EXPERIMENT MANUAL

GeckoBot 2.0

YOU MUST CLEAN THE GLASS!

See page 14.

THAMES & KOSMOS

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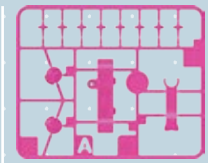
KIT CONTENTS

Do you have any questions, or are you missing any parts?
Our tech support team will be glad to help you!
USA: support@thamesandkosmos.com
or 1-800-587-2872
UK: support@thamesandkosmos.co.uk
or 01580 713000

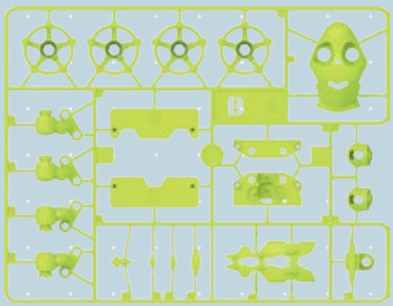
What's inside your experiment kit:


A


P1


P2


P3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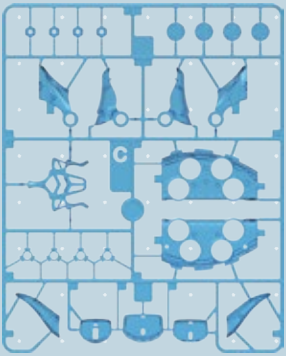
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P4


P5

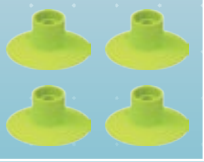

P6


P7


P8


P9


P10


P11


P12

Checklist:

✓	No.	Description	Quantity	Part No.
○	A	Pink plastic frame (A1–A5) (screw included in A4)	1	729836
○	B	Green plastic frame (B1–16)	1	729837
○	C	Blue plastic frame (C1–15)	1	729838
○	P1	Eye	2	729845
○	P2	Crown gear	1	729839
○	P3	Tall gear	1	729840
○	P4	Gear with axle	8	729841
○	P5	Thin gear	4	729842
○	P6	Double gear	3	729843
○	P7	Battery compartment	1	729844
○	P8	Wire	1	729846
○	P9	Metal shaft	2	729847
○	P10	Screw	10	724224
○	P11	Suction cup	4	724228
○	P12	Nut	1	729848

Wow!
So many parts!

YOU WILL ALSO NEED:

1 x AAA battery (1.5 volt, type LR03), small magnetic Phillips-head screwdriver (PH00, PH0, or PH1 recommended), diagonal cutters or scissors and nail file, clean window or other smooth climbing surface

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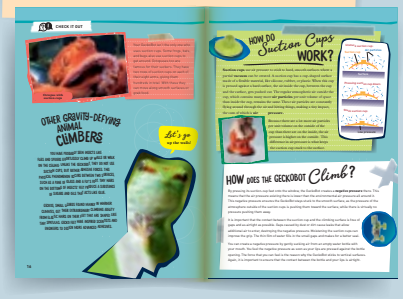
TIP

ADDITIONAL INFORMATION CAN BE FOUND IN THE CHECK IT OUT SECTIONS ON PAGE 16 AND THE INSIDE OF THE BACK COVER.

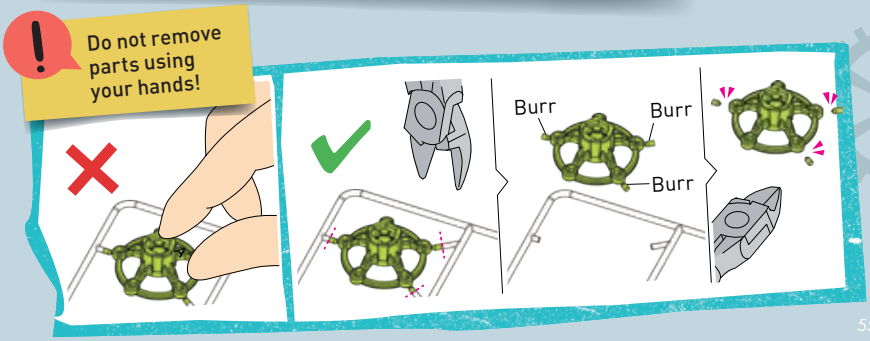


TIP

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.

Ready? **Let's get building!**



SAFETY INFORMATION

WARNING! Not suitable for children under 3 years. Choking hazard — small parts may be swallowed or inhaled.

WARNING: This toy is only intended for use by children over the age of 8 years, due to accessible electronic components. Instructions for parents or care givers are included and shall be followed. Keep packaging and instructions as they contain important information. Store the experiment material, particularly the battery-powered motor and assembled model out of the reach of small children.

WARNING! This kit contains sharp points for functional reasons. Do not injure yourself!

Notes on Disposal of Electrical and Electronic Components

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

Safety for Experiments with Batteries

- → To operate the models, you will need one AAA battery (1.5-volt, type LR03), which could not be included in the kit due to its limited shelf life.
- → An adult should insert and change the battery. For instructions on how to insert and change the battery, see step 32.
- → Avoid a short circuit of the battery. A short circuit can cause the wires to overheat and the battery to explode.
- → Different types of batteries or new and used batteries are not to be mixed.
- → Do not mix old and new batteries.
- → Do not mix alkaline, standard (carbon-zinc), or rechargeable (nickel-cadmium) batteries.
- → The battery is to be inserted with the correct polarity (+ and -) (step 32). Press it gently into the battery compartment.
- → Always close battery compartment with the lid.
- → Non-rechargeable batteries are not to be recharged. They could explode!
- → Rechargeable batteries are only to be charged under adult supervision.
- → Rechargeable batteries are to be removed from the toy before being charged.
- → Exhausted batteries are to be removed from the toy.
- → The supply terminals are not to be short-circuited.
- → Dispose of used batteries in accordance with environmental provisions, not in the household trash. Dispose of electrical device / electrical parts separately in accordance with environmental provisions.
- → Be sure not to bring batteries into contact with coins, keys, or other metal objects.
- → Avoid deforming the batteries.
- → Have an adult check the model before use to make sure it is assembled properly. Always operate the motorized model under adult supervision. After you are done experimenting, remove the battery from the battery compartment.
- → The toy is not to be connected to more than the recommended number of power supplies, this means only use the included battery compartment.

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 GeckoBot 2.0!

Scan this QR code to view helpful assembly and troubleshooting videos.

— 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.

— Make sure the model is used only on well-secured surfaces.

— Please supervise children around windows.

— Children should be supervised by an adult at all times when playing with the toy.

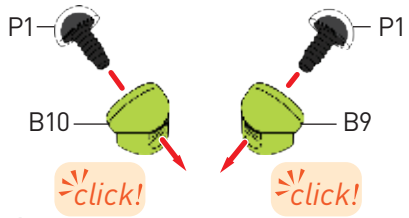
— Do not let the robot model climb so high up a vertical surface that it goes out of reach. Prevent the robot from falling onto people or objects that might be damaged by it.

And most importantly: Have fun with your GeckoBot 2.0!

THE RIGHT TOOL

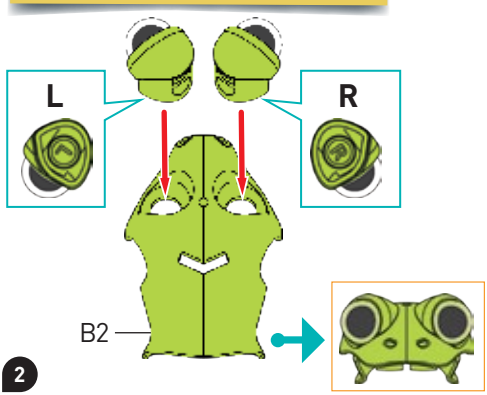
The right tool can make assembling your model much easier and it can also make your model work better in the end. It is best to cut the plastic parts out of their frames with a small diagonal cutter (such as those used for electronics work) or model pliers. Using these tools, the parts can be precisely 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.

HEAD ASSEMBLY



1

Pay attention to the letters on the bottom, indicating left and right.



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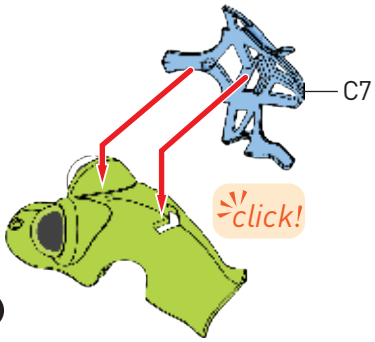

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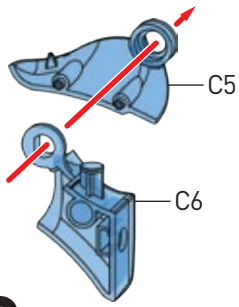

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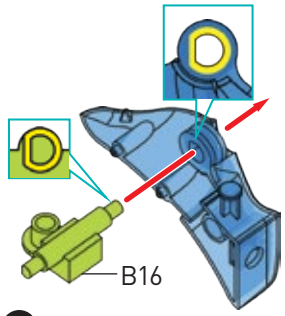

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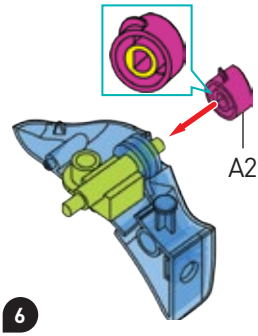

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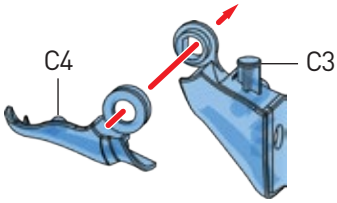

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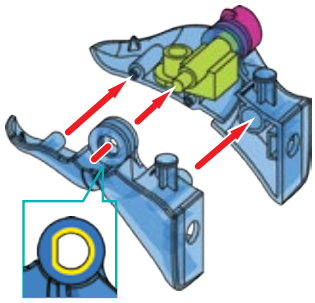

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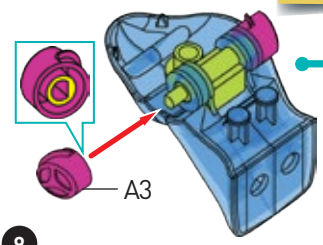
Make sure A2 and A3 are installed correctly.



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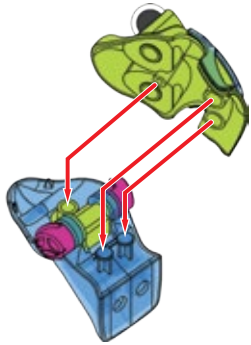

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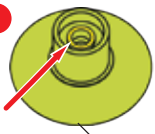
11

FEET ASSEMBLY

Make sure the area marked in yellow is clean.

1



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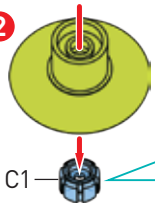

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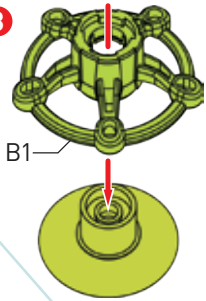
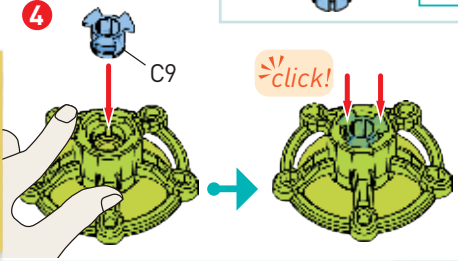


Hold the parts flat on the surface with your fingers.

4



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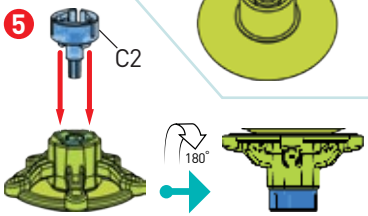
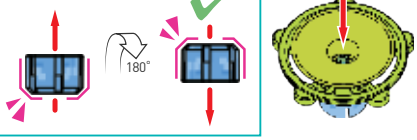


6

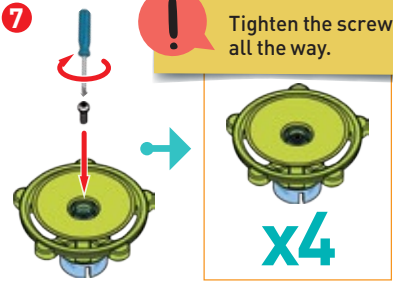
1. Remove C1.
2. Flip C1 over.
3. Reinsert C1 with the orientation shown.



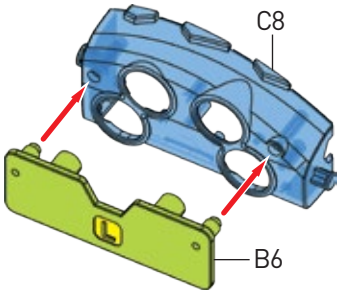
12

7

Tighten the screw all the way.



GEAR BOX ASSEMBLY



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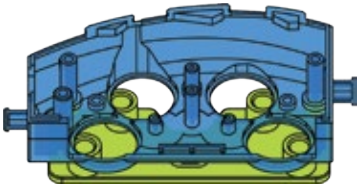
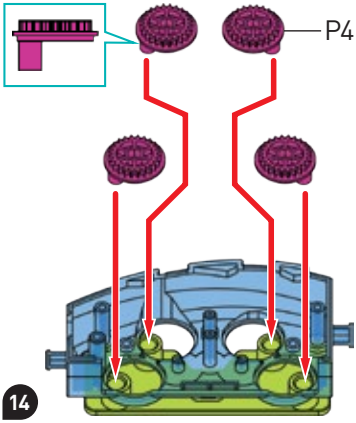


Place B6 on a flat surface.



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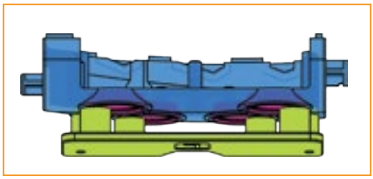
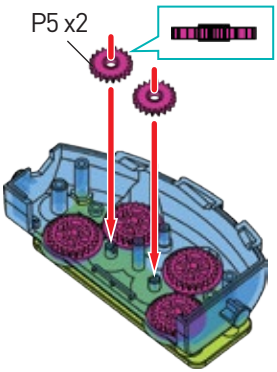


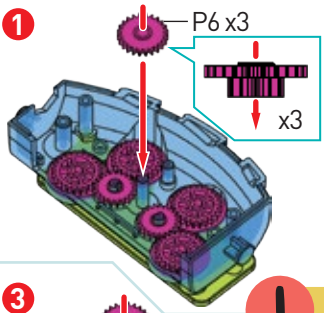
Make sure to place the four pink P4 axles into the holes in B6. Look from the side to make sure you cannot see any of the pink axles sticking out.



Make sure the gears mesh.

15

1



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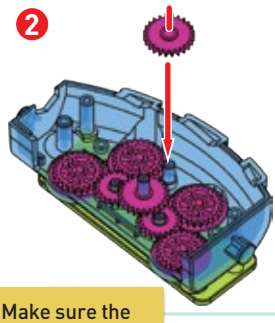

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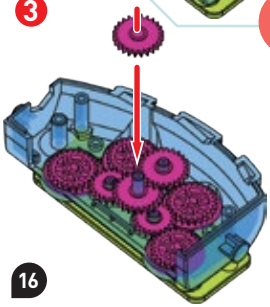
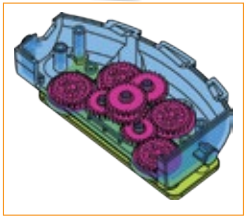


Make sure the gears mesh.



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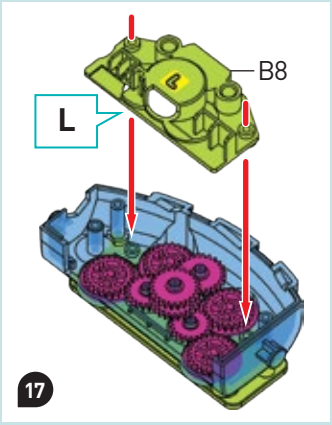
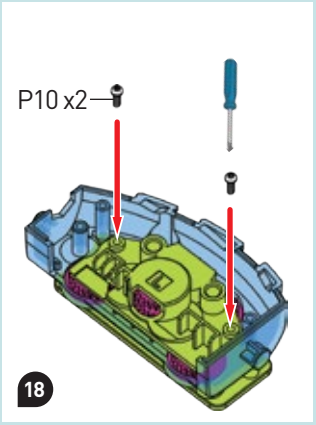

B8
L
17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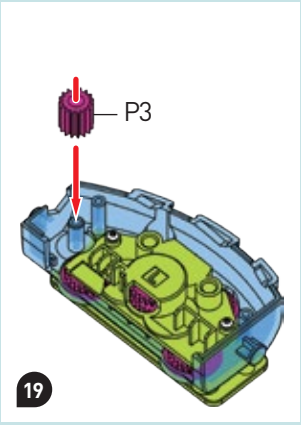
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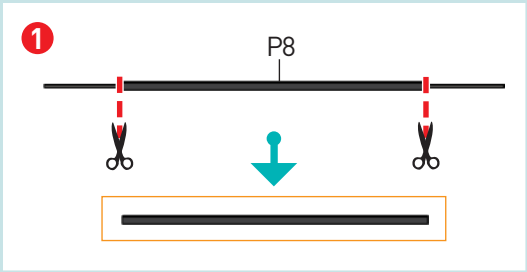
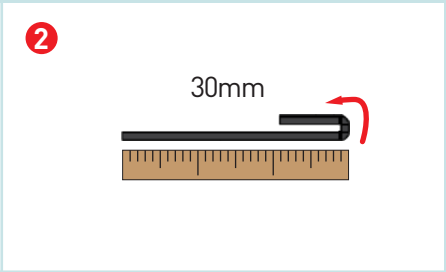
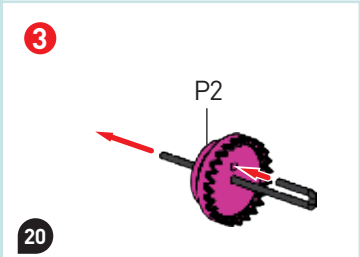

1
P8


2
30mm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P2
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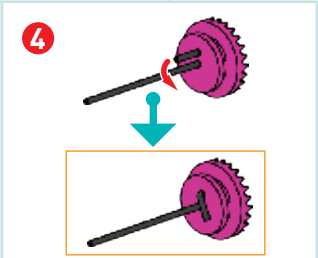
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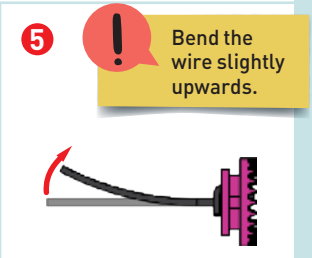
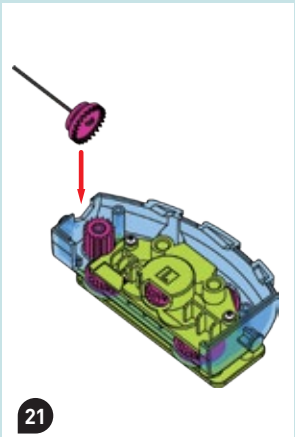

5
Bend the wire slightly upwards.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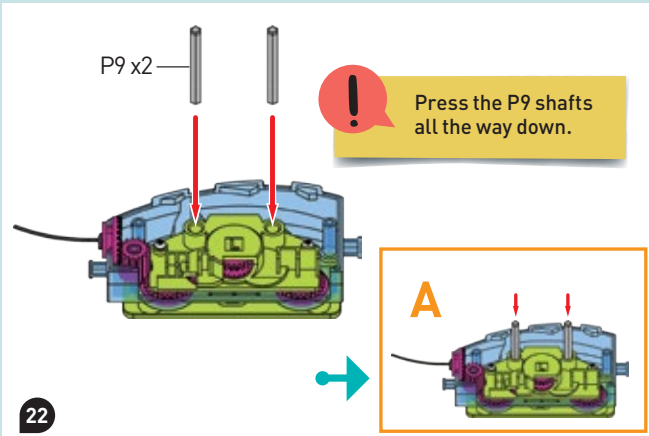
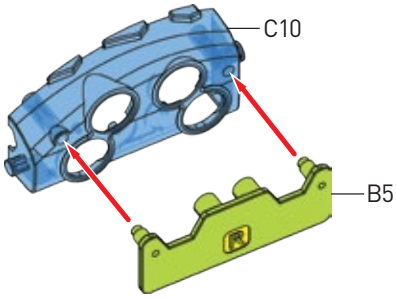

P9 x2
Press the P9 shafts all the way down.
A
22



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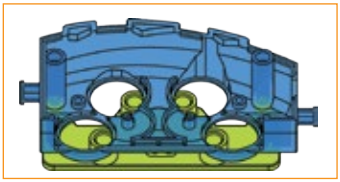
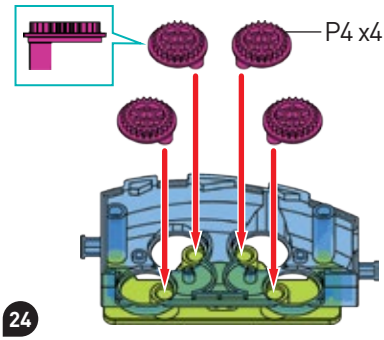


Place B5 flat on the table.



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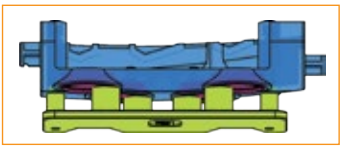
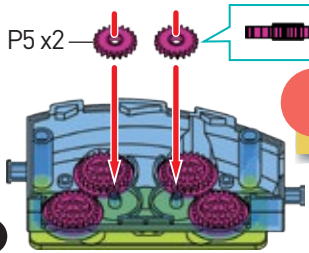
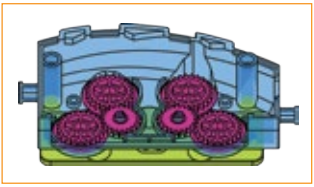


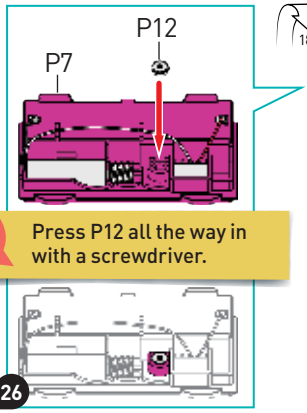
Make sure to place the four pink P4 axles into the holes in B5. Look from the side to make sure you cannot see any of the pink axles sticking out.



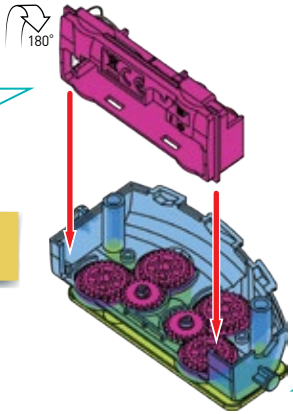
25

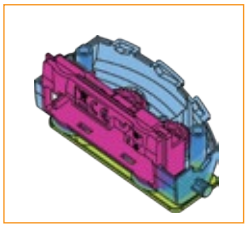
Make sure the gears mesh.

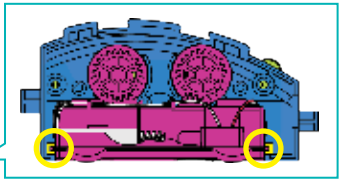




Press P12 all the way in with a screwdriver.







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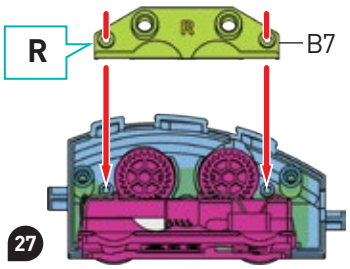
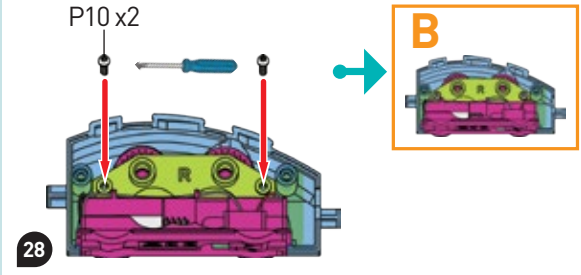
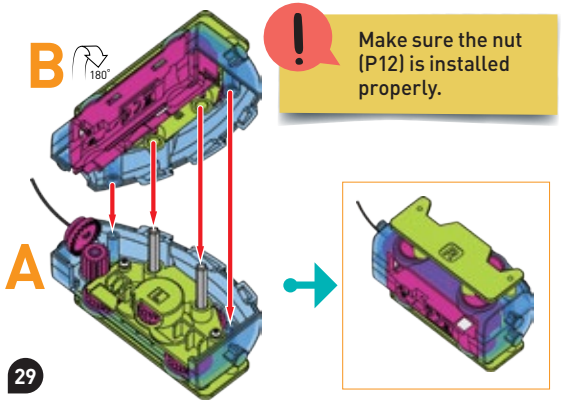
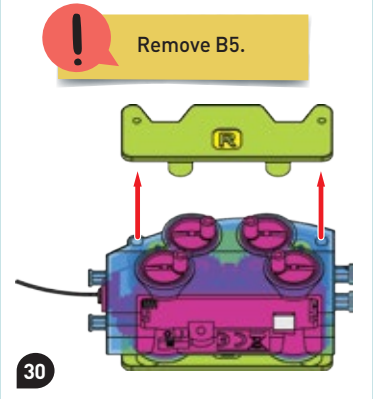
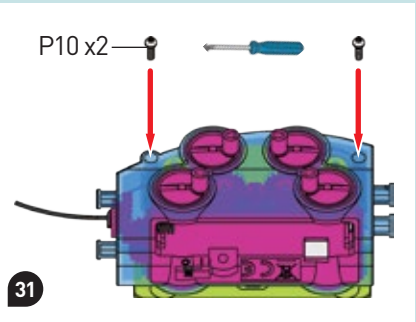
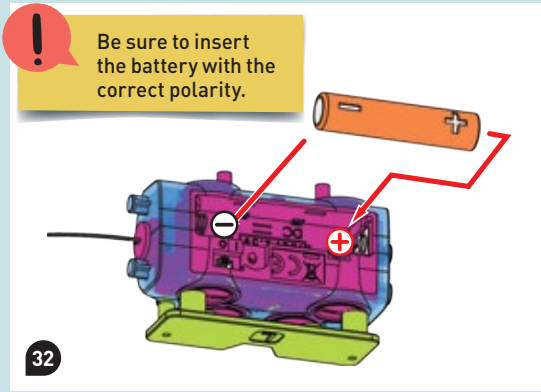

R
B7
27

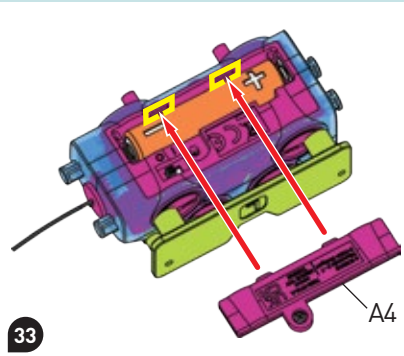

P10 x2
B
28


B
180°
A
Make sure the nut (P12) is installed properly.
29


Remove B5.
30


P10 x2
31


Be sure to insert the battery with the correct polarity.
32


A4
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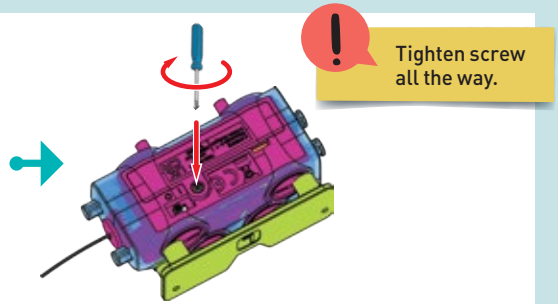
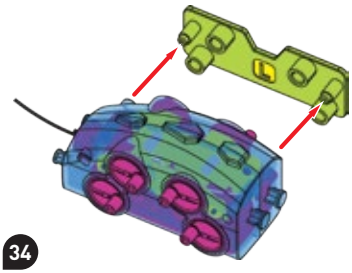

Tighten screw all the way.

Remove B6.



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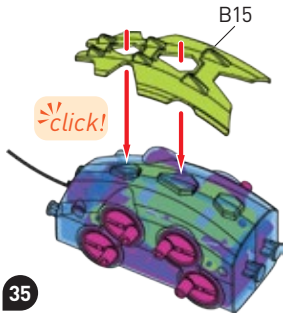

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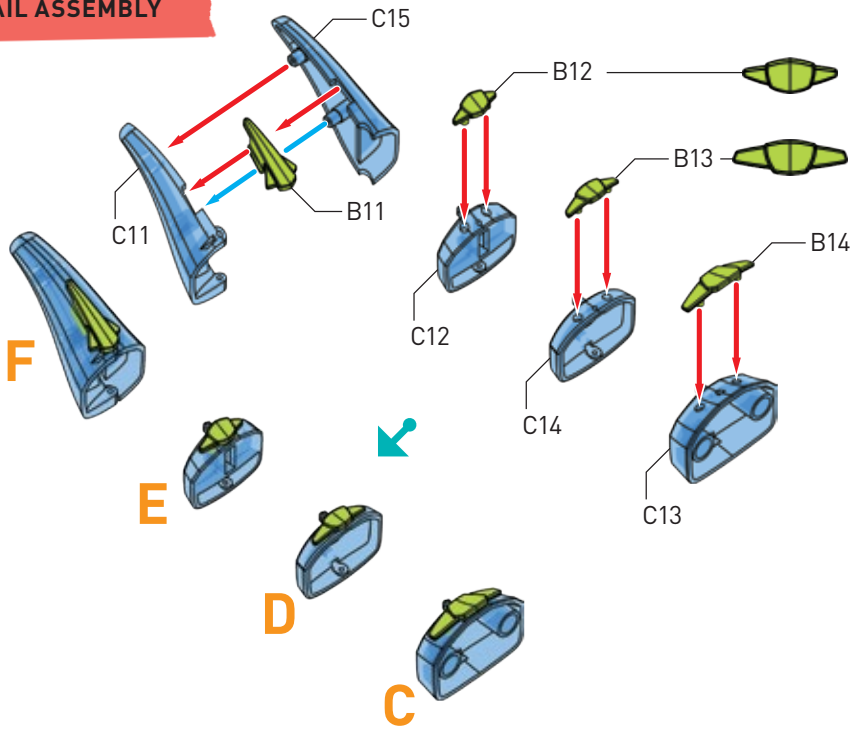
TAIL ASSEMBLY



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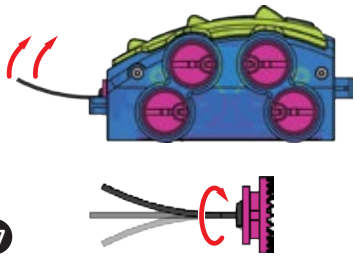
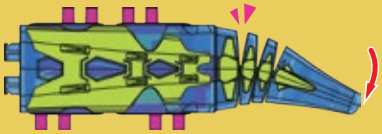
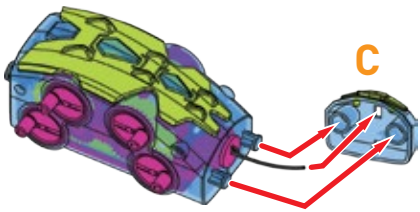


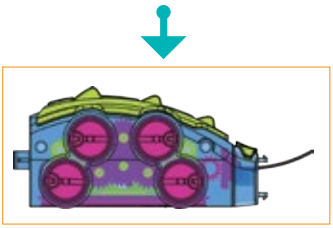
37

Make sure the wire is curved enough. The amount of curvature affects how much the tail can swing.

During the tail assembly, there will be gaps between the segments. This allows for the tail to swing.







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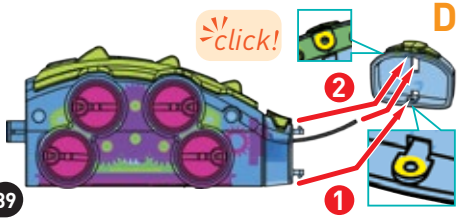

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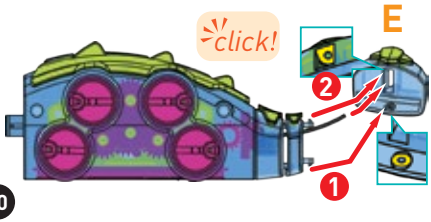

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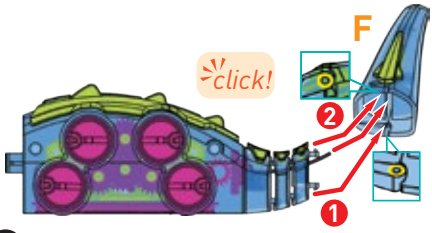
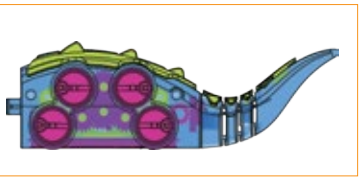
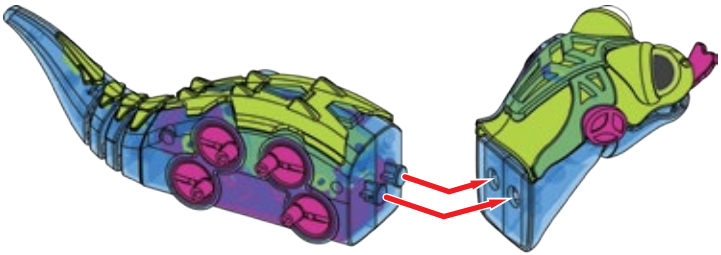


41

Make sure the wire passes through each of the segments of the tail.





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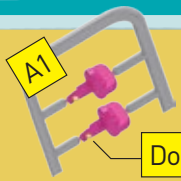
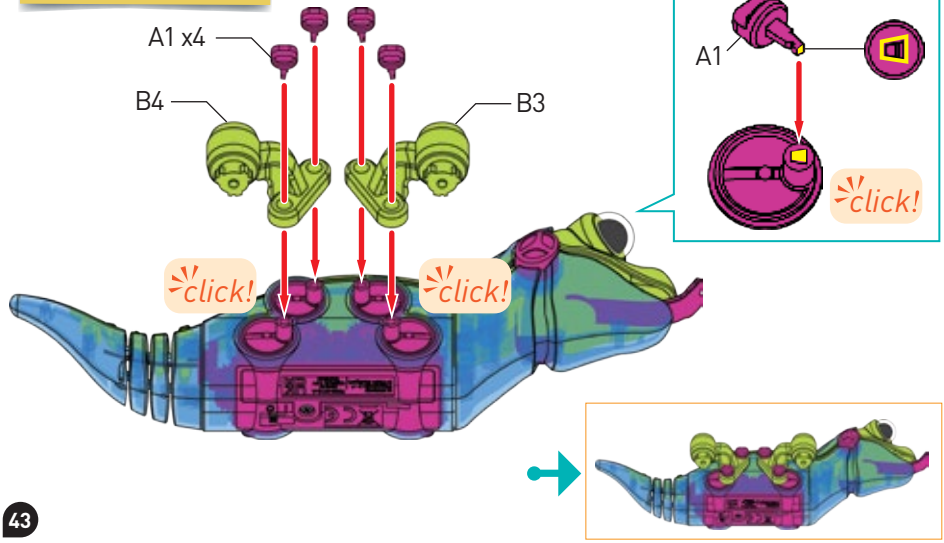
LEGS ASSEMBLY

IMPORTANT!
For the eight A1 parts, do **NOT** remove the small hooks on the parts.



See note above!



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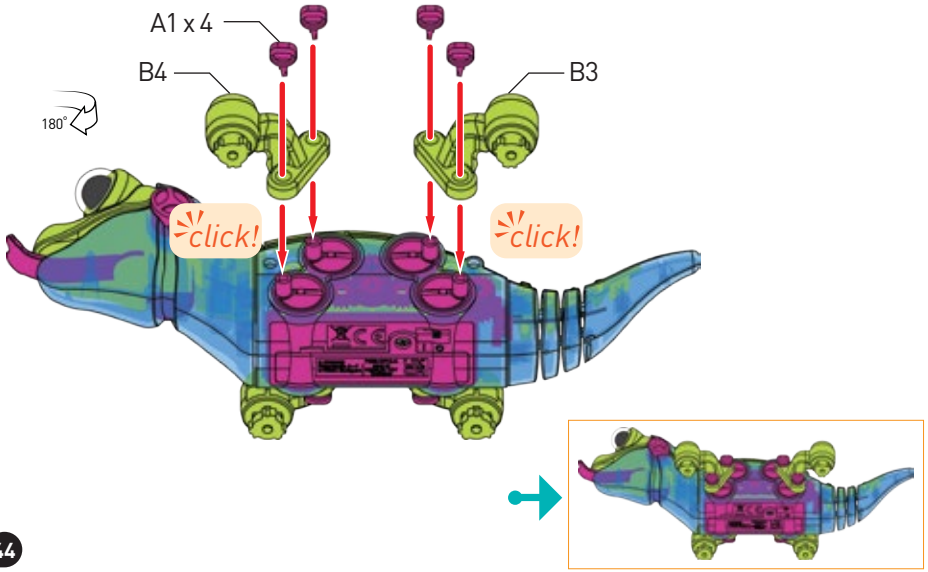

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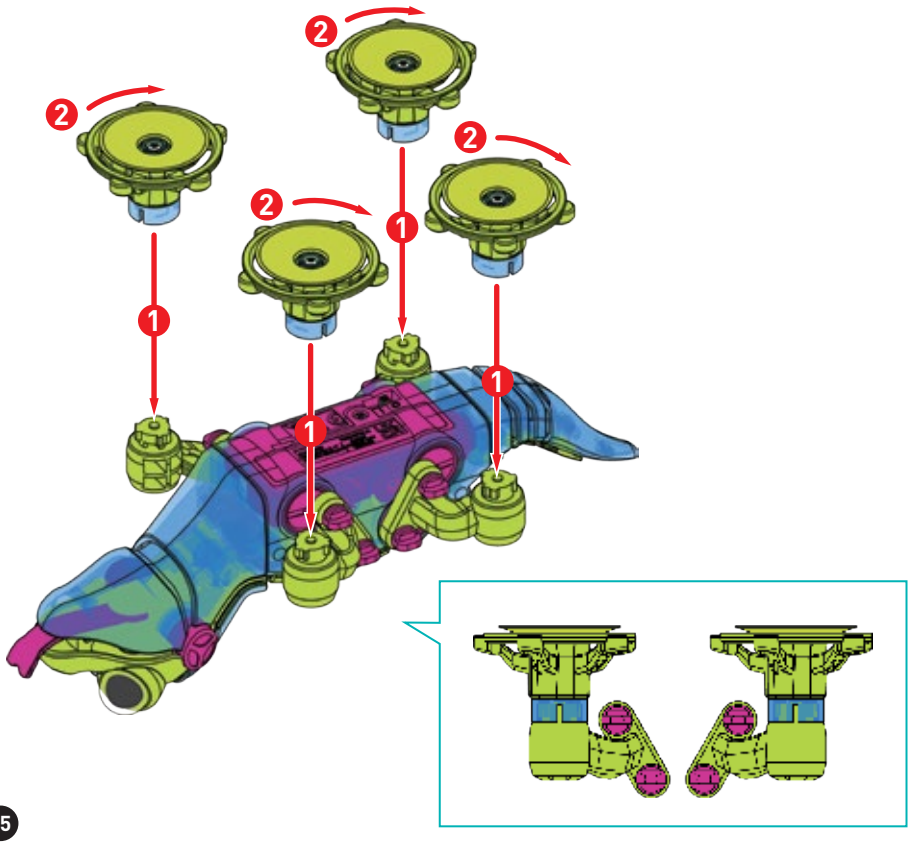

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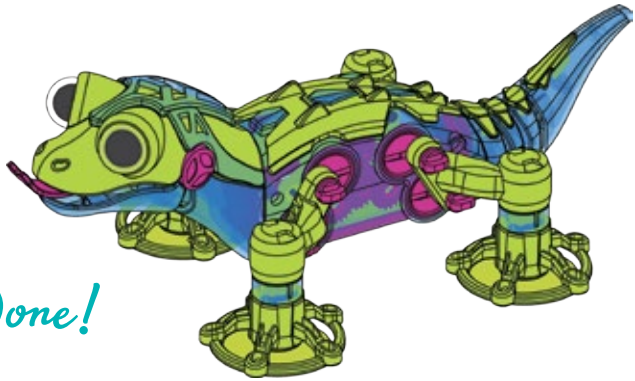
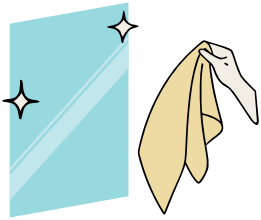


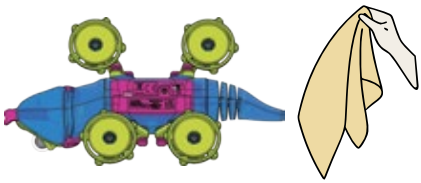
Done!

OPERATION AND TIPS

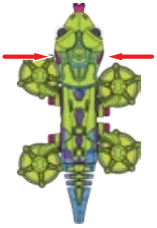
A Choose a hard, smooth surface, like a glass window or mirror. (Drywall and plaster walls are too rough and are not suitable climbing surfaces.)

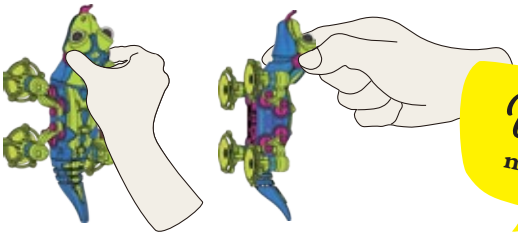
B Before climbing, clean the climbing surface and all four suction cups on the GeckoBot with a microfiber cloth. Clean the glass with window cleaner like Windex or rubbing alcohol. It must be completely clean! Any dust or grease on the surface or the suction cups may cause the GeckoBot to slip.





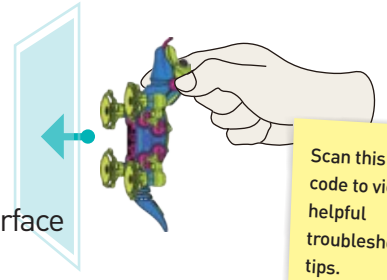
C Hold the GeckoBot by pinching the two pink circles on the sides of its head with your thumb and index finger.





D Turn the switch on with your other hand, then place the GeckoBot onto the climbing surface, ensuring all four suction cups are parallel to the surface. Slowly move the GeckoBot toward the surface until the suction cups adhere, then release your hand. Keep your hands below the GeckoBot while it is climbing in case it falls off the window.

"0" : Off
"I" : On



Scan this QR code to view helpful troubleshooting tips.

EXPERIMENTS

1. Follow the directions on page 14, and place the GeckoBot on a window to climb sideways. How long can it climb before falling off?

   Now use rubbing alcohol to clean the surface of the window and the suction cups. Can the GeckoBot walk even longer?

2. Have the GeckoBot walk upwards a window.
   How long can it climb before falling off?
   (Reminder: do not let the GeckoBot climb out of your reach!)

3. Now try having the GeckoBot walk downwards on a window.
   Is its performance better or worse than walking upwards?

4. Now try having the GeckoBot walk on a horizontal table. What do you notice?
   Does it work better on certain materials?

5. Try climbing with and without the GeckoBot's tongue.
   Does it make any difference to performance?

CHECK IT OUT

Octopus with suction cups

Your GeckoBot isn't the only one who uses suction cups. Some frogs, bats, and bugs also use suction cups to get around. Octopuses too are famous for their suckers. They have two rows of suction cups on each of their eight arms, giving them hundreds in total. With these they can move along smooth surfaces or grab food.

OTHER GRAVITY-DEFYING ANIMAL CLIMBERS

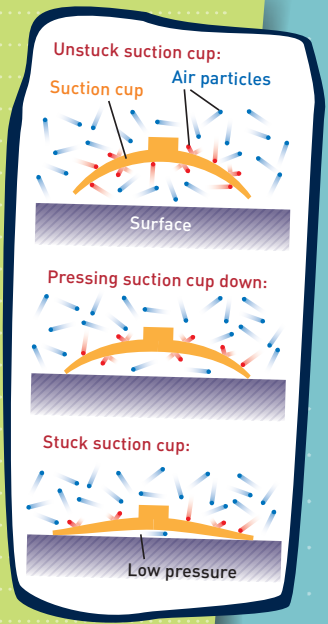
YOU HAVE PROBABLY SEEN INSECTS LIKE FLIES AND SPIDERS EFFORTLESSLY CLIMB UP WALLS OR WALK ON THE CEILING. UNLIKE THE GECKOBOT, THEY DO NOT USE SUCTION CUPS, BUT RATHER ADHESIVE FORCES. THIS PHYSICAL PHENOMENON OCCURS BETWEEN TWO SURFACES, SUCH AS A PANE OF GLASS AND A FLY'S FOOT. TINY HAIRS ON THE BOTTOMS OF INSECTS' FEET PRODUCE A SUBSTANCE OF SUGARS AND OILS THAT ACTS LIKE GLUE.

GECKOS, SMALL LIZARDS FOUND MAINLY IN WARMER CLIMATES, GET THEIR EXTRAORDINARY CLIMBING ABILITY FROM ELASTIC HAIRS ON THEIR FEET THAT ARE SHAPED LIKE TINY SPATULAS. GECKO FEET HAVE INSPIRED SCIENTISTS AND ENGINEERS TO DESIGN MORE ADVANCED ADHESIVES.

HOW DO *Suction Cups* WORK?

Suction cups use air pressure to stick to hard, smooth surfaces where a partial **vacuum** can be created. A suction cup has a cup-shaped surface made of a flexible material, like silicone, rubber, or plastic. When this cup is pressed against a hard surface, the air inside the cup, between the cup and the surface, gets pushed out. The regular atmospheric air outside the cup, which contains many more **air particles** per unit volume of space than inside the cup, remains the same. These air particles are constantly flying around through the air and hitting things, making a tiny impact, the sum of which is **air pressure.**

Because there are a lot more air particles per unit volume on the outside of the cup than there are on the inside, the air pressure is higher on the outside. This difference in air pressure is what keeps the suction cup stuck to the surface.



HOW DOES THE GECKOBOT *Climb*?

By pressing its suction-cup feet onto the window, the GeckoBot creates a **negative pressure** there. This means that the air pressure existing there is lower than the environmental air pressure all around it. This negative pressure ensures the GeckoBot stays stuck to the smooth surface, as the pressure of the atmosphere outside of the suction cups is pushing them toward the surface, while there is virtually no pressure pushing them away.

It is important that the contact between the suction cup and the climbing surface is free of gaps and as airtight as possible. Gaps caused by dust or dirt cause leaks that allow additional air to enter, destroying the negative pressure. Moistening the suction cups can improve the grip. The thin film of water fills in the small gaps and makes for a better seal.

You can create a negative pressure by gently sucking air from an empty water bottle with your mouth. You feel the negative pressure as soon as your lips are pressed against the bottle opening. The force that you can feel is the reason why the GeckoBot sticks to vertical surfaces. Again, it is important to ensure that the contact between the bottle and your lips is airtight.

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