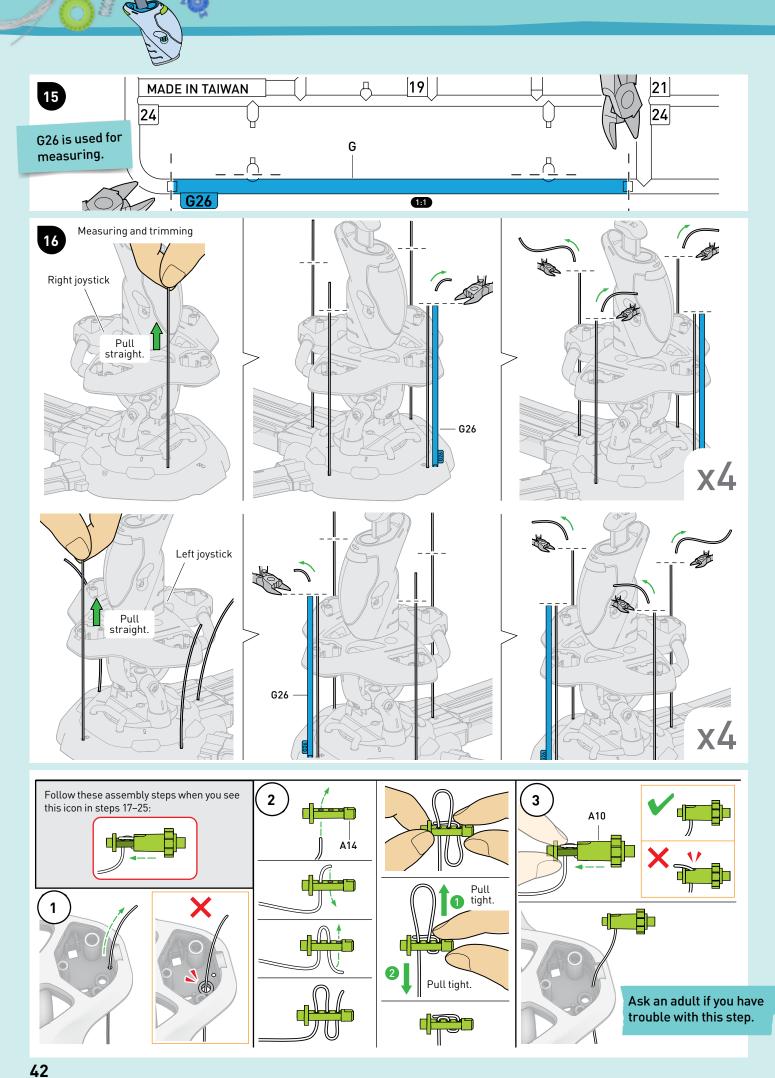




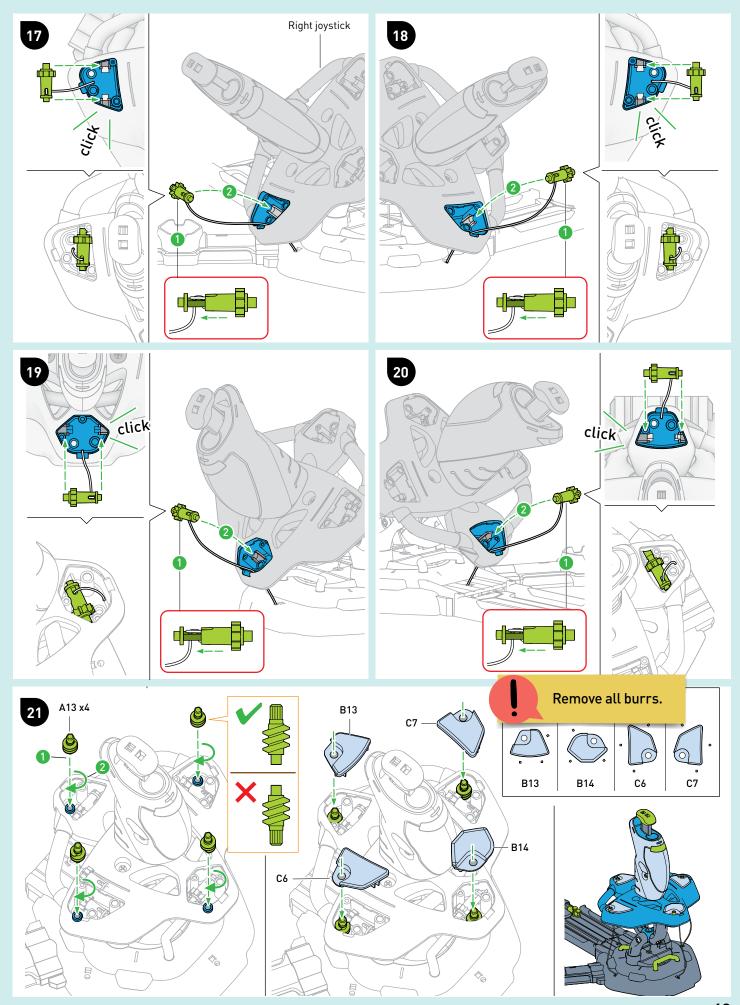


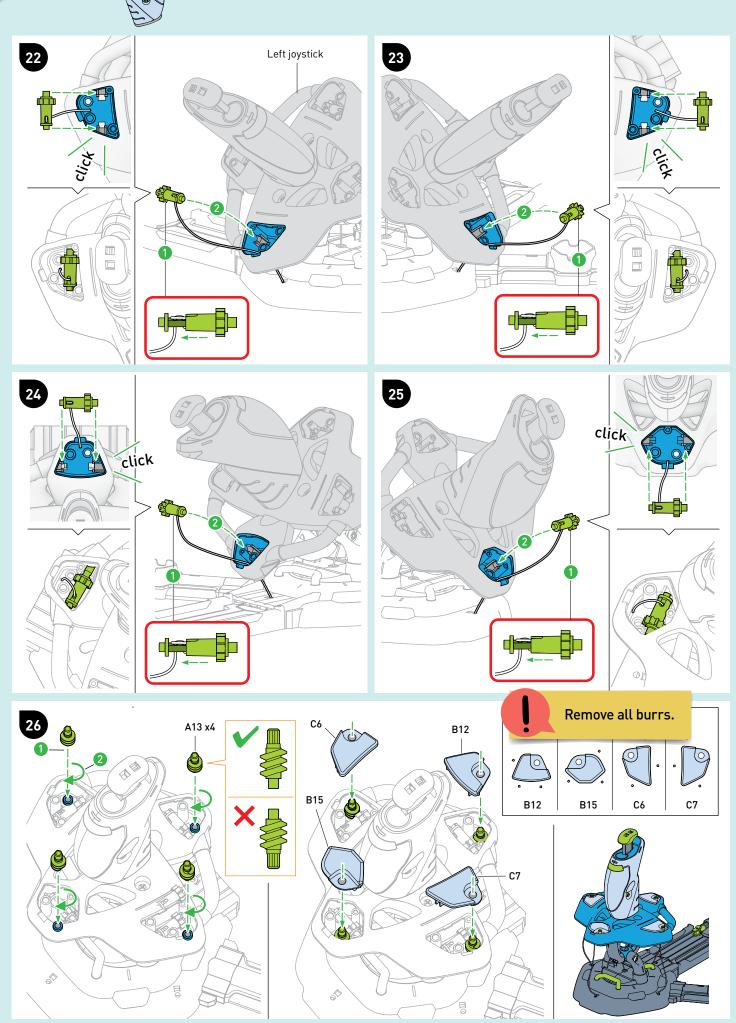




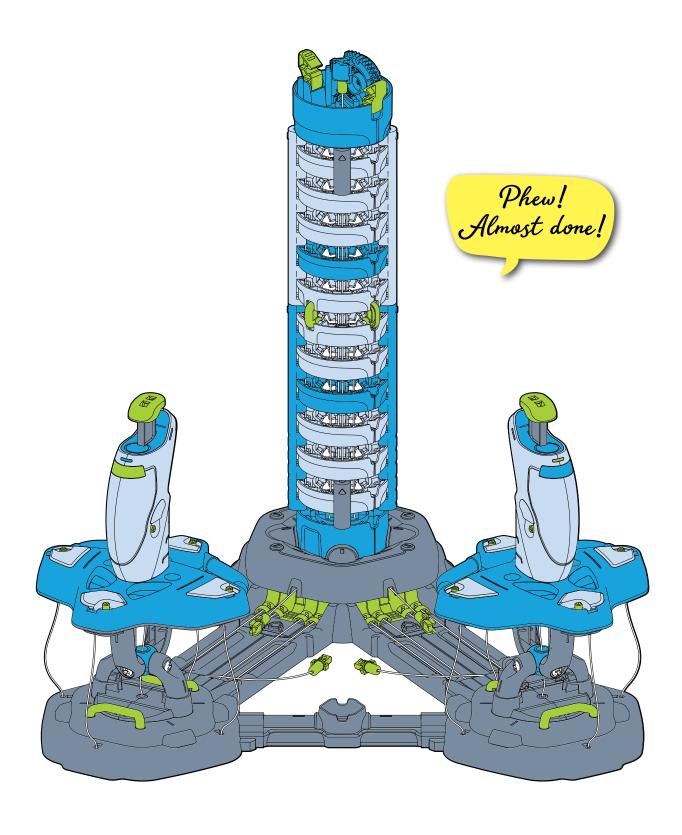














**Machines and Robots as** 

# Humanity's Helpers

Nowadays, robots and other machines have become commonplace as helpers. Since the 1950s, robots of all kinds have eased the workload of factory workers all over the world. For example, hardly any part of a car's assembly process happens without robots.



These industrious helpers screw and weld together automobile parts on the assembly line, which would take people a lot of time and effort. But robots can also be found outside of factories. In houses, for example, vacuuming robots help to keep household dust in check.

### WHAT IS A ROBOT, ANYWAY?!

ROBOTS ARE MACHINES THAT FOLLOW PREVIOUSLY-PROGRAMMED INSTRUCTIONS.

THE WORD ROBOT COMES FROM THE CZECH WORD "ROBOTA," WHICH MEANS

SOMETHING LIKE "FORCED LABOR." A ROBOT ONLY FOLLOWS THE COMMANDS FOR WHICH IT HAS BEEN PROGRAMMED.



### AI — ARTIFICIAL INTELLIGENCE

The field of robotics is always evolving. Currently, artificially intelligence — Al for short — is an important topic. Artificial intelligences are able to learn large amounts of information independently. Based on what it has learned, the Al can react to specific situations and make decisions. For instance, a robot named Pepper can analyze the **facial expressions, gestures, and emotions** of different people. Based on that information, Pepper reacts to the person interacting with it in various ways.



### TRENDY!

The global leader in robotics is the Asian country of Japan. Robots can be found there in many different areas. In some hotels and restaurants, robots greet guests, help chop vegetables and prepare dishes in the kitchen, or serve meals. There are also cafes where are no people working — only robots **prepare** and serve drinks to customers.



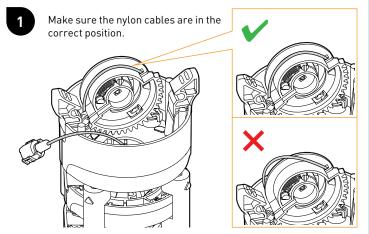


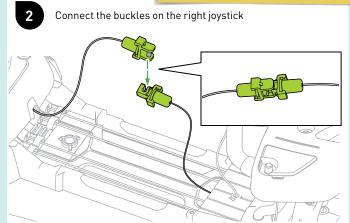
### **ADJUSTING THE NYLON CABLES**

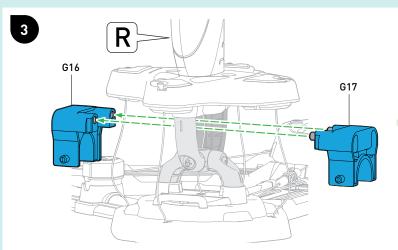
**ADJUSTING CABLES** 

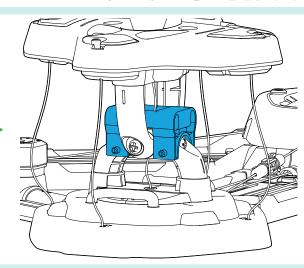
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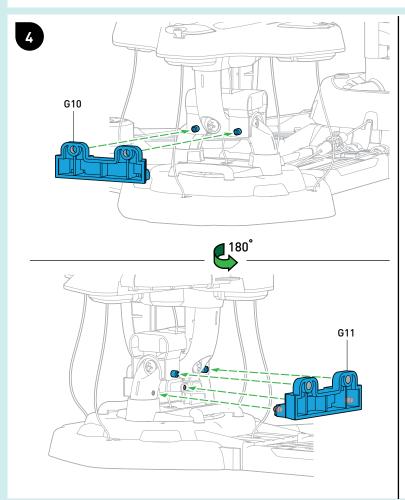


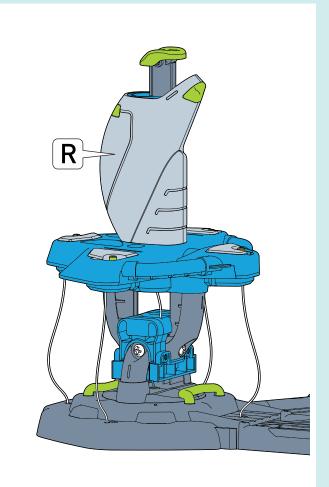




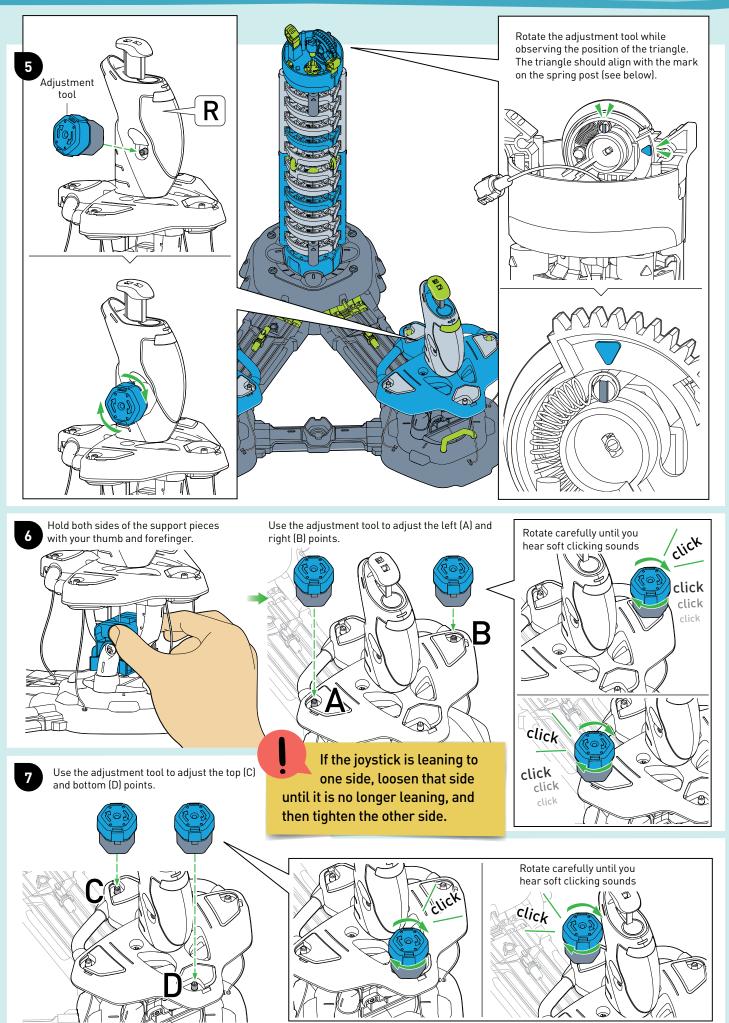




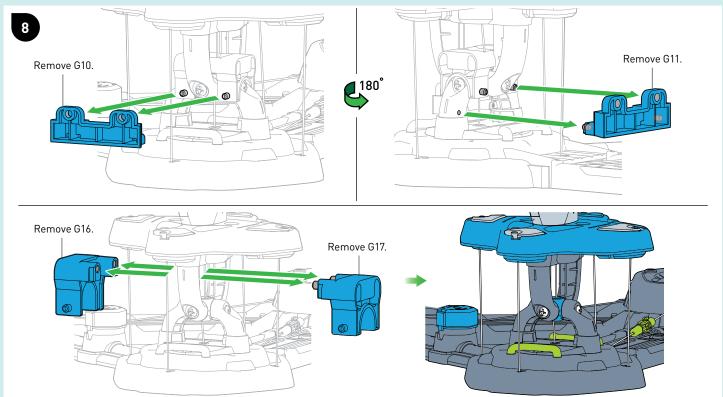


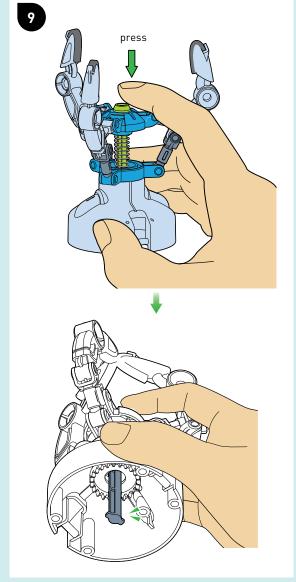


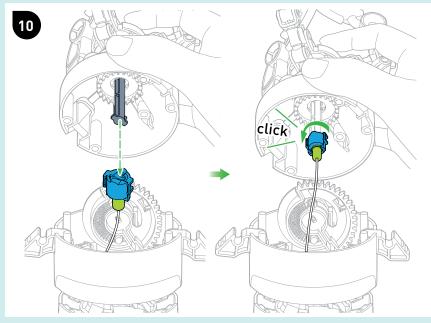


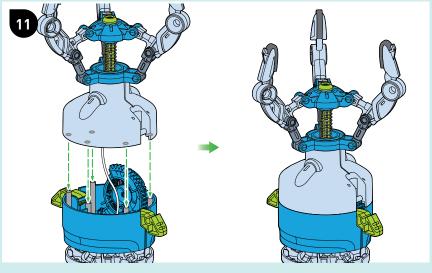




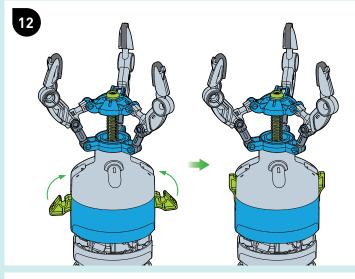


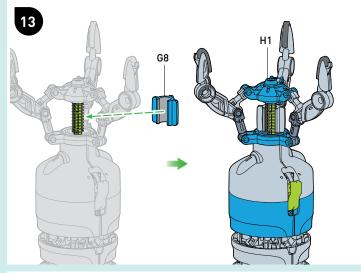


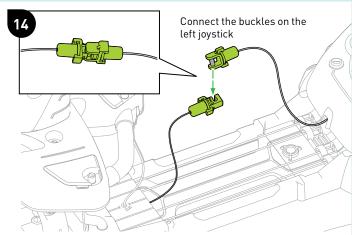


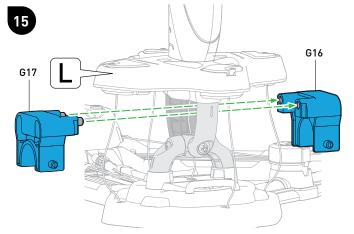


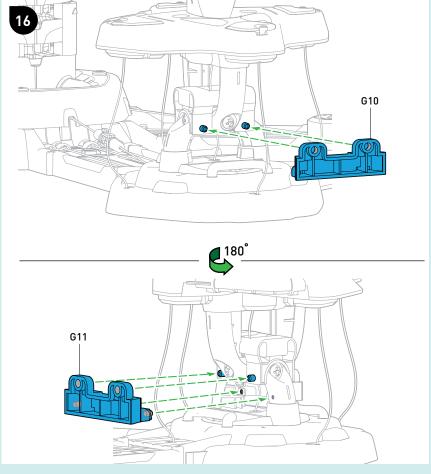


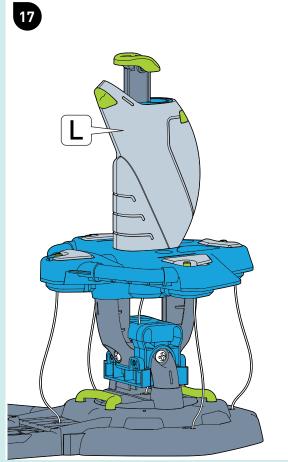


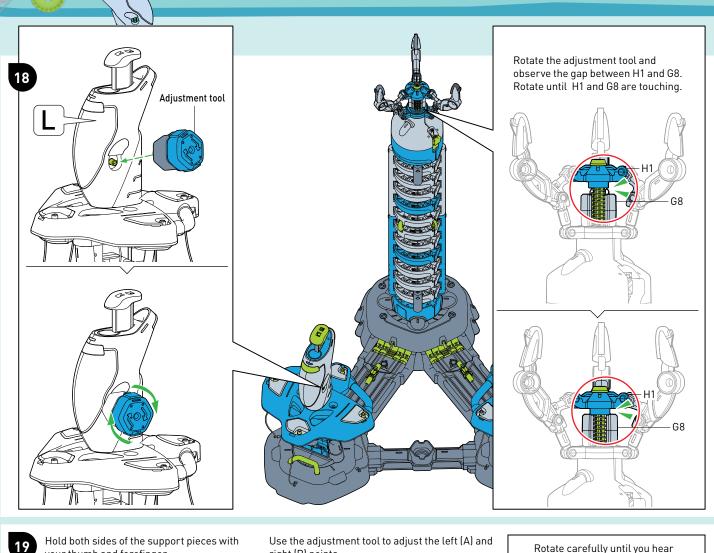


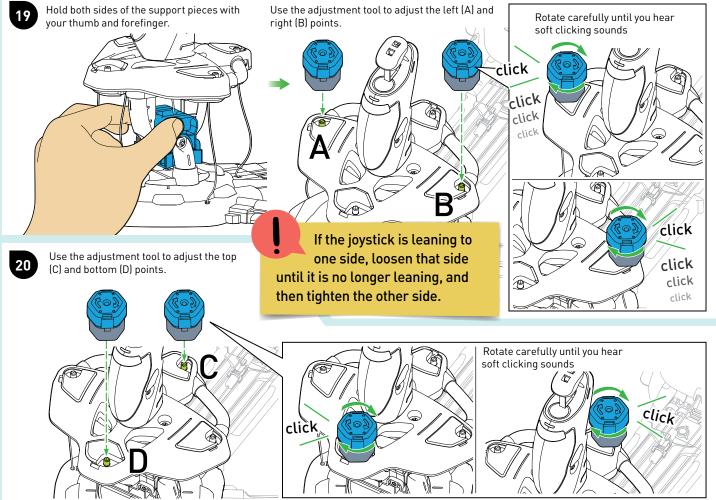




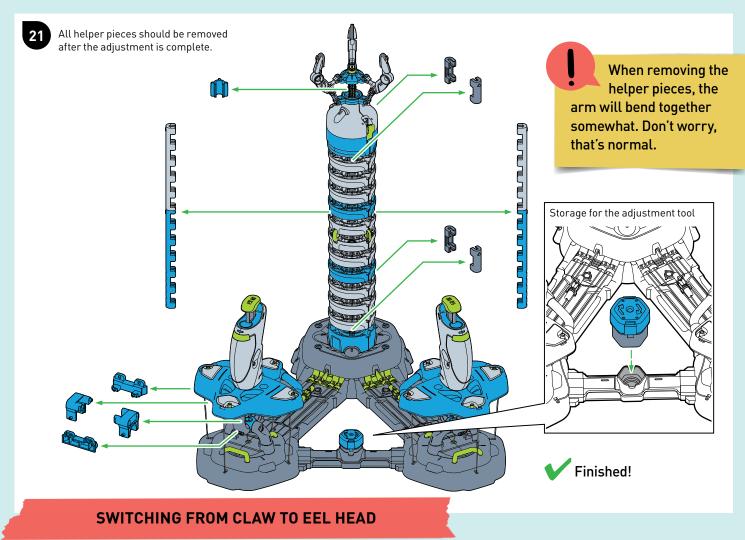


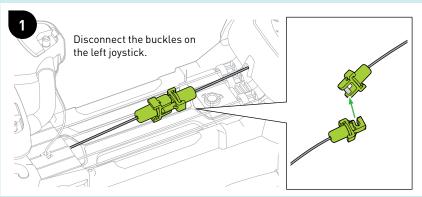


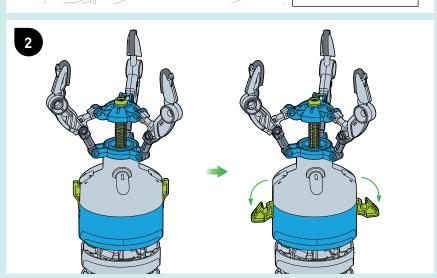


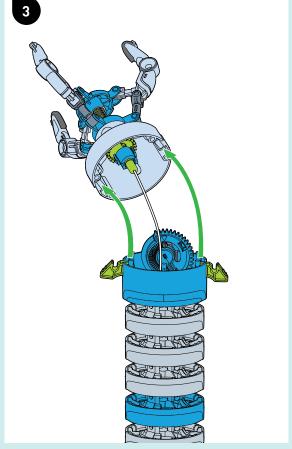




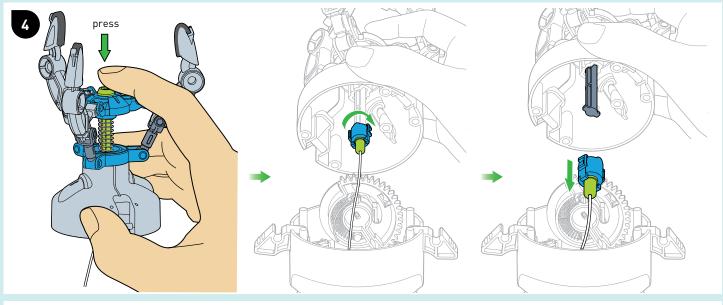


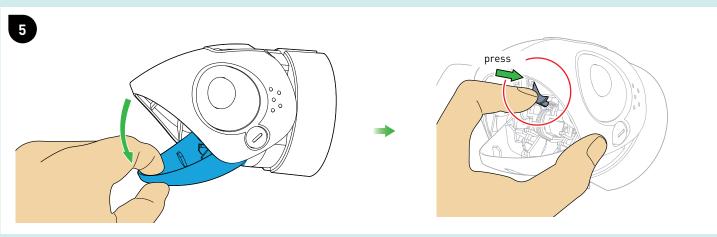


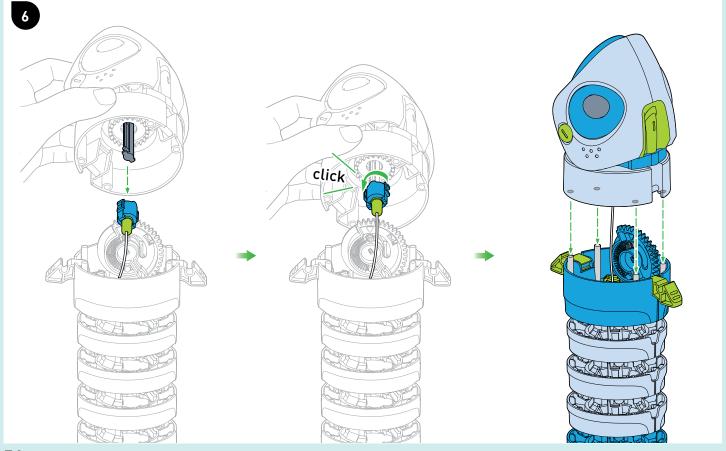




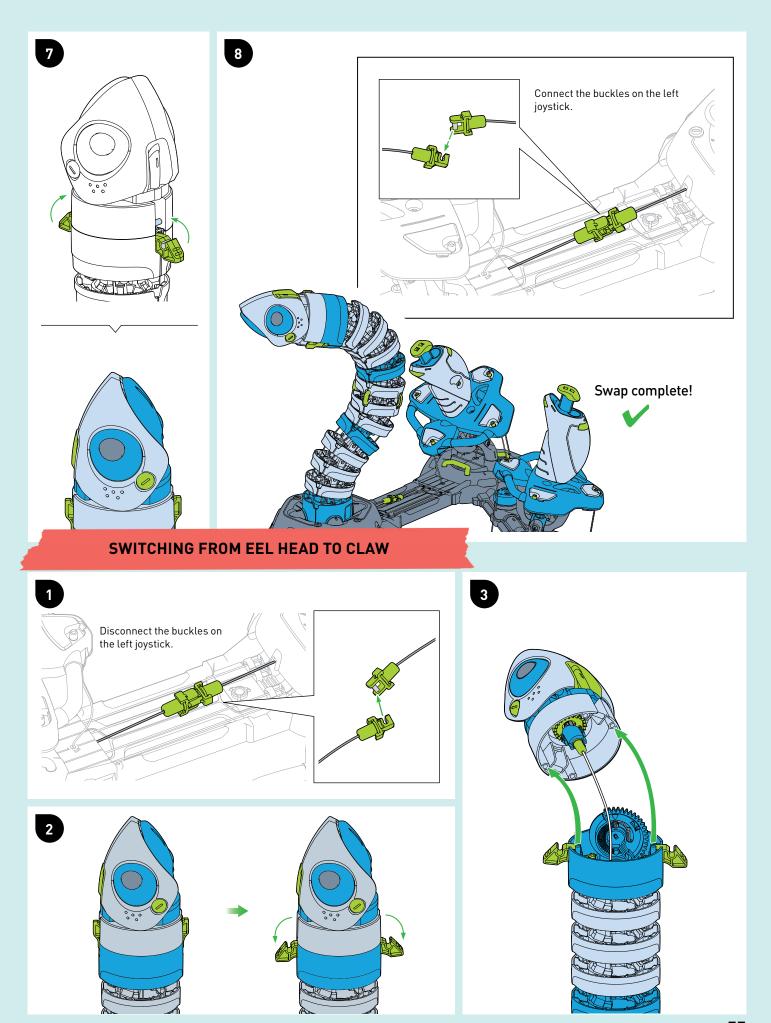




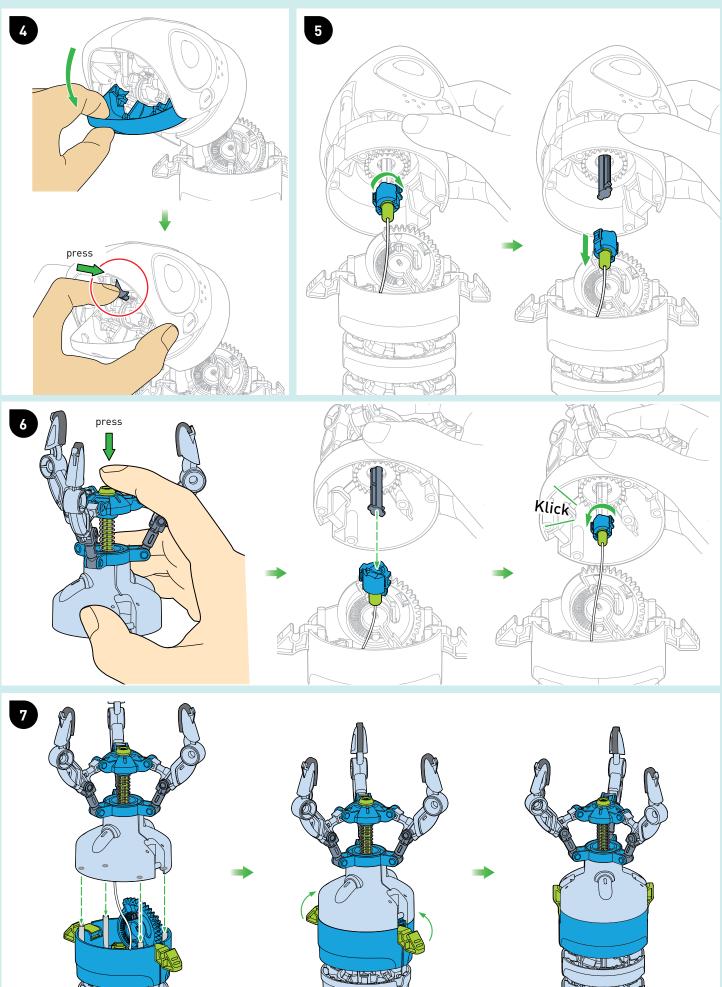




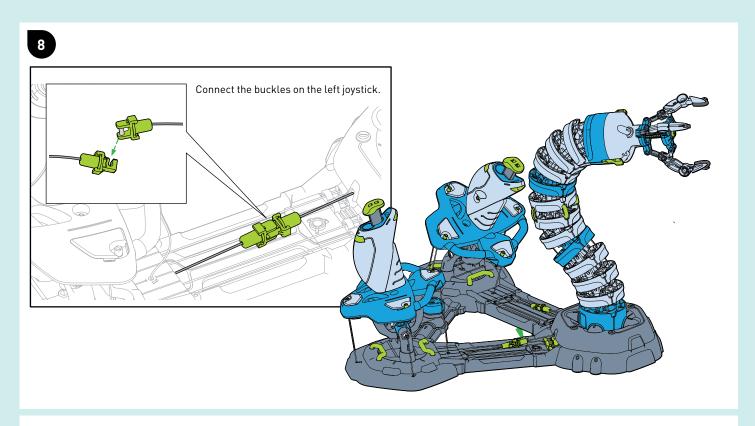




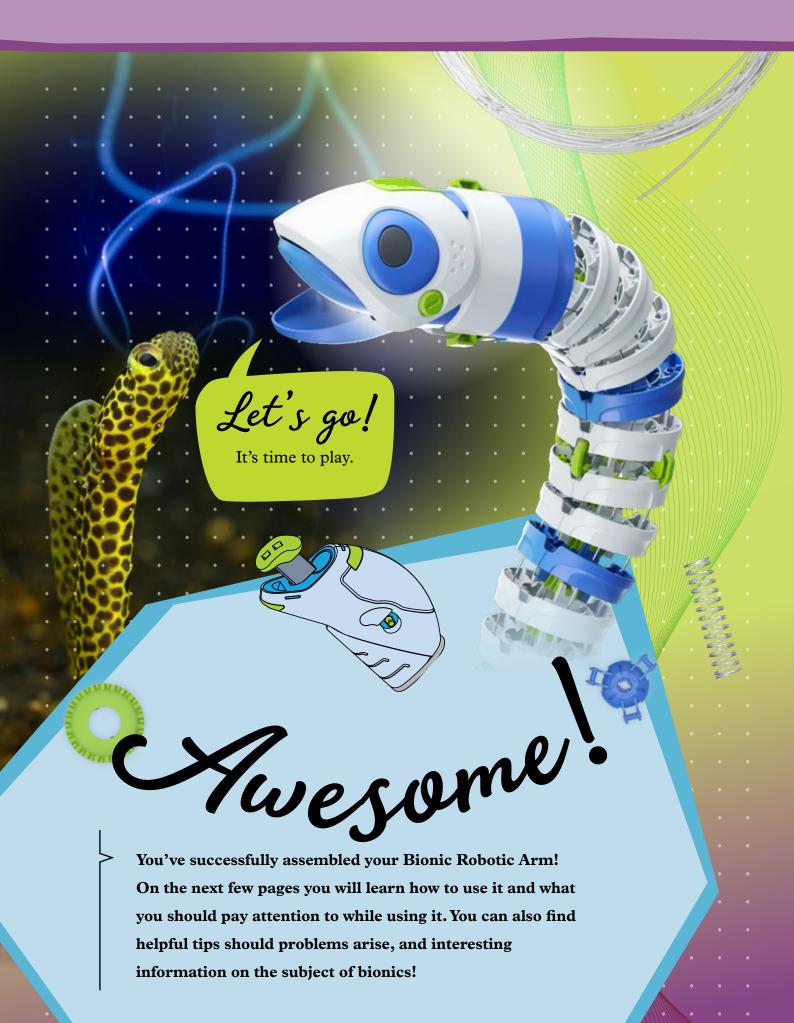




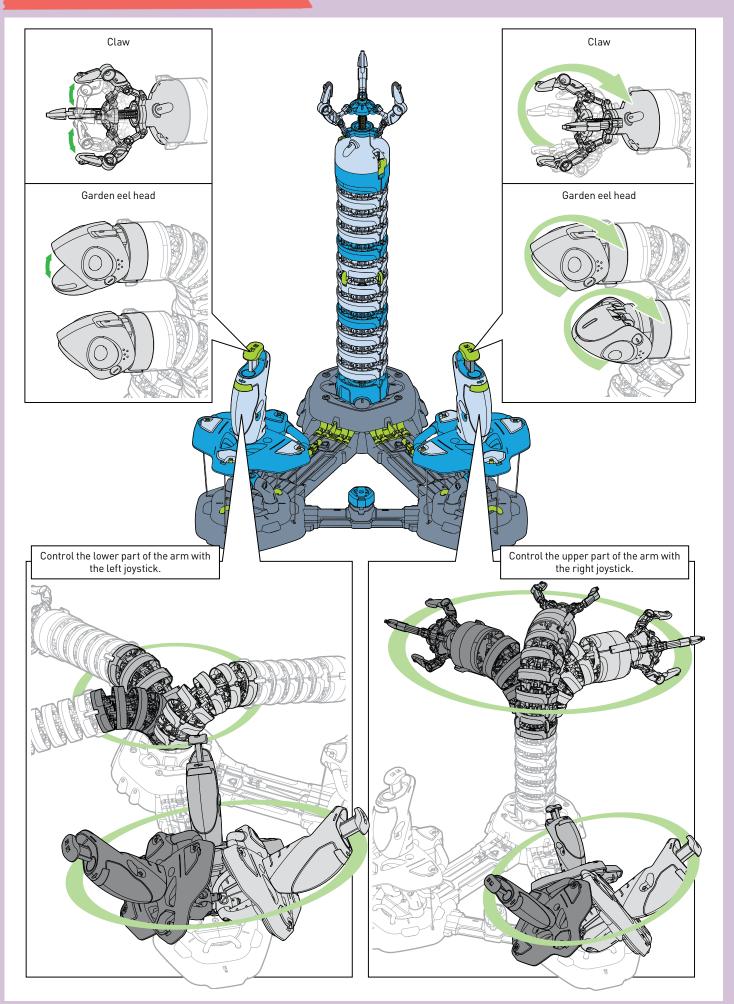








### **HOW TO PLAY**



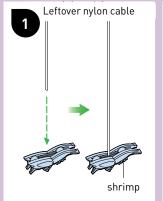


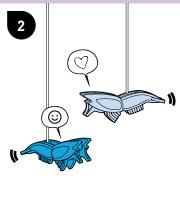


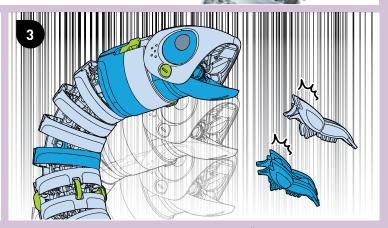
Of course, we've also prepared a little game for you! To play, you will have to attach the garden eel head to your Bionic Robotic Arm. The goal is to catch the shrimp!

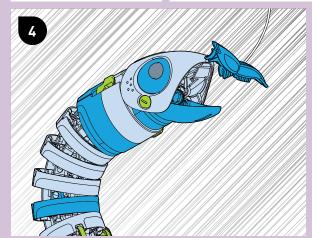
Take the leftover nylon cable, and attach it to the little shrimp that you made back on page 5. Hang them near your robotic arm, and try to catch them!

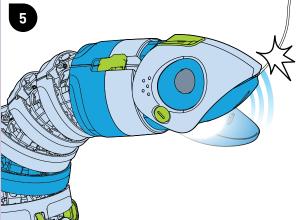
To make it a little harder, get a friend or a family member to join you. They'll hold the shrimp near the Bionic Robotic Arm and move them slowly back and forth. Try to catch them on the move!





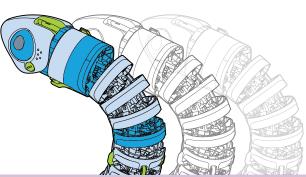












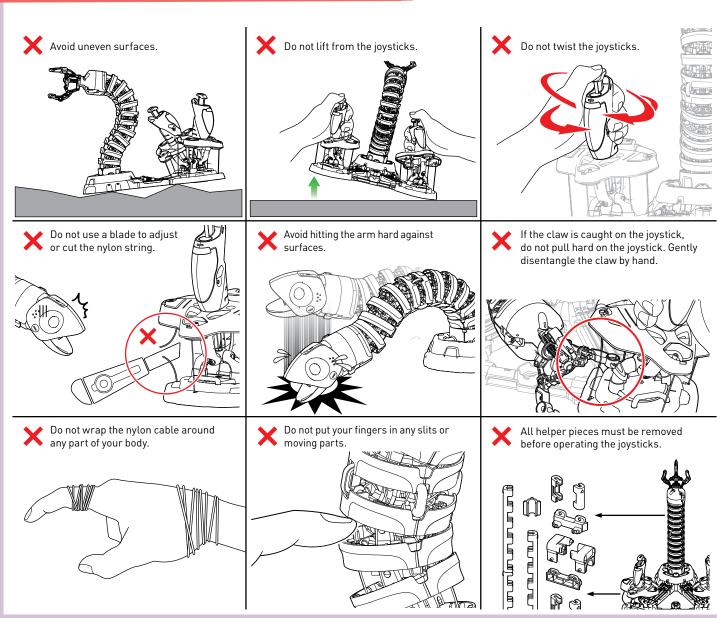


### HOW LONG DOES IT TAKE YOU TO CATCH THE SHRIMP?

Grab a stopwatch and time yourself! Start the stop watch before touching the robotic arm, and stop it when you catch the shrimp! Record your time in this table!

Attempt 1	Attempt 5	Attempt 9
Attempt 2	Attempt 6	Attempt 10
Attempt 3	Attempt 7	Attempt 11
Attempt 4	Attempt 8	Attempt 12

### **HANDLING AND PRECAUTIONS**





## **BIONICS**

Nature offers a variety of interesting strategies that organisms use to solve problems or complete tasks. The word bionic comes from "bio-" and "electronic." The field of bionics has to do with studying and understanding nature's solutions and applying them to technology. One famous example is hook and loop fasteners, like Velcro, which were inspired by burrs. Burrs are a type of seed case covered • in little hooks, which can fasten into the fur of passing animals. An imitation of this mechanism can now be found on shoes, clothing, and more.

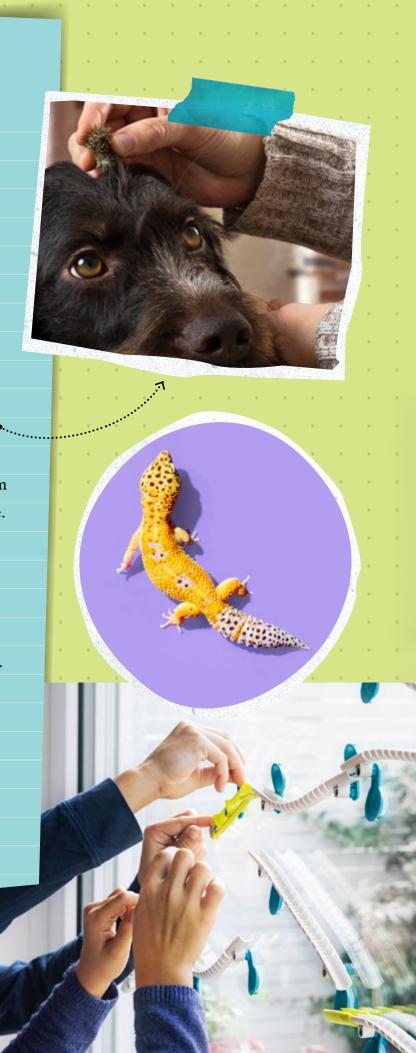
Bionics can also sometimes be found in toys!

You can find the biological inspiration for the

Thames & Kosmos Gecko Run marble run
right in the name. The kit's nano-adhesive pads
cling to smooth surfaces like the feet of a gecko.

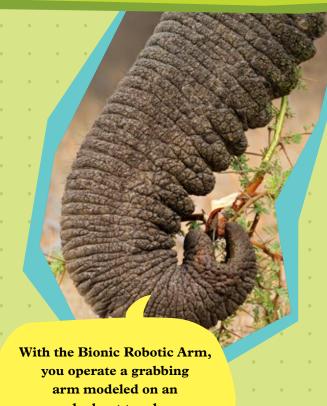
A gecko can effortlessly stick to surfaces like
glass and stone thanks to microscopic hairs
on its feet.





### AN ELEPHANT'S TRUNK

Your Bionic Robotic Arm was also inspired by nature's technology. It might remind you of the trunk of an elephant. The trunk is an elephant's most important tool. It serves not only as a scent organ, but also used for touching, sucking, and grabbing. Thanks to about 40,000 muscles, the trunk is extremely strong, and has very good fine motor control despite its size. In comparison, we humans have about 656 muscles in total.



elephant trunk.



### GARDEN EEL

With the "fish head," your Bionic Robotic Arm looks more like a garden eel. Garden eels live on the sandy ocean floor in "gardens" colonies of up to a thousand individuals — from which they get their name. The holes that the little eels live in are dug using their pointed

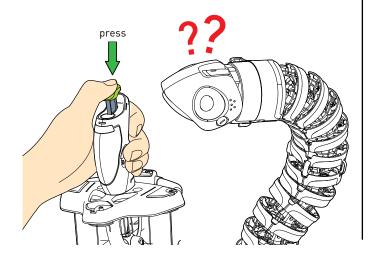
tails. They are the only vertebrates that live their whole lives in one place, hardly ever moving around. Like your Bionic Robotic Arm, they wave the front part of their bodies back and forth to grab food.

#### **TROUBLESHOOTING**



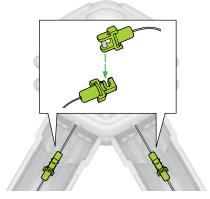
### **PROBLEM**

The claw or eel head does not open well.



### **SOLUTION**

1. Make sure that the buckles are securely fastened, and the cord is not caught on anything.

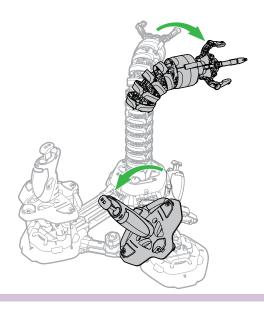


2. Check that steps 7–17 on pages 11–14 and 7–17 on pages 16–19 were performed correctly.



### **PROBLEM**

The arm moves opposite to the movement of the joysticks.



### SOLUTION

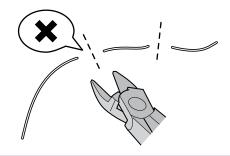
Check the following steps in order until the problem is resolved:

- 1. Steps 2-26 on pages 31-38.
- 2. Steps 4-11 on pages 41-42.

C

### PROBLEM

The nylon cord was cut to the wrong length and can't be used.



### **SOLUTION**

Substitute 0.8mm nylon string or fishing line.

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Manual layout: Studio Gibler, Stuttgart
Material images: CIC Components Industries Co., Ltd., Taiwan
Manual photos: Jaimie Duplass & beror (all adhesive strips © fotolia); thisisengineering, p. 4 top left hand;
Billy Huynh, p. 46 background; Andy Kelly, p. 47 middle; Joakim Honkasalo, p. 58 background;
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