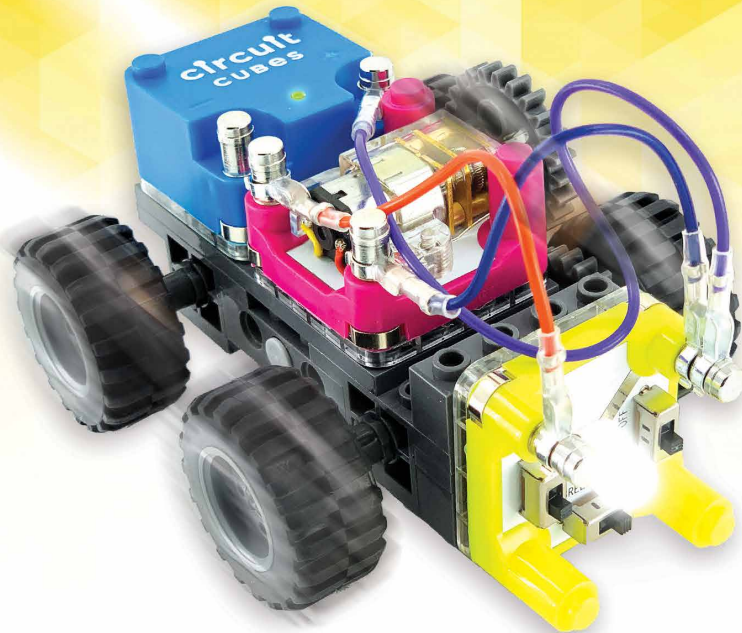


POWER YOUR BUILDS

GEARS GO!

MULTI-VEHICLE MOBILITY LAUNCH KIT



**circuit
CUBES**

CUBES

Bring your toys to life with Circuit Cubes, the electronic building blocks that add power, motion, and light to your creations. Designed by STEM teachers, Circuit Cubes can turn a light on, power a motor, or make wheels spin — plus, they work with your LEGO® bricks.

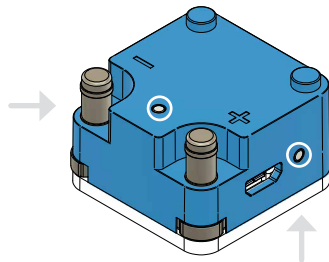
CHARGING

Unplugged (top light)

- ● = ON
- ● + ● = short circuit

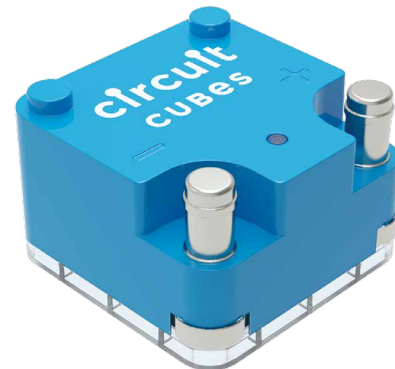
Plugged (side light)

- ● = charging
- ● = charge complete



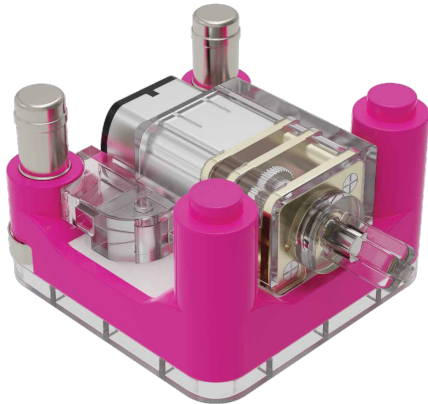
BATTERY CUBE

The standard battery Cube is the power for your circuit. It has a positive and negative terminal. Just turn on the switch to power your creation and it's rechargeable too. If the LED on the top of your cube is flashing red then you have caused a short circuit and power output is disabled to allow you to troubleshoot the circuit.



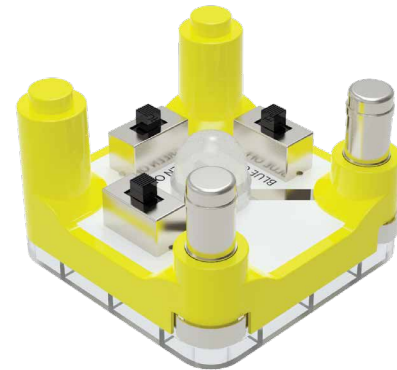
MOTOR CUBE

A perfect fit for your LEGO® gears and wheels, this mighty little motor actually rotates at more than 1,000 RPM (rotations per minute), but the tiny gears attached to the motor shaft reduce the rotations to about 100 RPM. This ensures maximum torque to turn the wheels or gears of your projects.



RGB LED CUBE

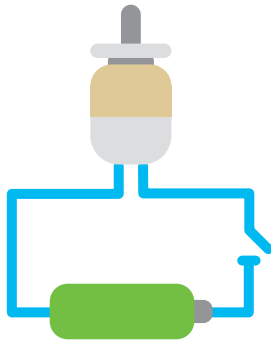
The Red-Green-Blue (RGB) LED has three different LEDs in one bulb. Use the small switches to turn on each of the different LEDs, and control the red, green, and blue lights. Try mixing the colors together to get different combinations for purple, teal, and yellow lights.



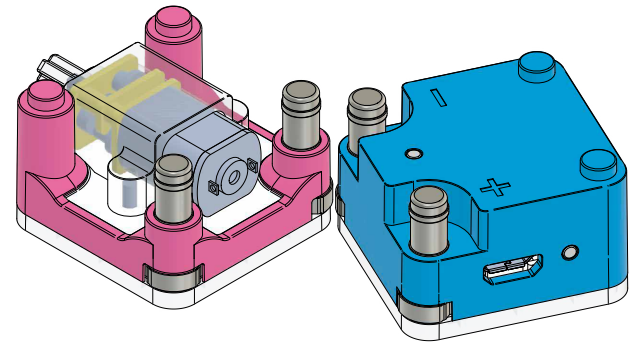
LET'S CONNECT

POLARITY

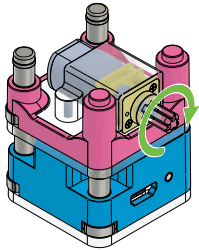
You won't find +/- signs on the motor cube because direct current (DC) motors, like this one, can accept current in both directions. If you wire it up one way, it will rotate in one direction. Flip your wires and it will spin in the opposite direction.



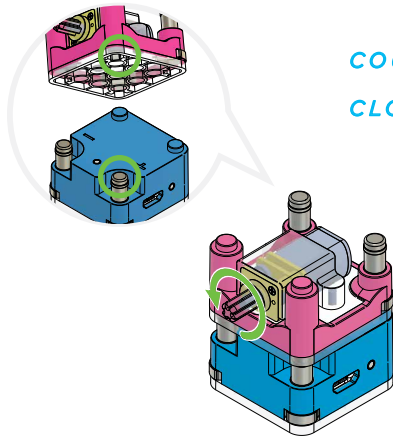
MAGNETIC



CONTACT

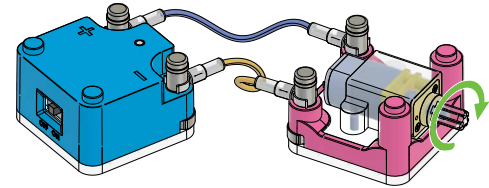


CLOCKWISE

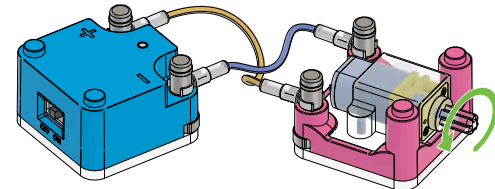


*COUNTER-
CLOCKWISE*

WIRE



CLOCKWISE

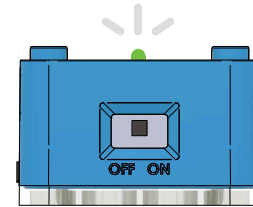


COUNTER-CLOCKWISE

HELLO CUBES

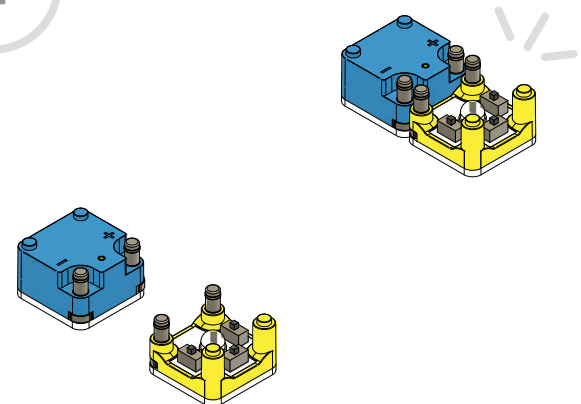
- 1 Turn on Battery: Power all your projects!
- 2 Battery & LED: Instant light!
- 3 Battery & Motor: Get things revving!
- 4 Battery & LED & Motor: Lights & action!
- 5 Motor & LED & Wheel: Turn the wheel to generate electricity!
- 6 Battery & Motor & Wheel & Wires: Your Circuit Cubes can take on anything!

1

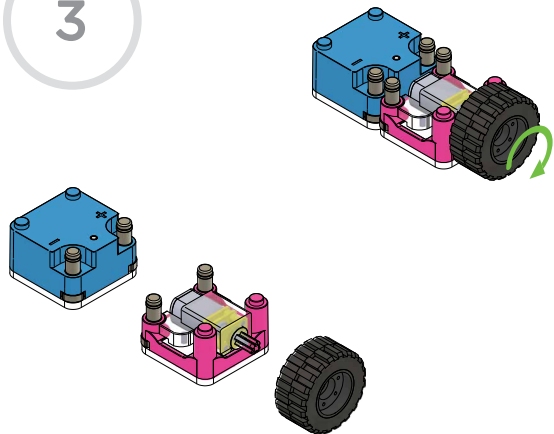


OFF → ON

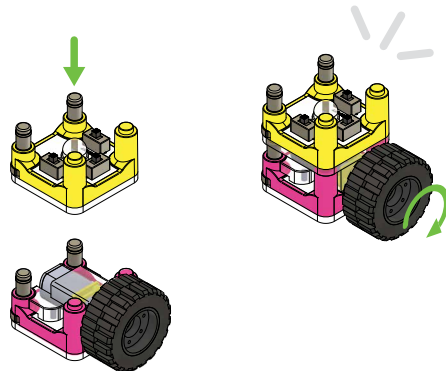
2



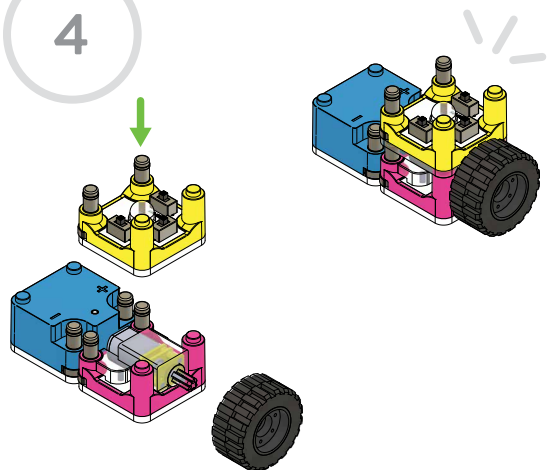
3



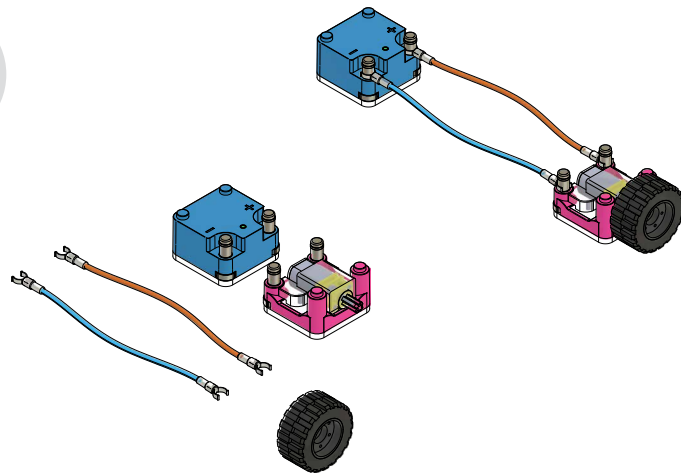
5



4

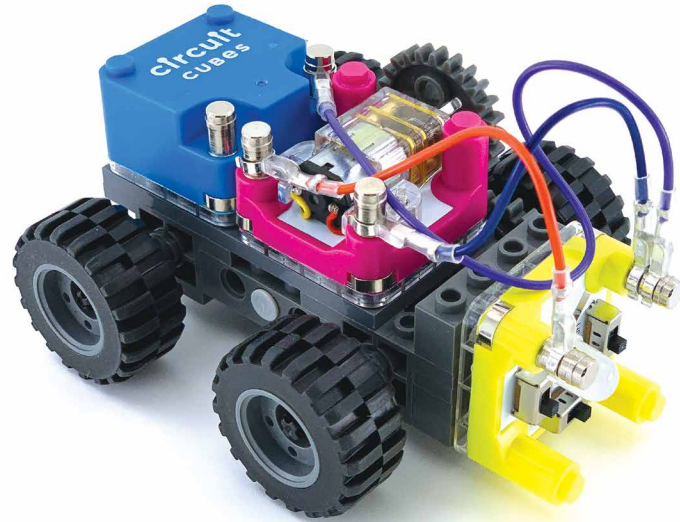


6



QUEST

A COMPACT EXPLORER TO LIGHT
THE WAY ON YOUR ADVENTURE



DUNE

A POWERFUL 4X4 SAND ROVER

GATOR

*SUPER TANK WITH
GRIPPY TREADS + PROPELLER*

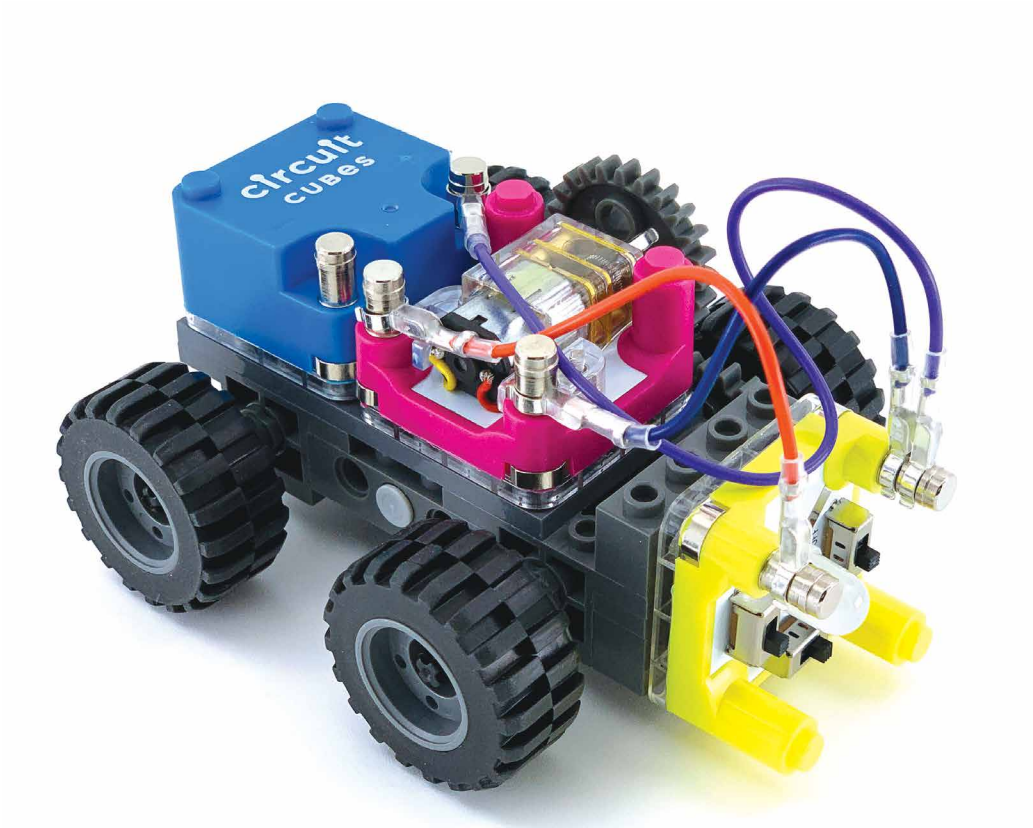


BLUR

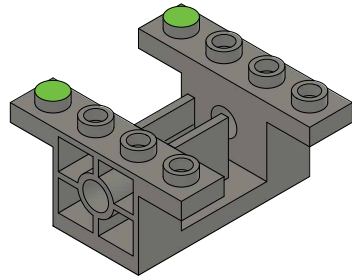
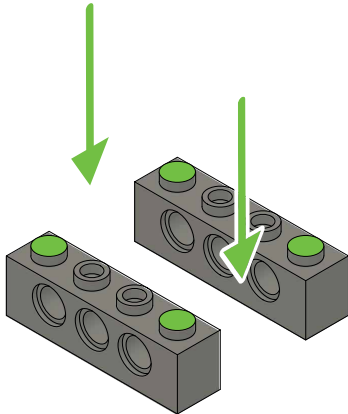
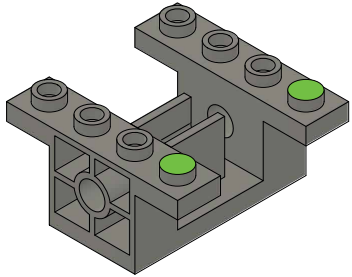
*A GEARED-UP JET DRAGSTER,
BUILT FOR SPEED*

QUEST

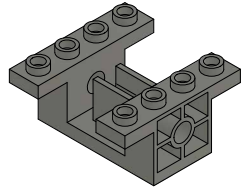
A COMPACT EXPLORER TO LIGHT THE WAY ON YOUR ADVENTURE



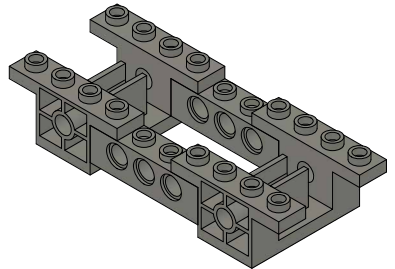
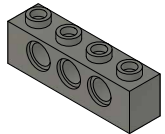
1



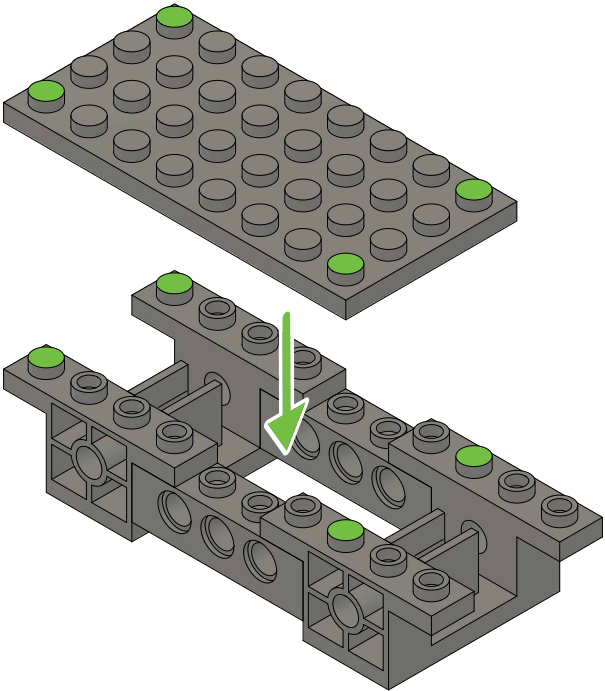
2



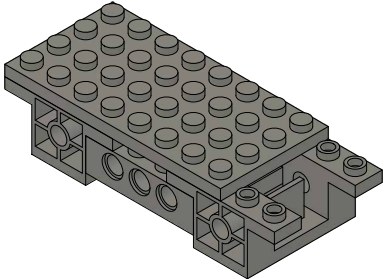
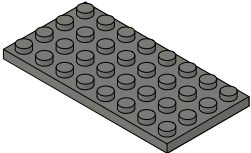
2



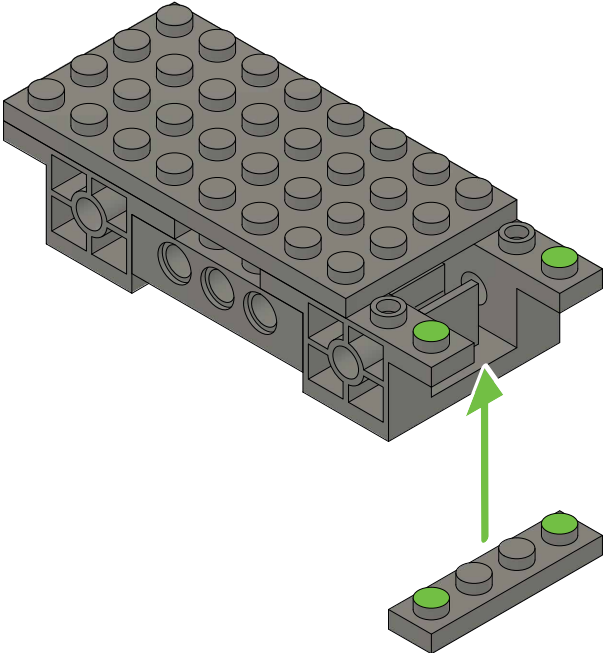
2



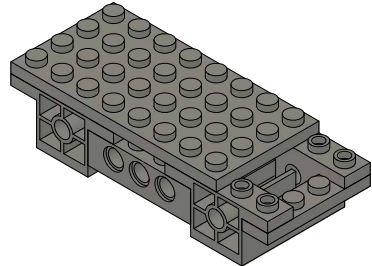
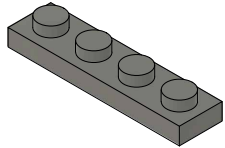
1



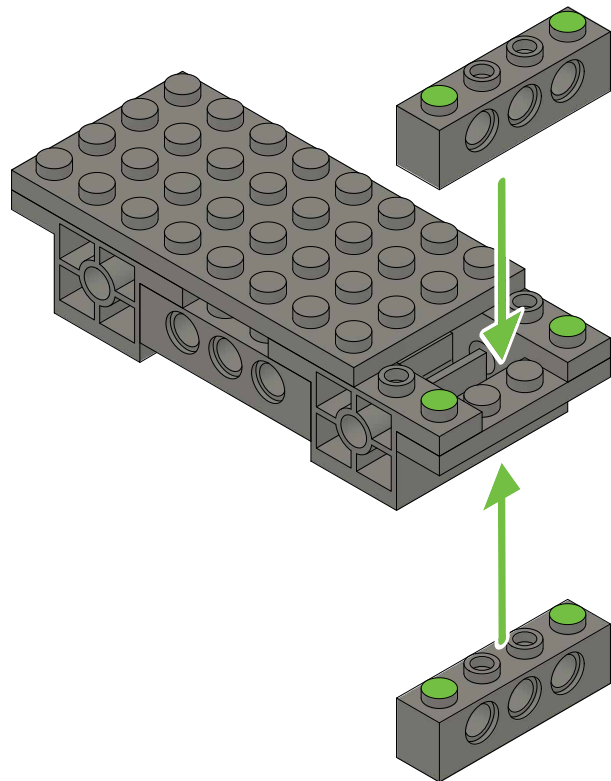
3



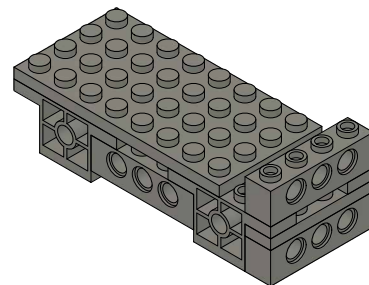
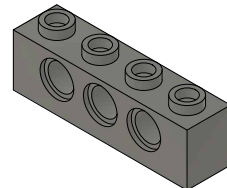
1



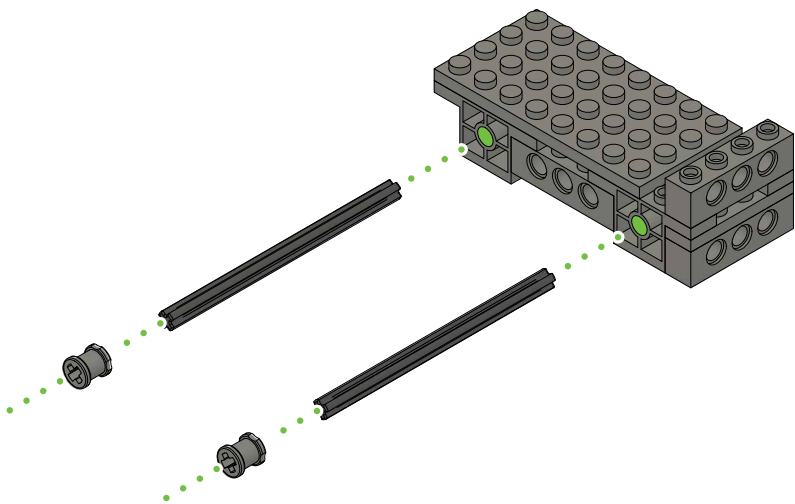
4



2



5



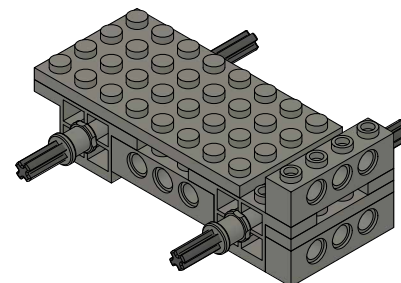
1:1 SCALE



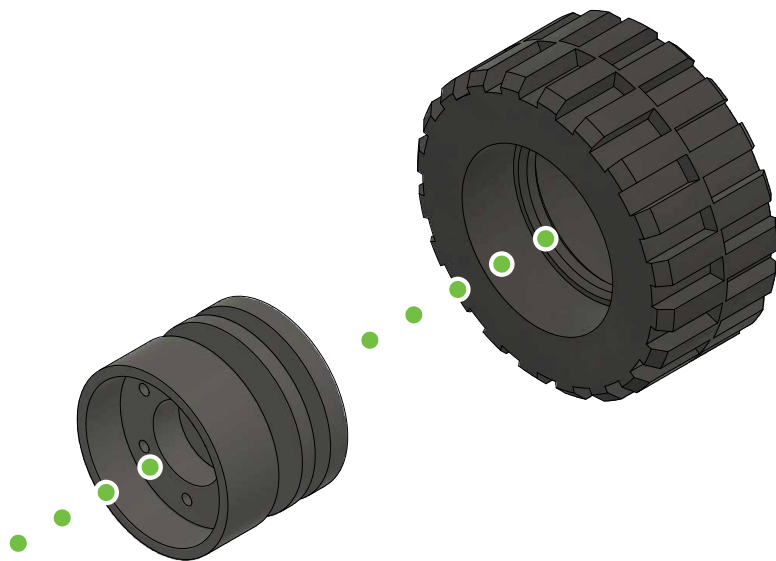
2



2



6



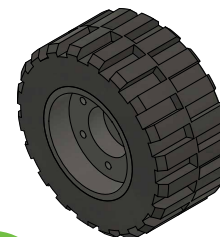
4



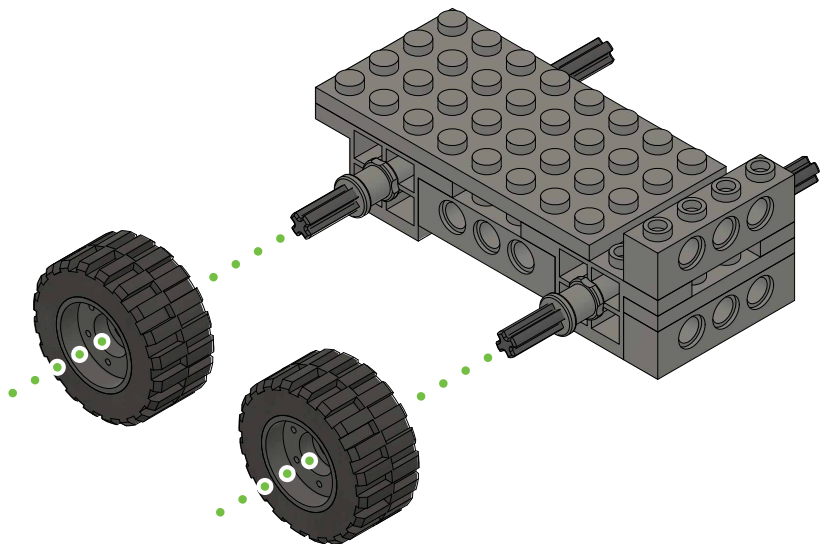
4



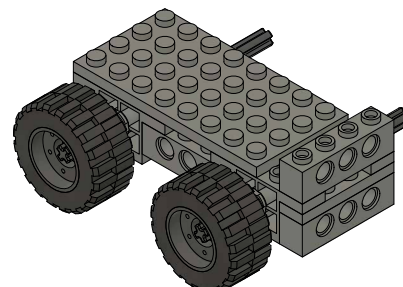
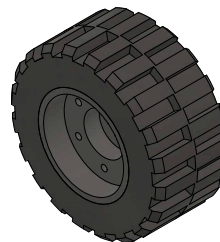
4x



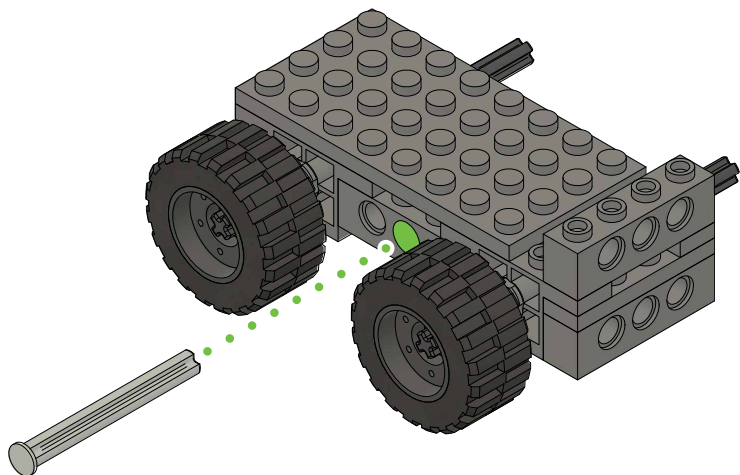
7



2



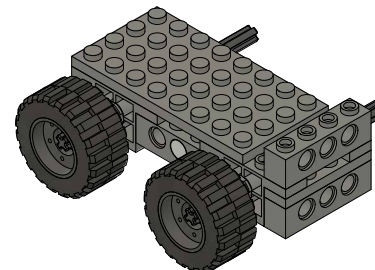
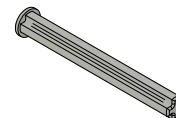
8



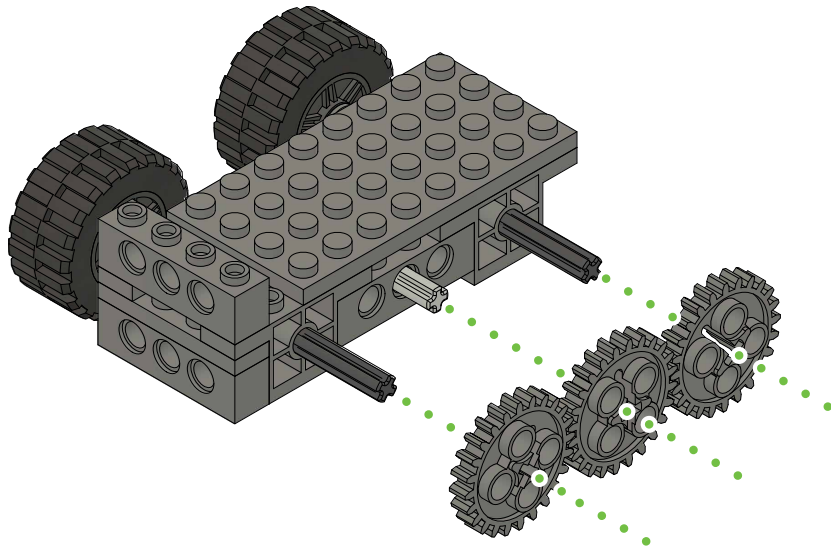
1:1 SCALE



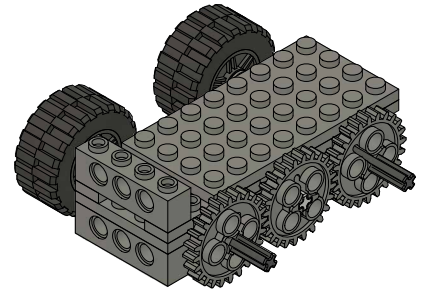
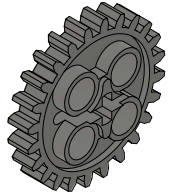
1



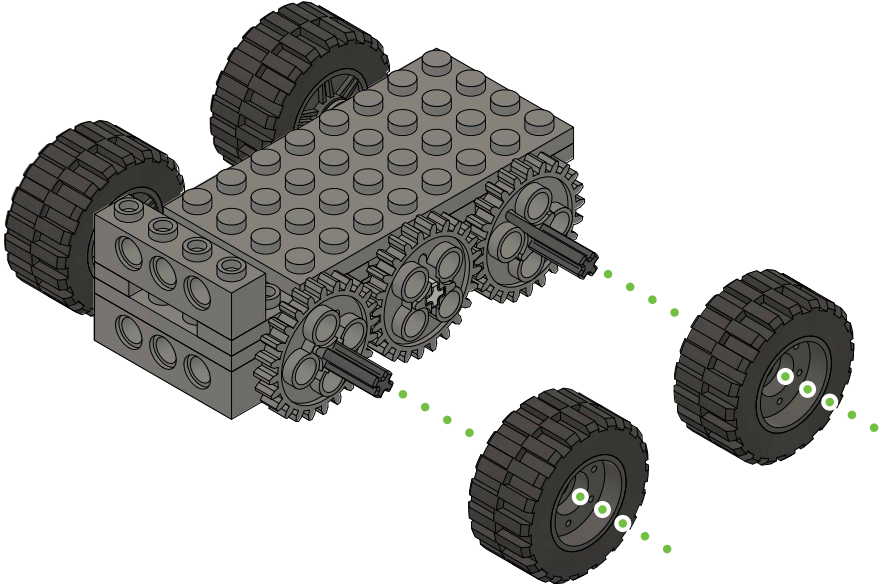
9



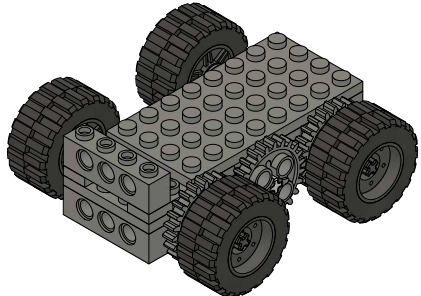
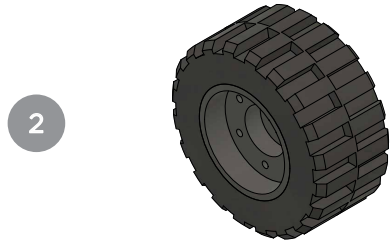
3



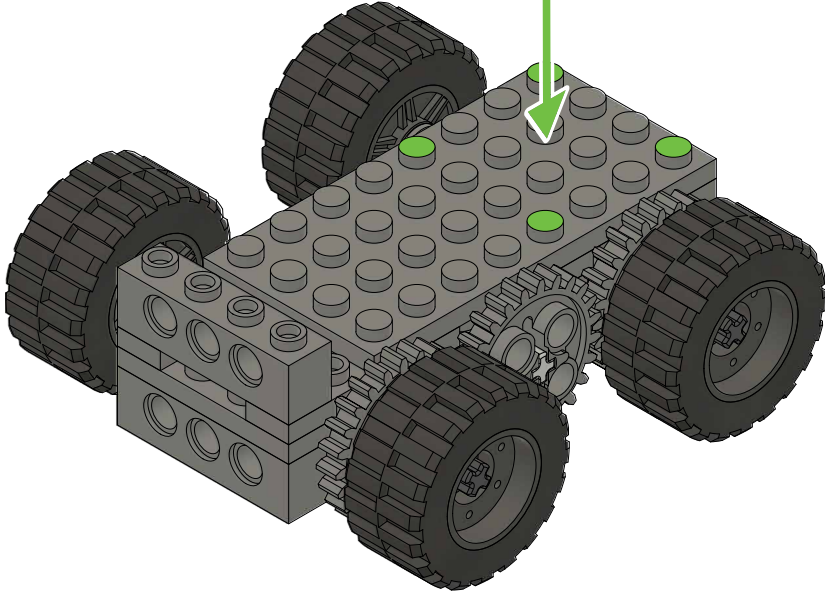
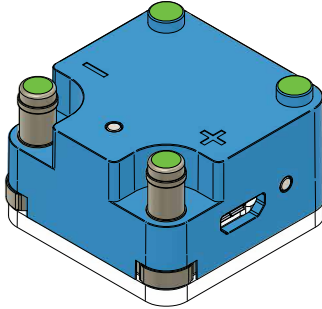
10



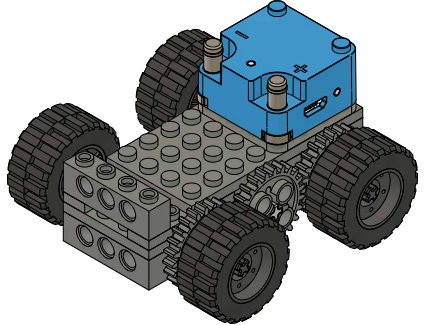
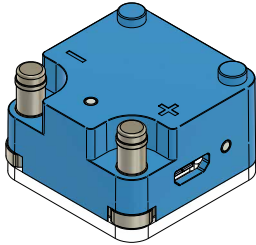
2



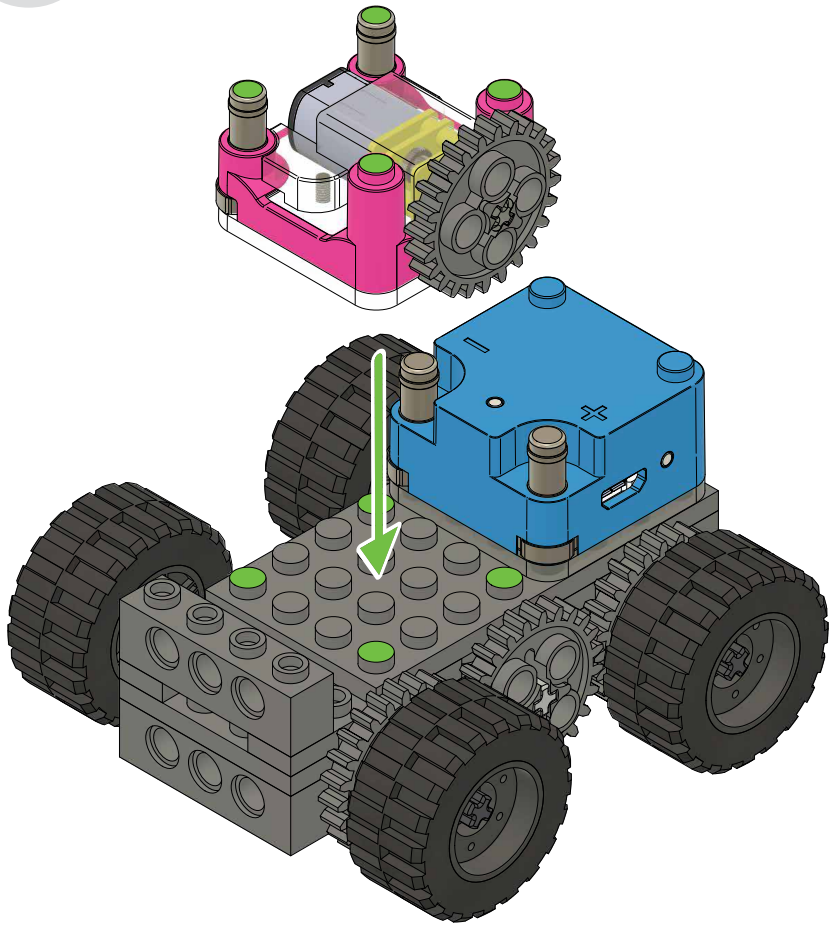
11



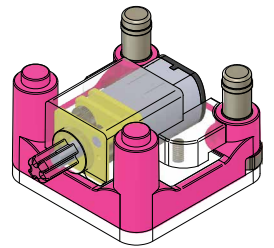
1



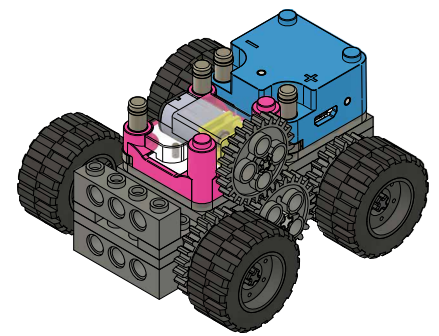
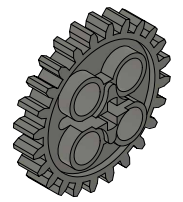
12



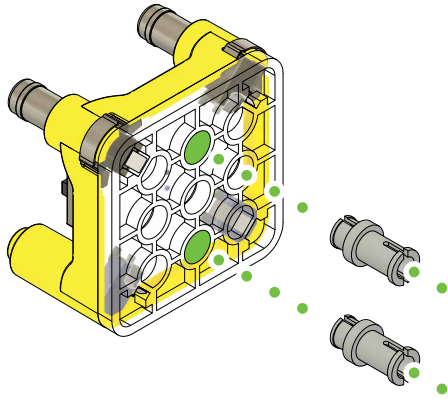
1



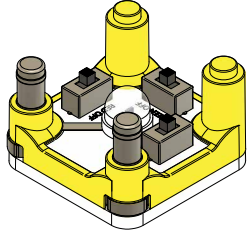
1



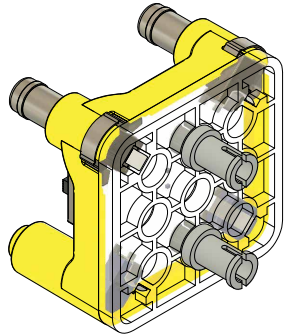
13



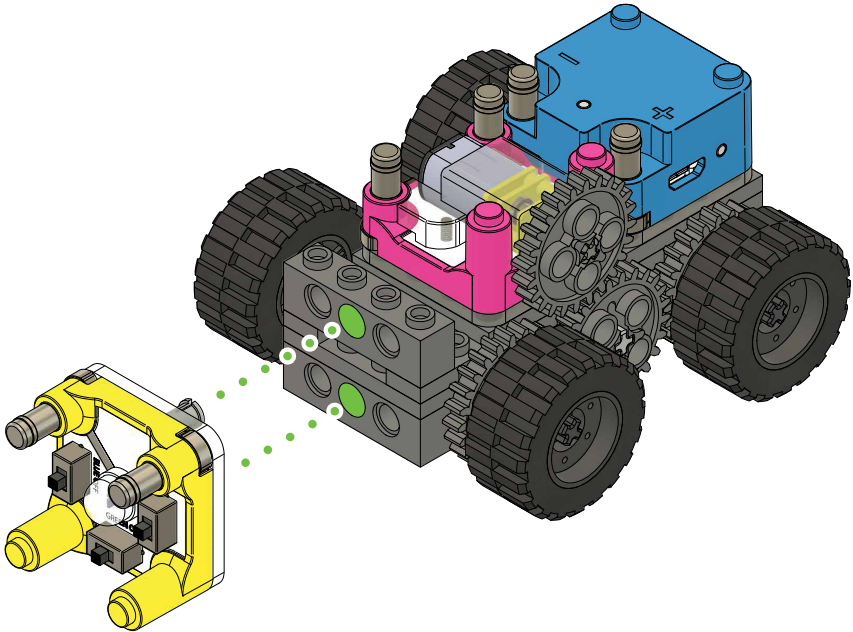
1



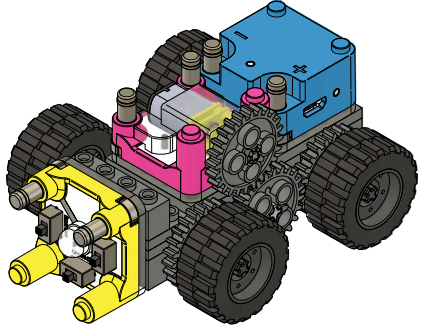
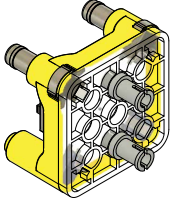
2



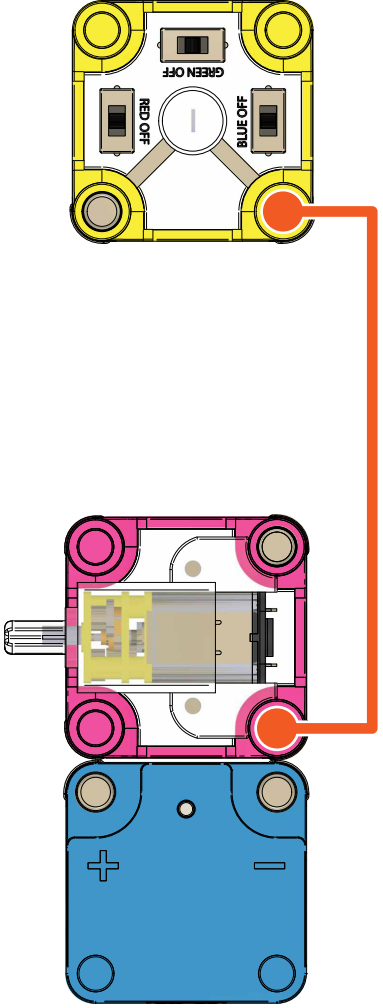
14



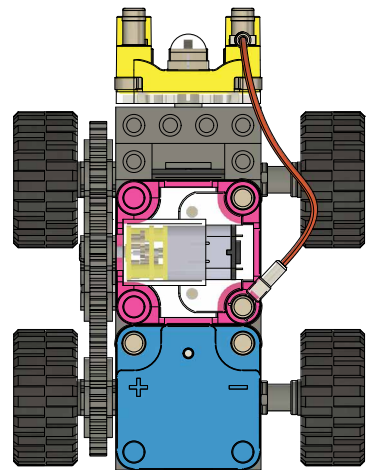
1



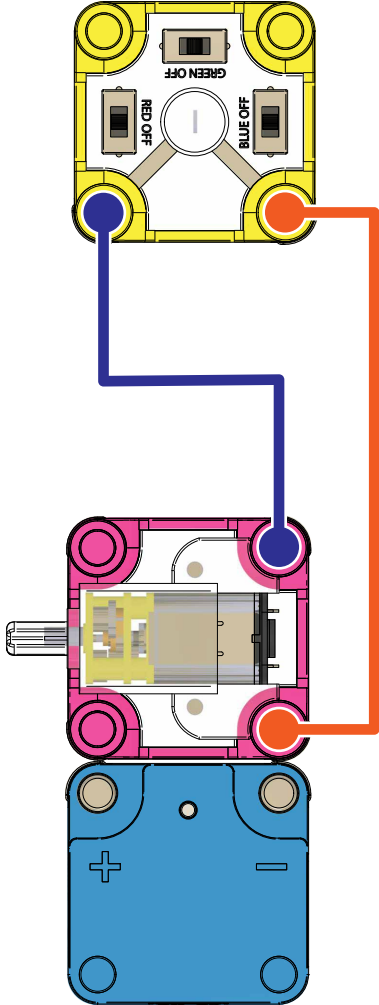
15



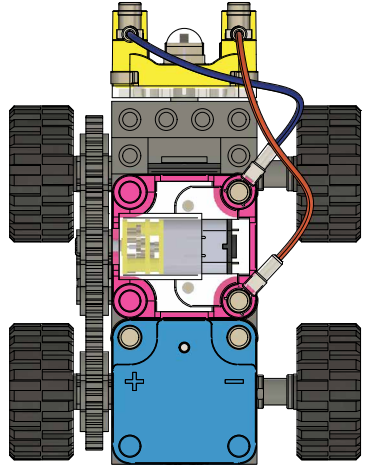
1



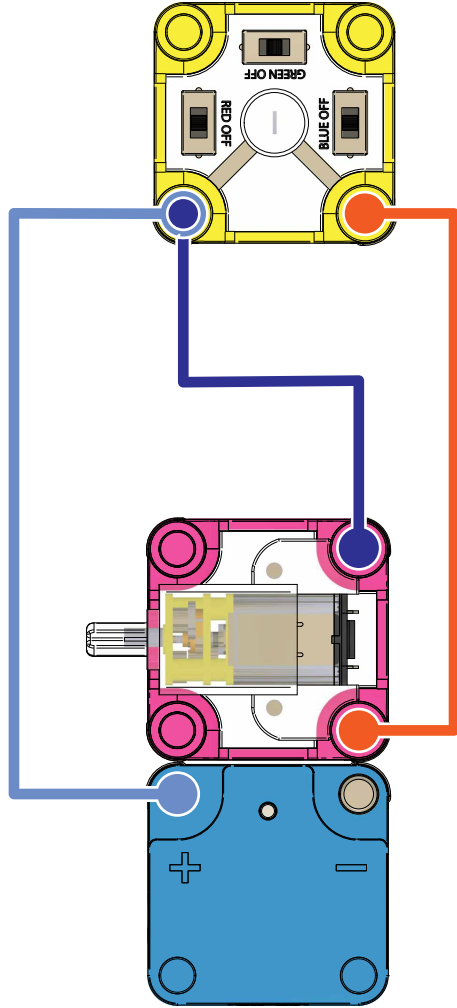
16



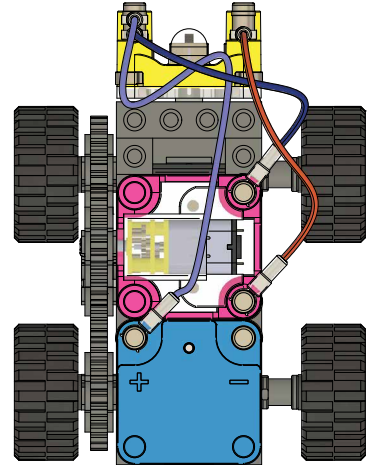
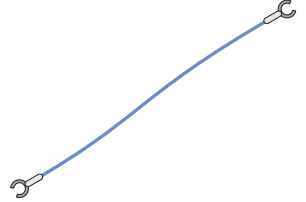
1



17



1

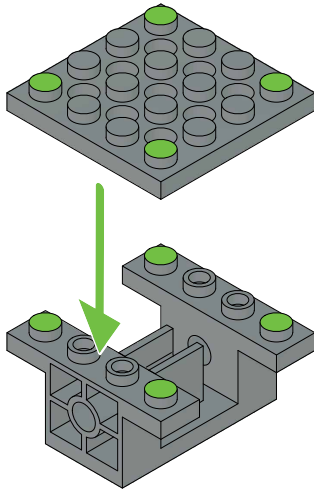


DUNE

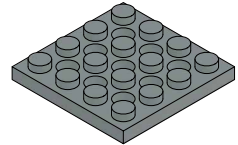
A POWERFUL 4X4 SAND ROVER



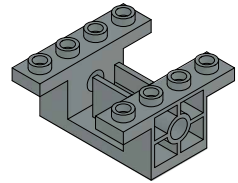
1



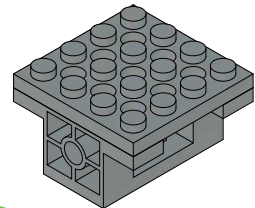
2



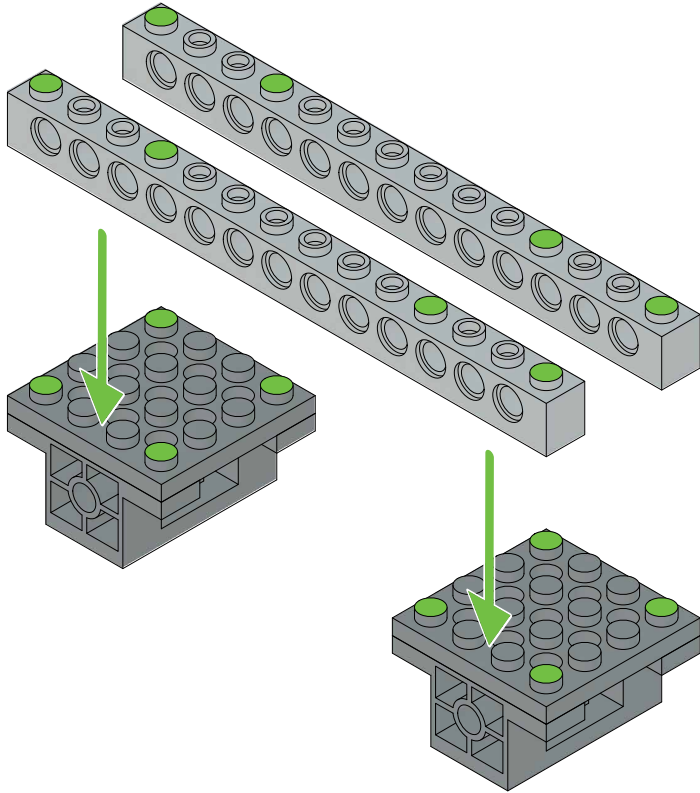
2



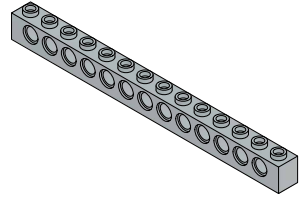
2x



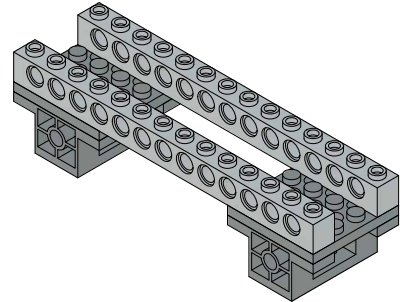
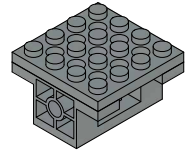
2



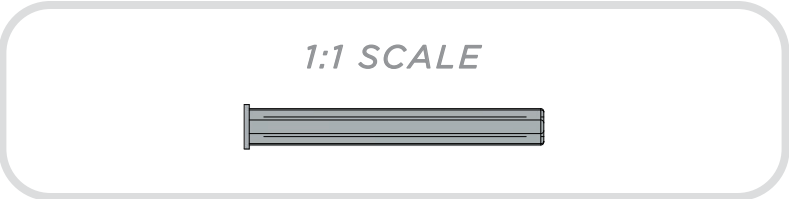
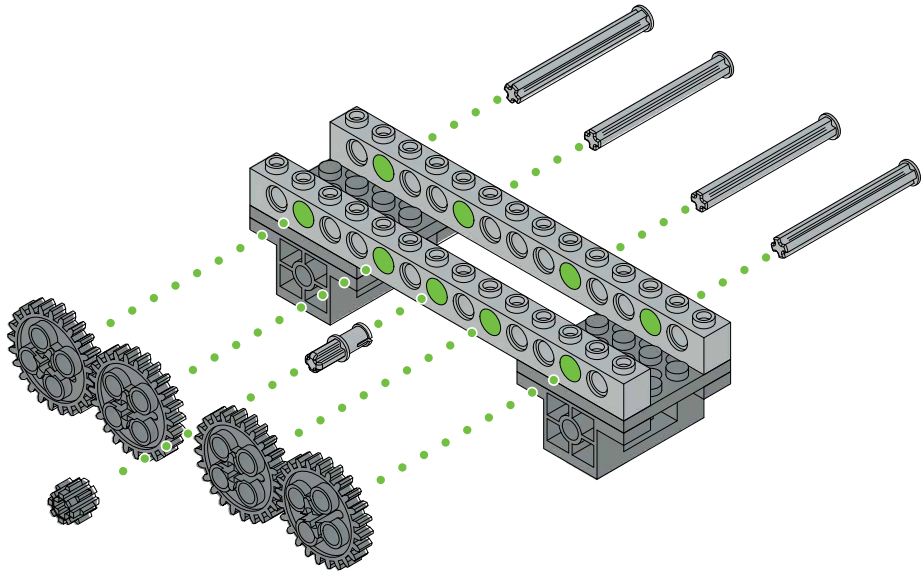
2



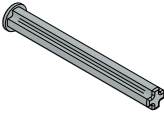
2



3



4



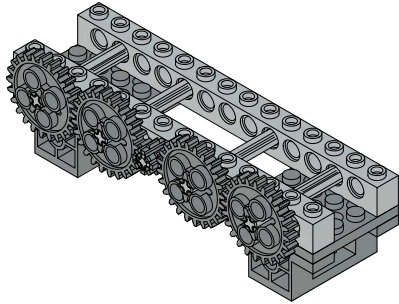
4



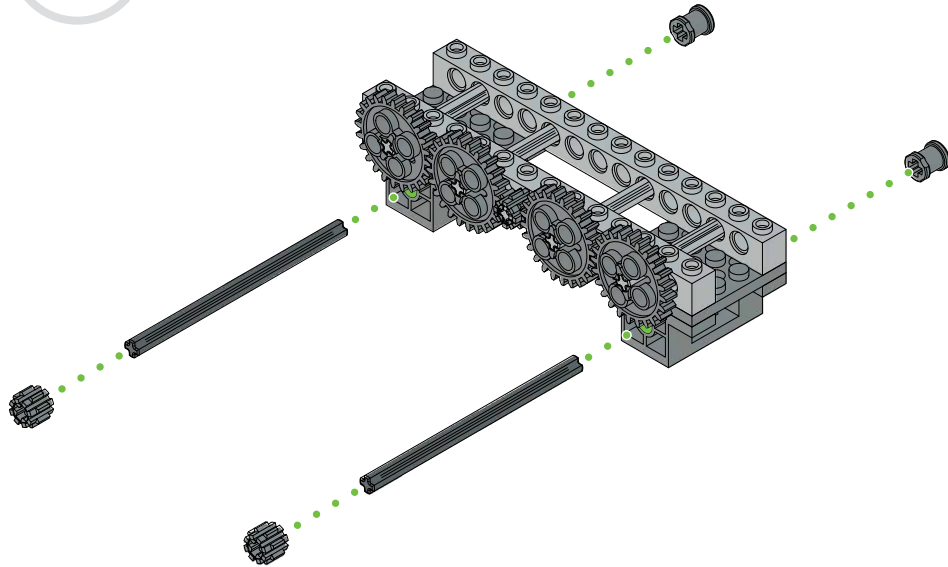
1



1



4



1:1 SCALE



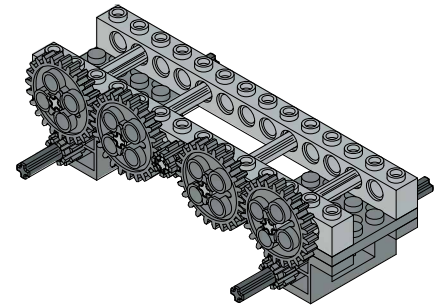
2



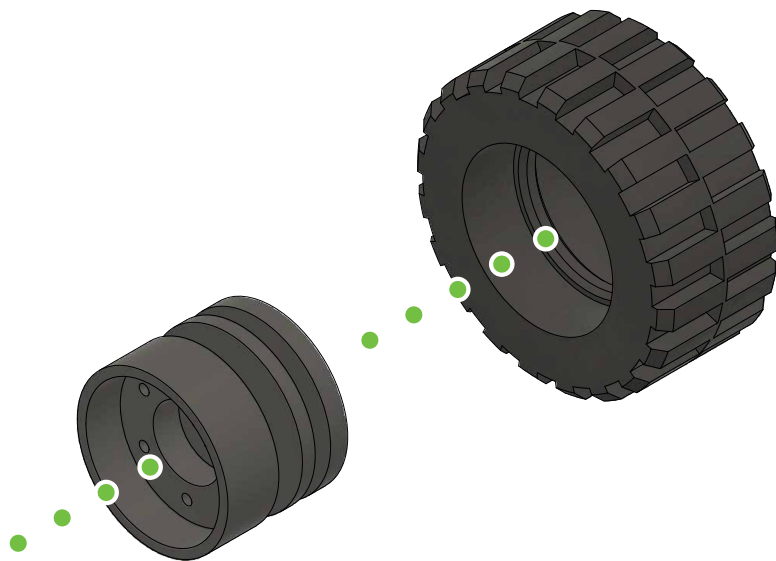
2



2



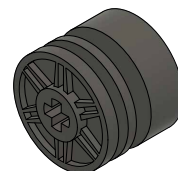
5



4



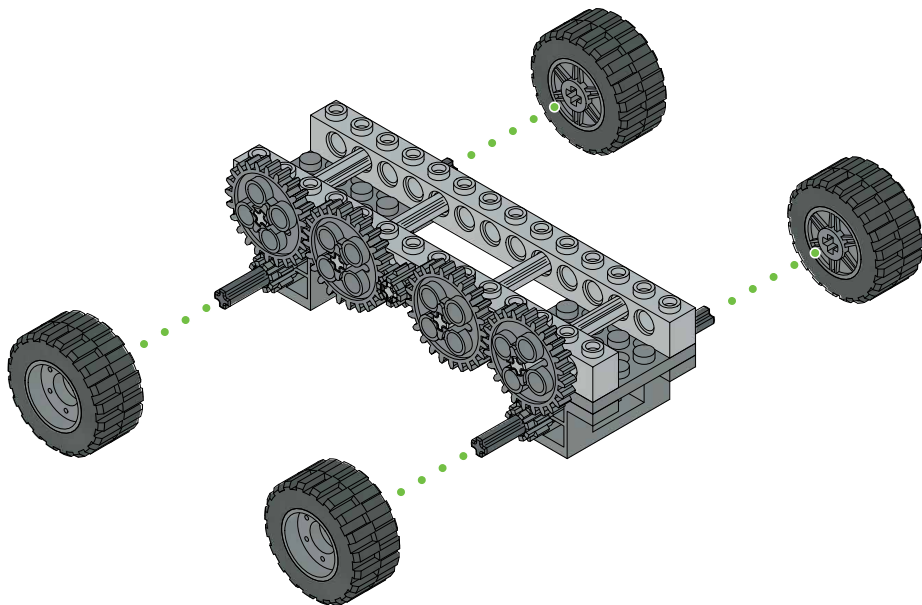
4



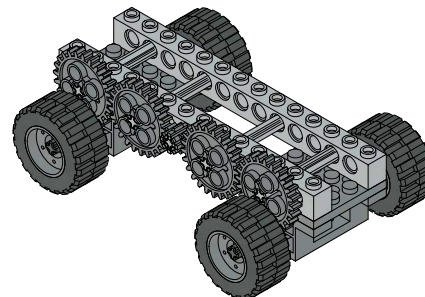
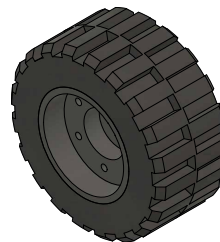
4x



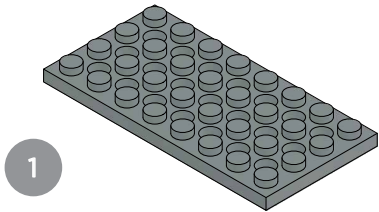
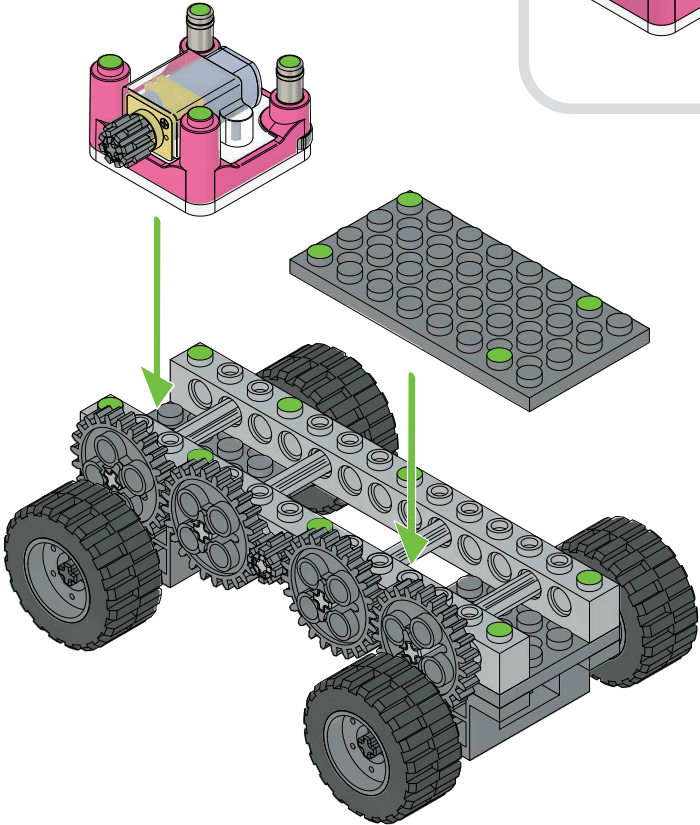
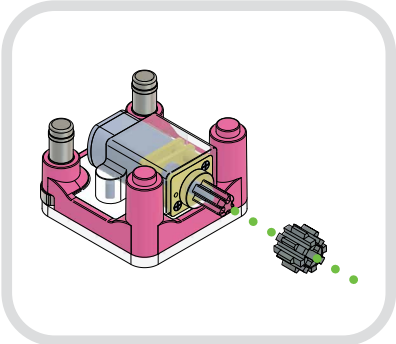
6



4



7

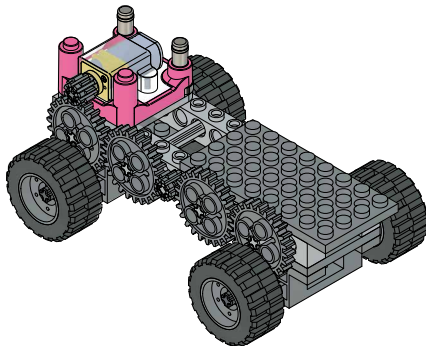
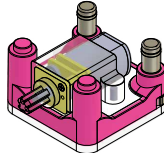


1

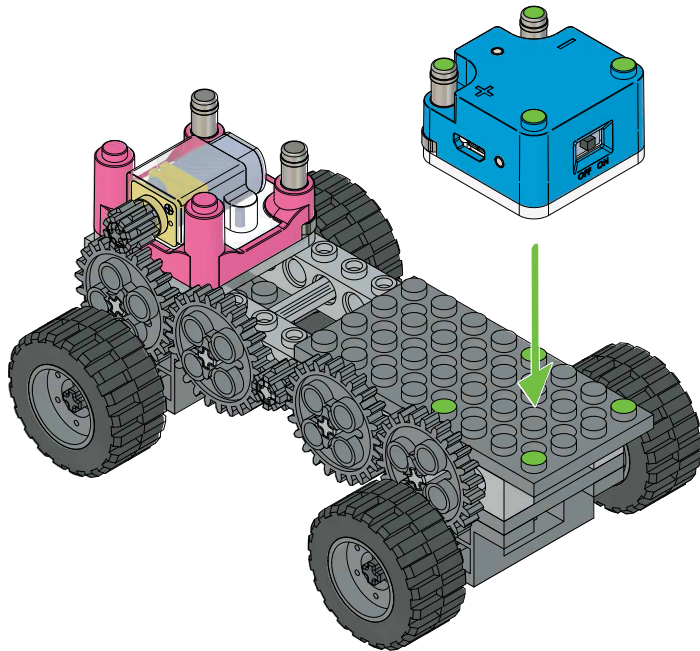
1



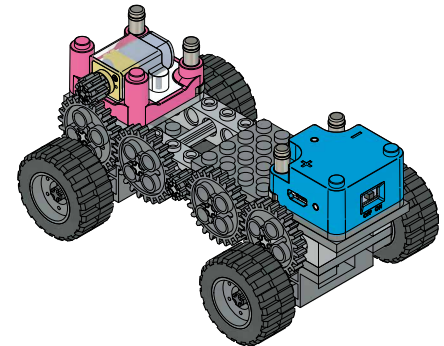
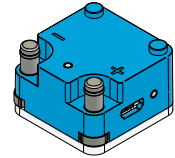
1



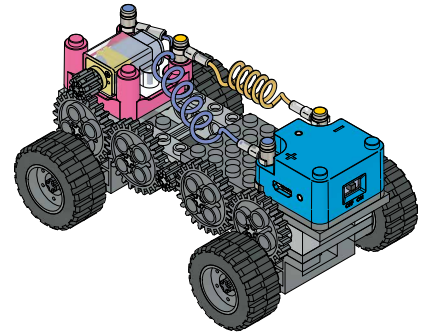
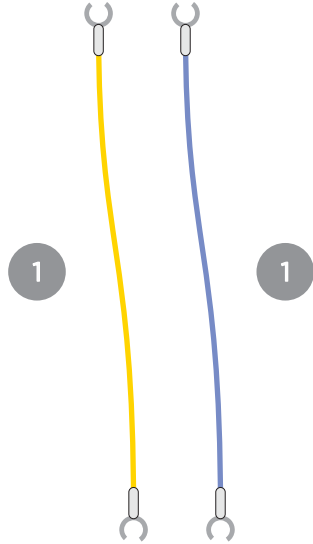
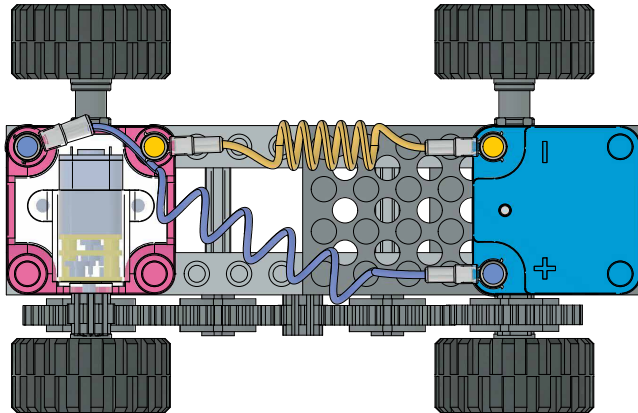
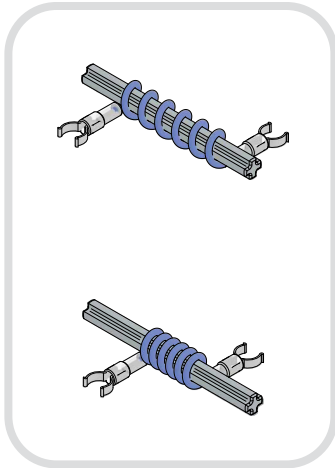
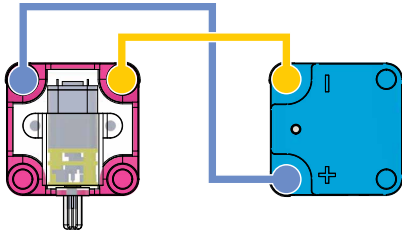
8



1

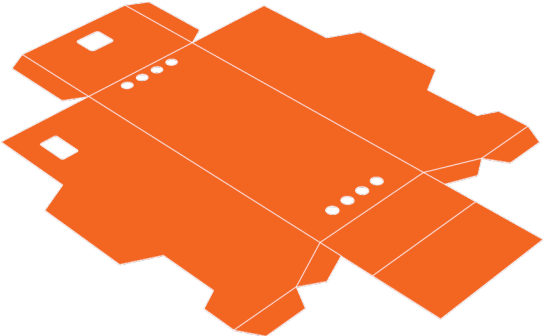


9

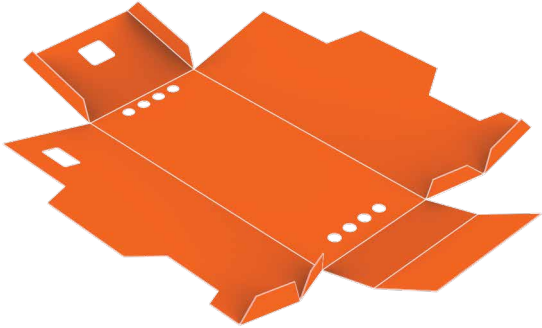


10

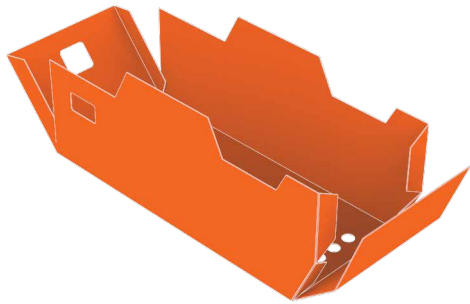
USE DOUBLE SIDED TAPE OR A GLUE STICK ON THE SHADED AREAS OF THE VEHICLE CUTOUTS



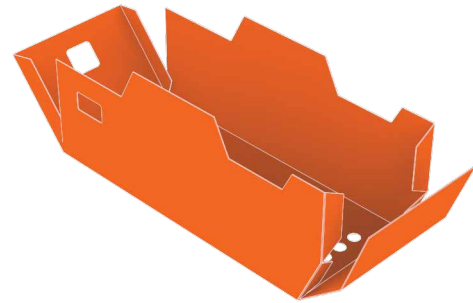
1



2

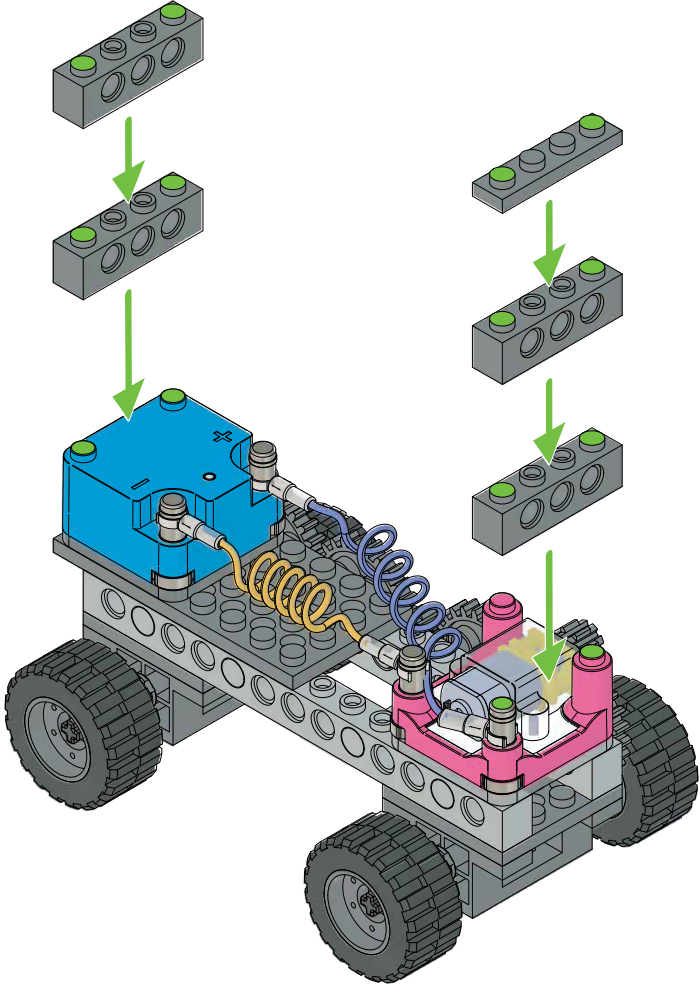


3

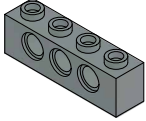


4

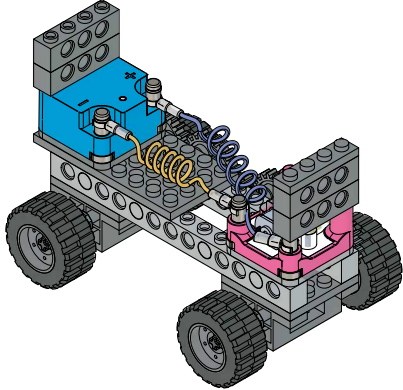
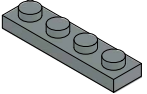
11



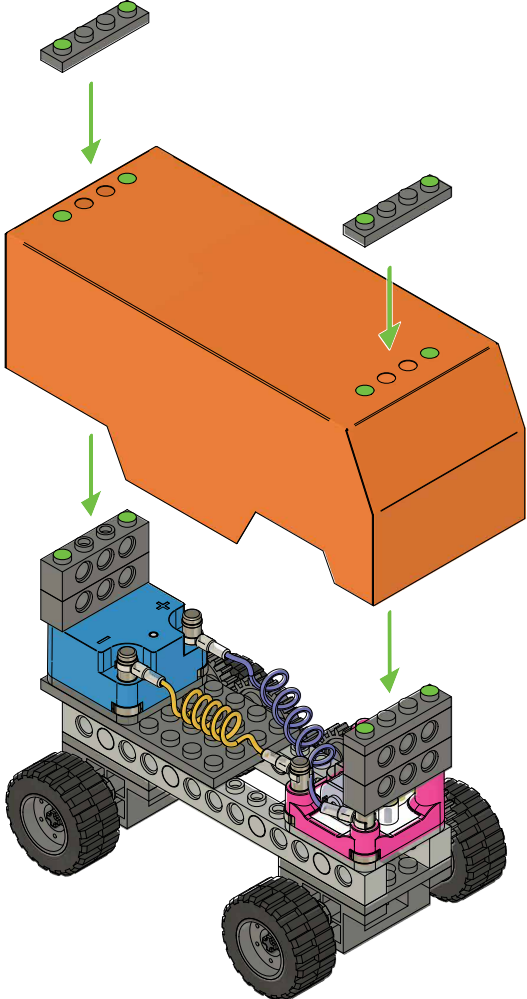
4



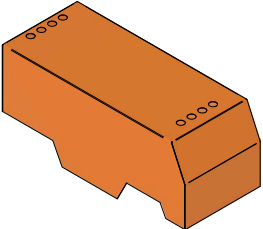
1



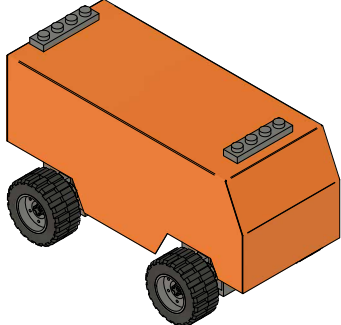
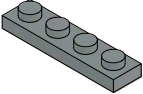
12



1



2

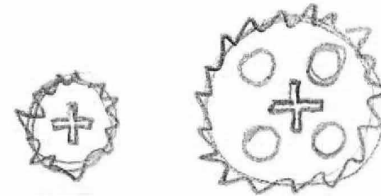


DUNE

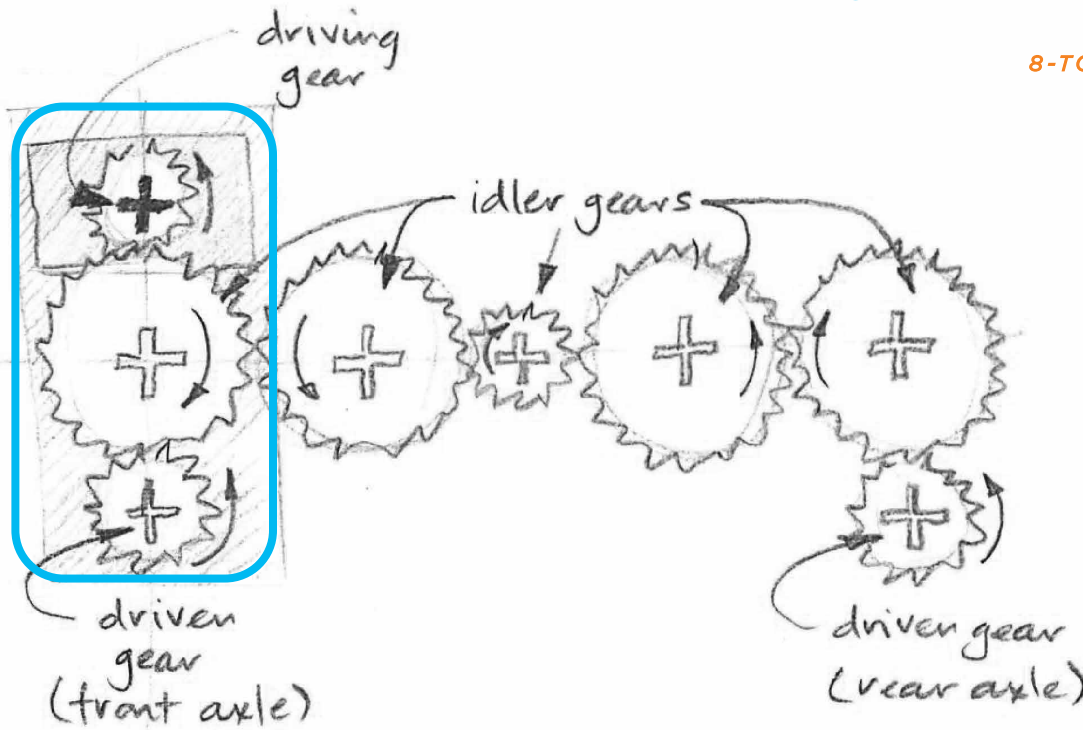
UNDERSTANDING DRIVE TRAIN

Dune's drive train uses two sizes of gears: 8-tooth & 24-tooth gear.

24-TOOTH GEAR

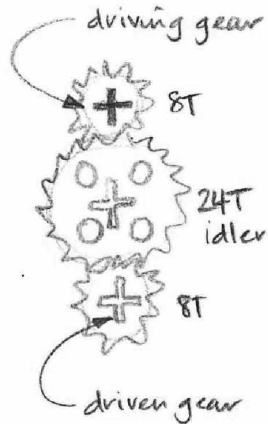


8-TOOTH GEAR



A single Motor spins all four of Dune's wheels. It accomplishes this using idler gears between the driving gear & two driven gears.

We can compute Dune's gear ratio by focusing on the three gears in the highlighted blue box that drives the front axle.



$$\text{Dune's gear ratio} = \frac{\# \text{teeth driving gear}}{\# \text{teeth driven gear}} = \frac{8T}{8T} = 1:1$$

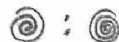
A 1:1 gear ratio means that the Motor & the wheel axles spin at the same speed.



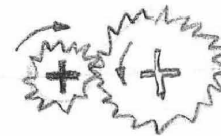
GEAR RATIO



SPEED UP



LESS TORQUE



GEAR RATIO



SLOW DOWN

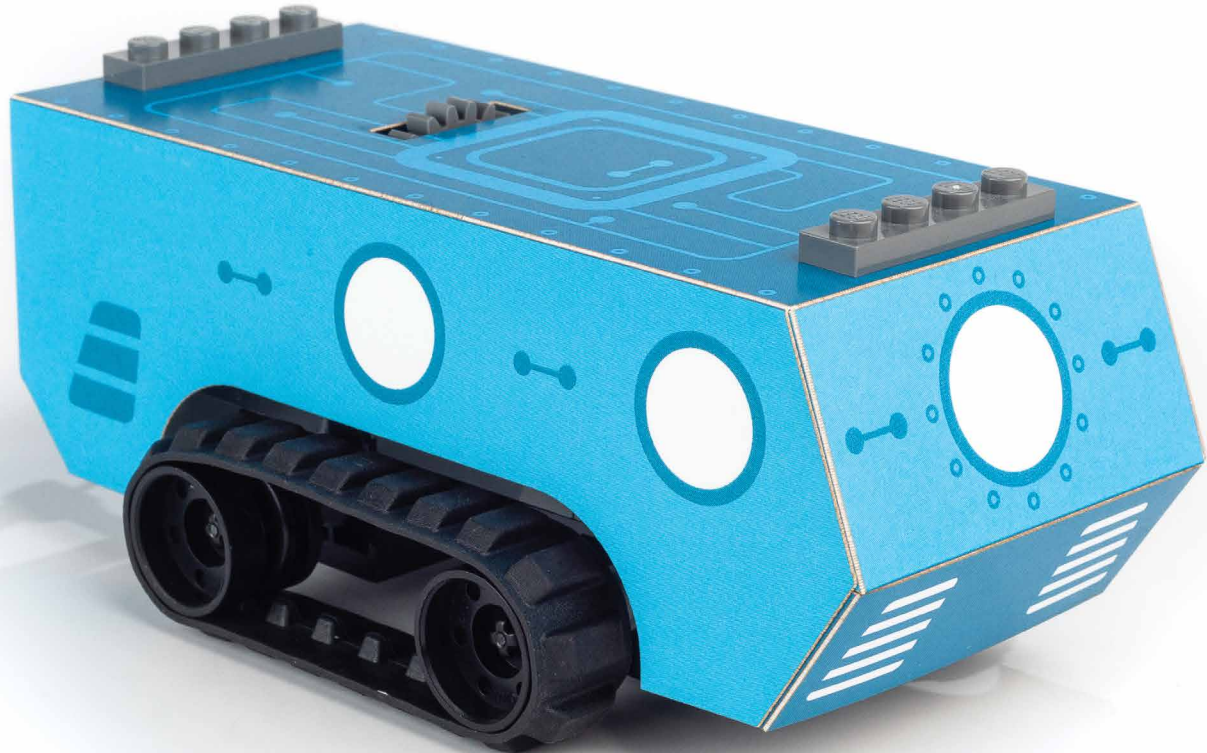


MORE TORQUE

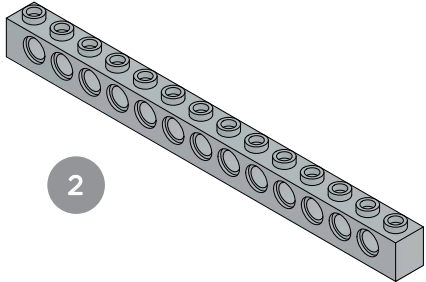
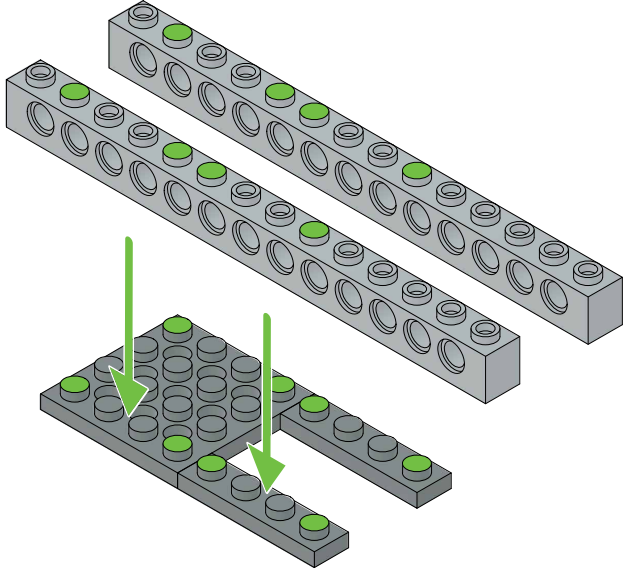


GATOR

SUPER TANK WITH GRIPPY TREADS + PROPELLER

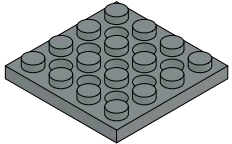


1

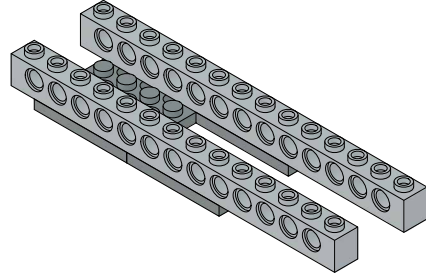
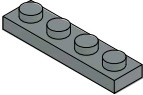


2

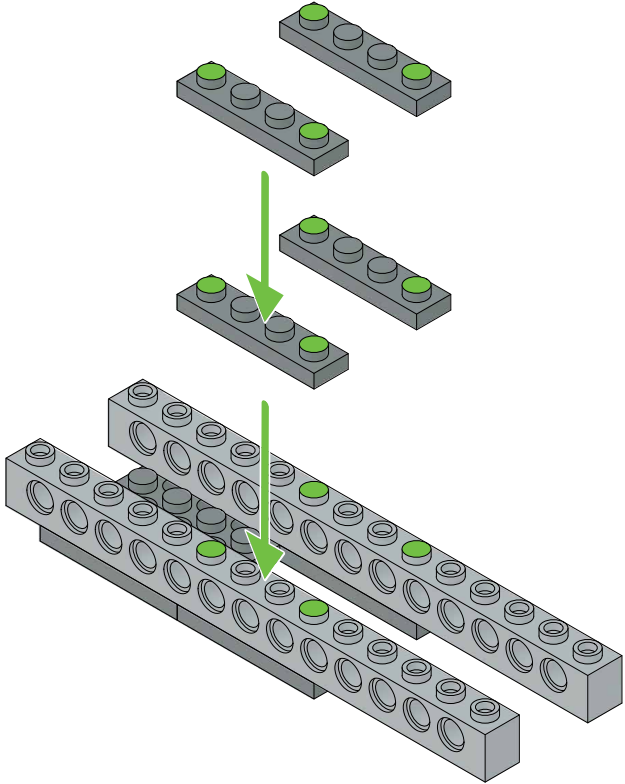
1



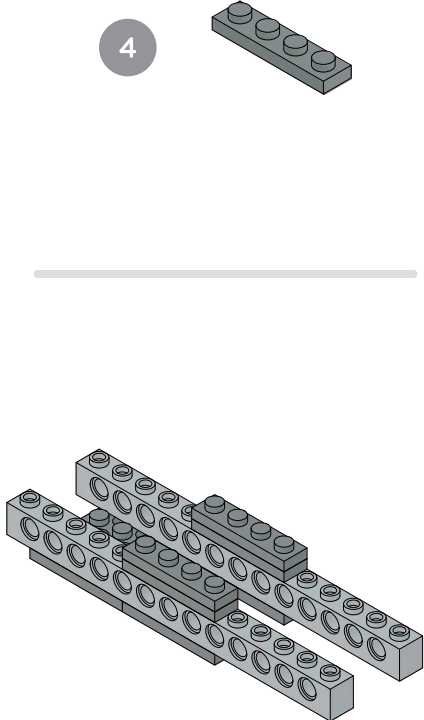
2



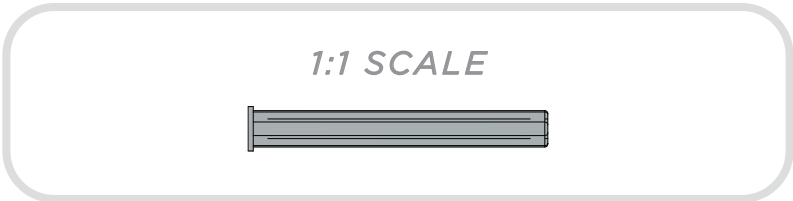
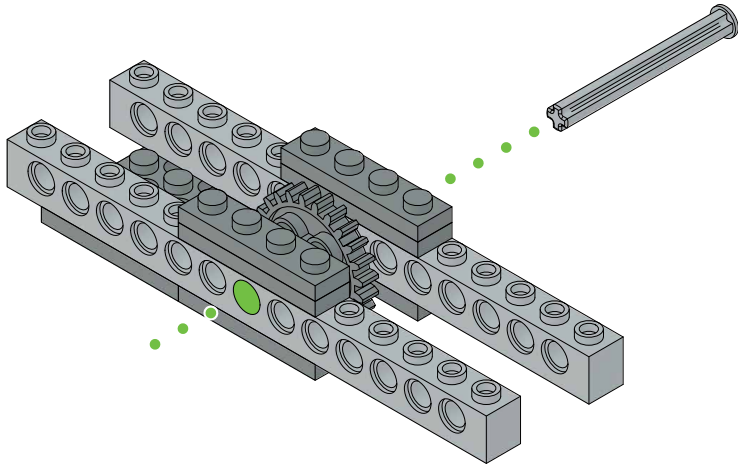
2



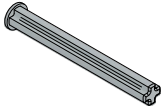
4



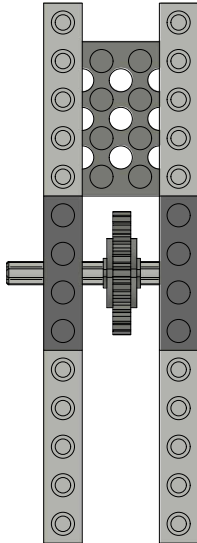
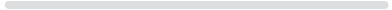
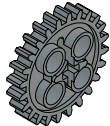
3



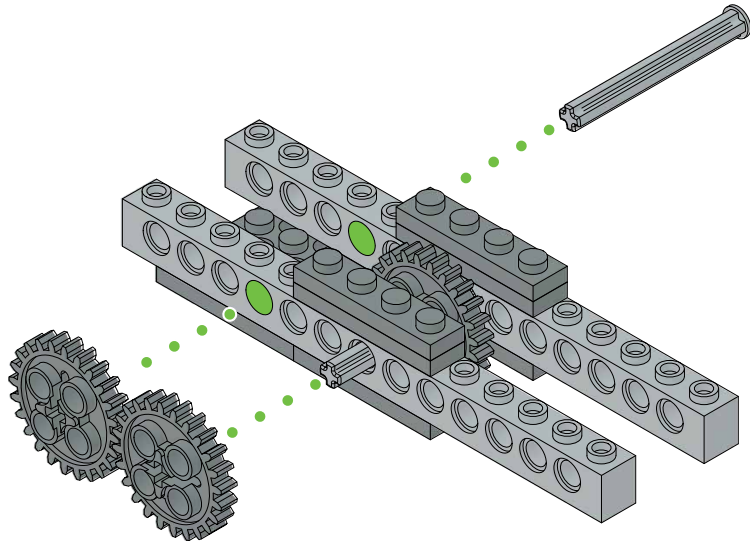
1



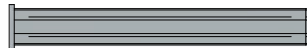
1



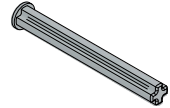
4



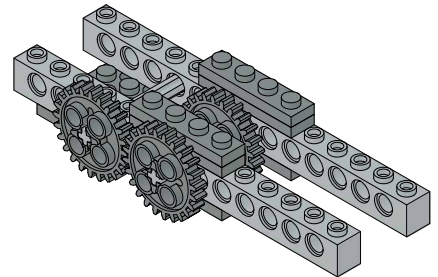
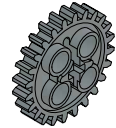
1:1 SCALE



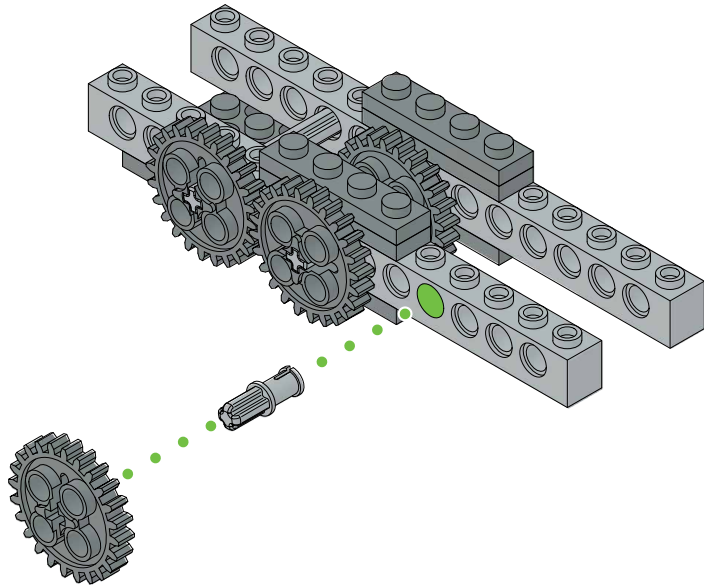
1



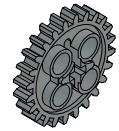
2



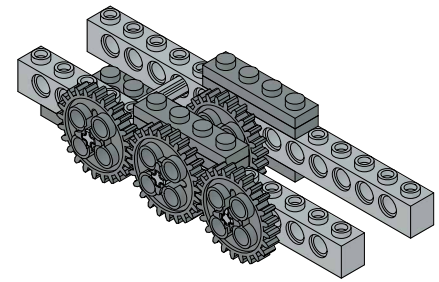
5



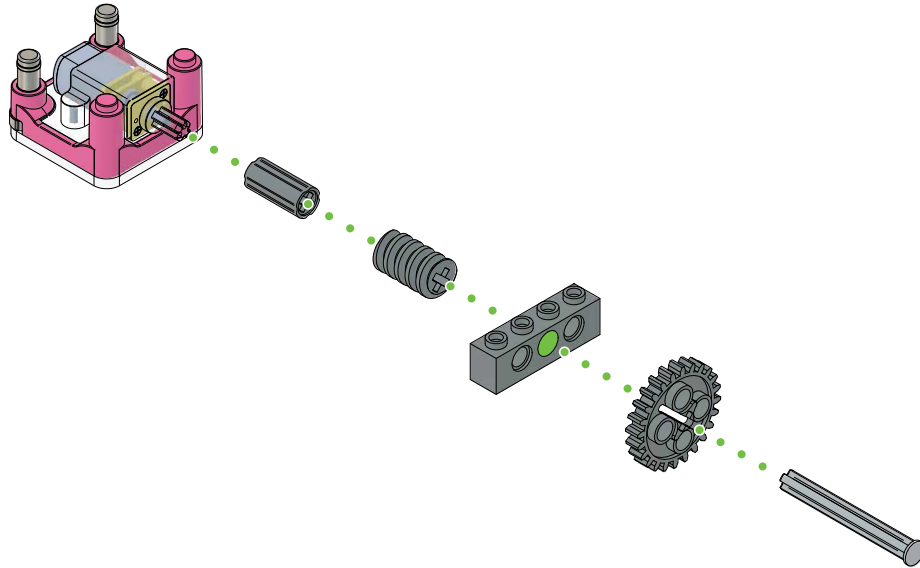
1




1

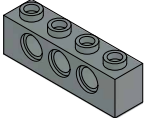
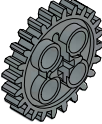
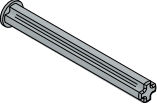


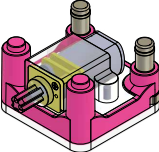


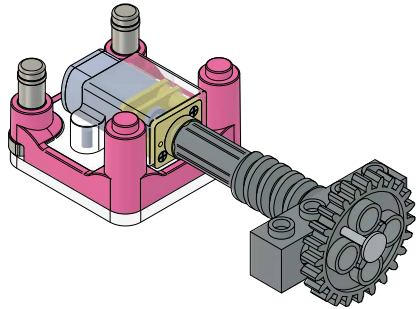
6



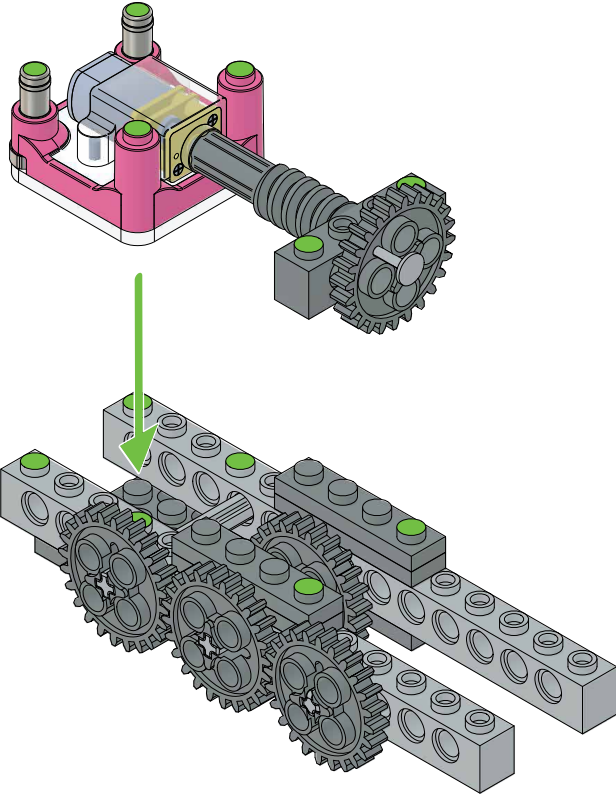
1:1 SCALE



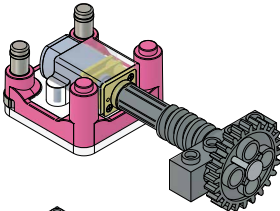
- 1 
- 1 
- 1 
- 1 
- 1 
- 1 



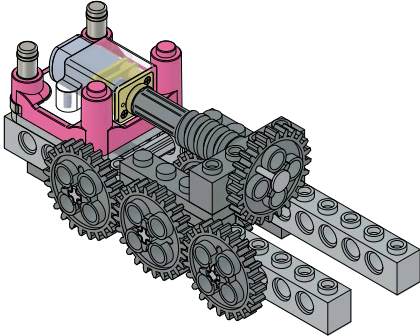
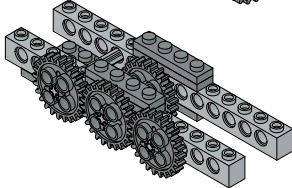
7



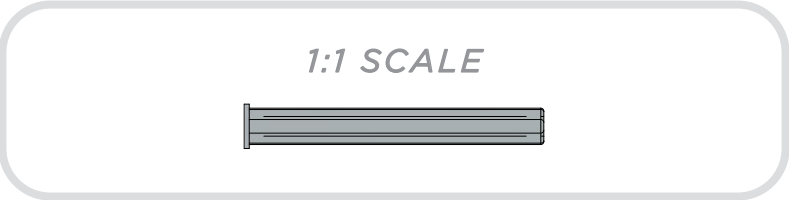
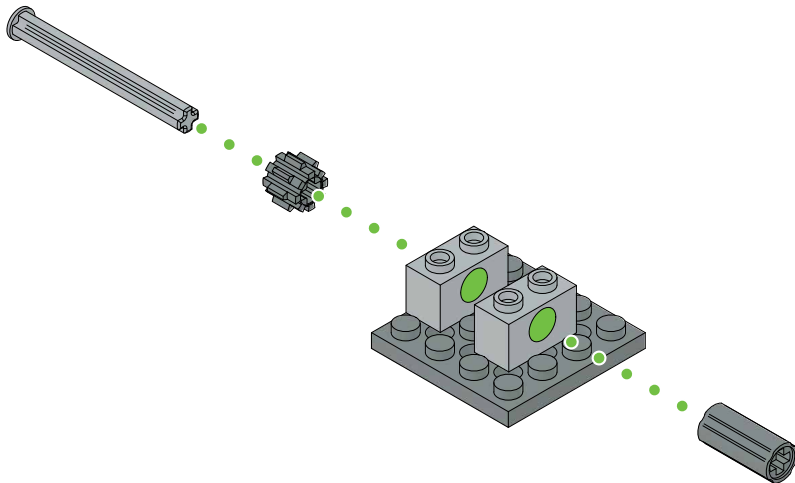
1



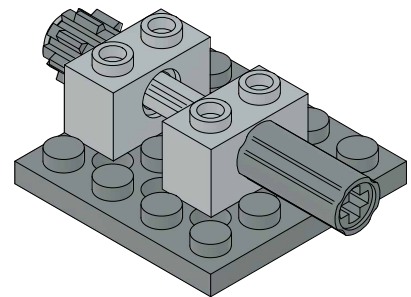
1



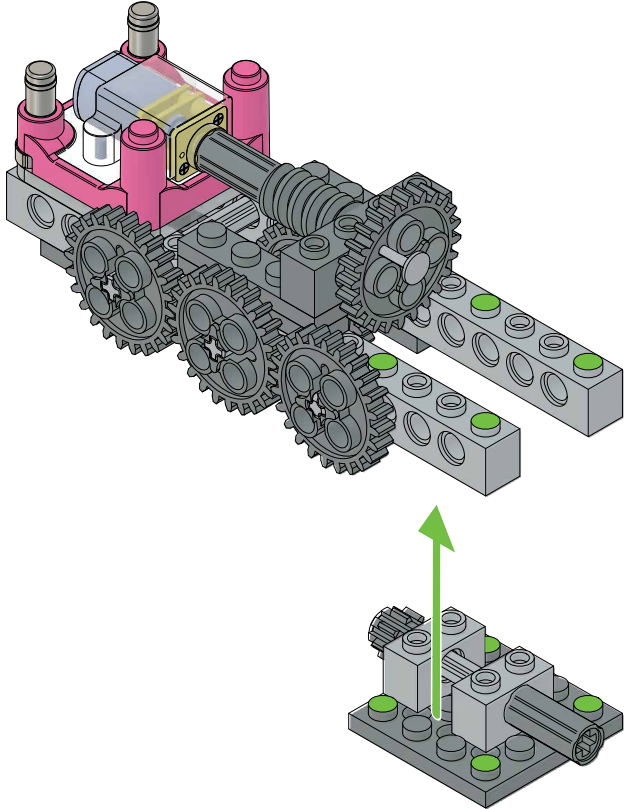
8



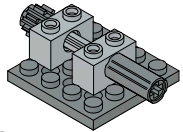
- 1
- 1
- 1
- 2
- 1



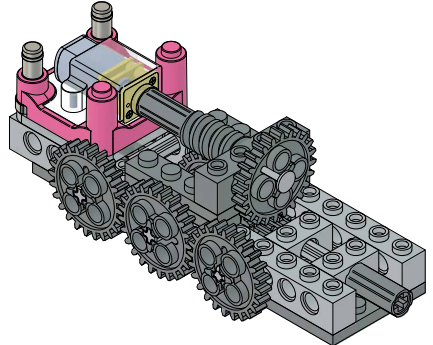
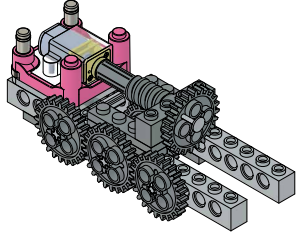
9



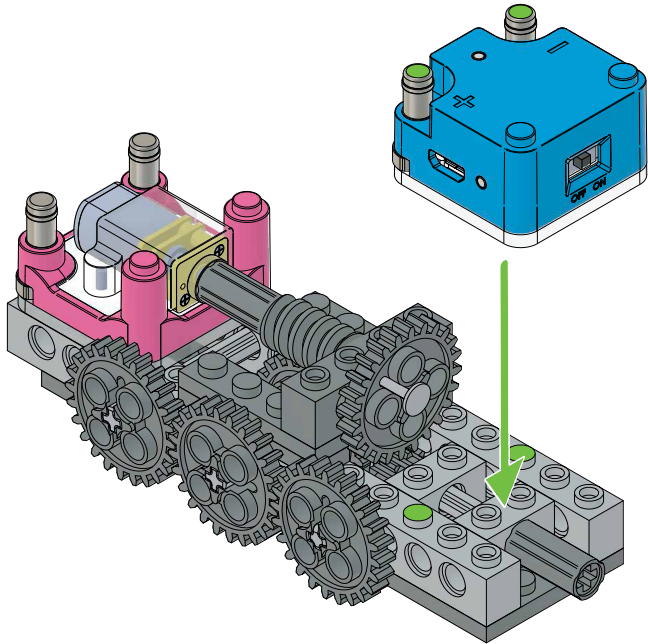
1



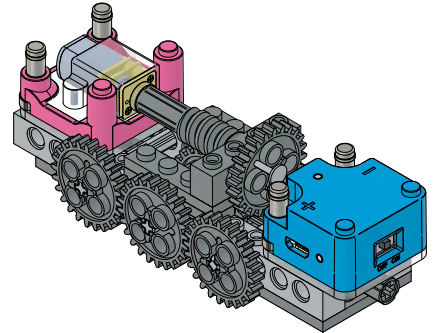
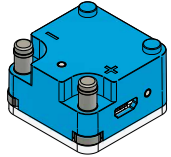
1



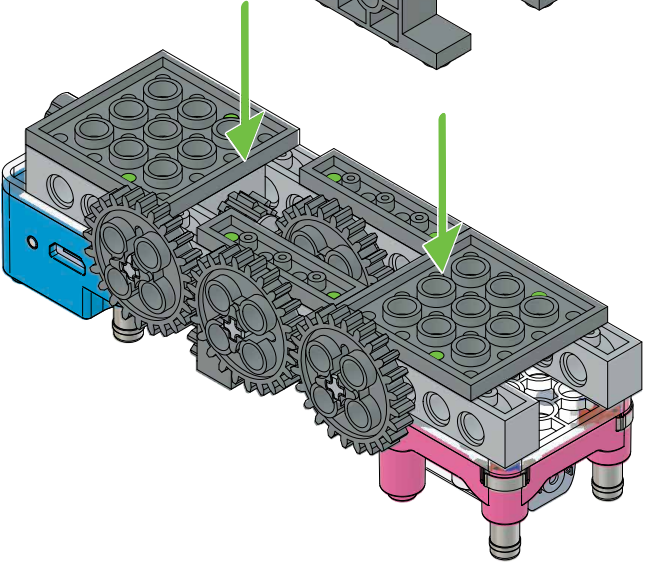
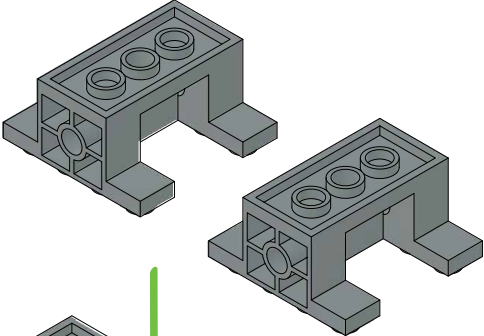
10



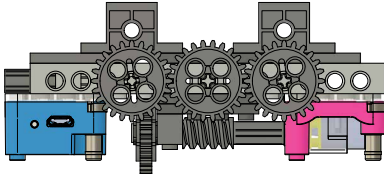
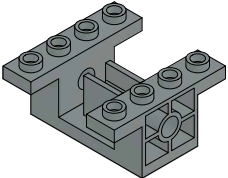
1



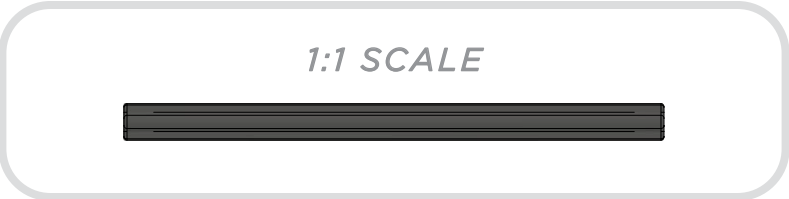
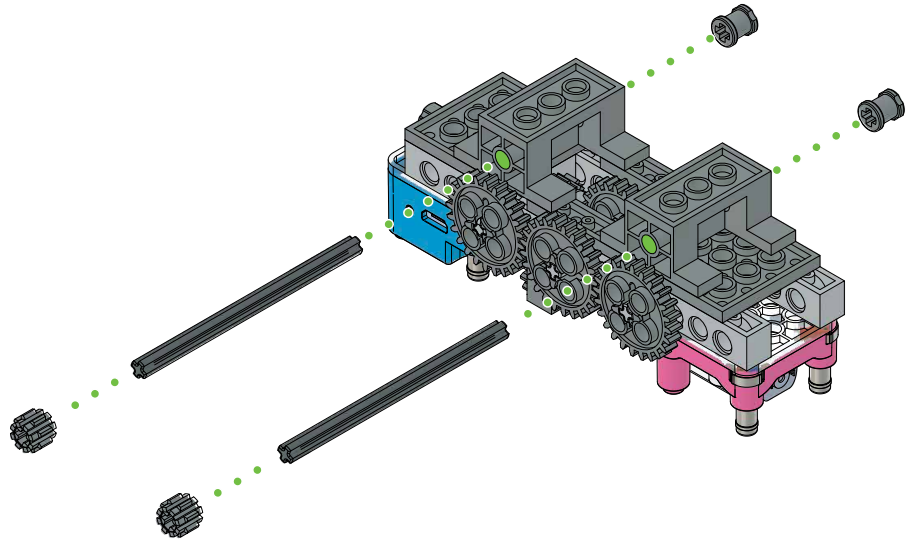
11



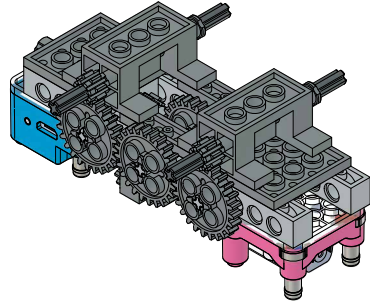
2



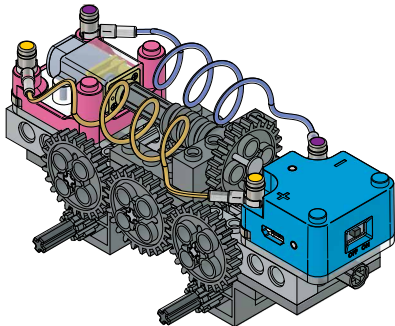
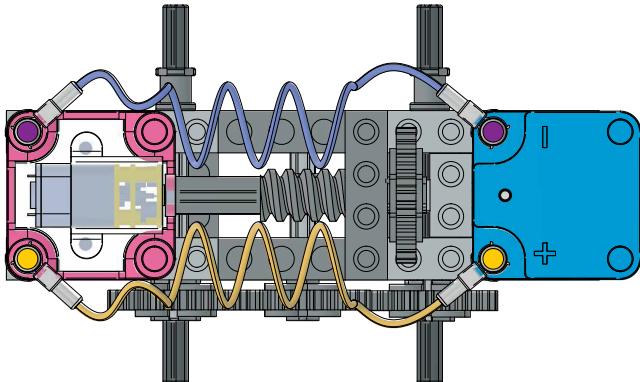
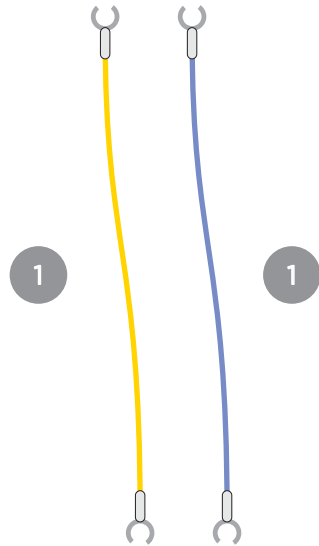
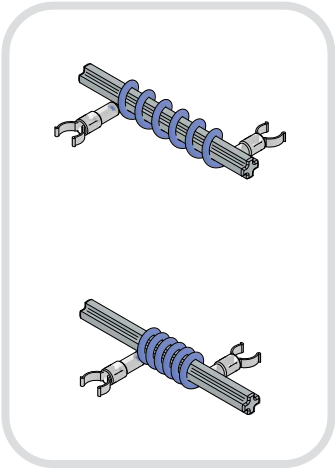
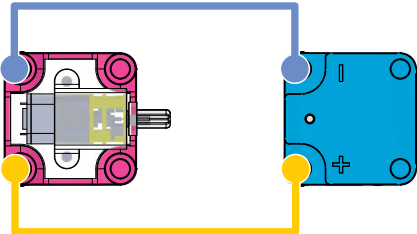
12



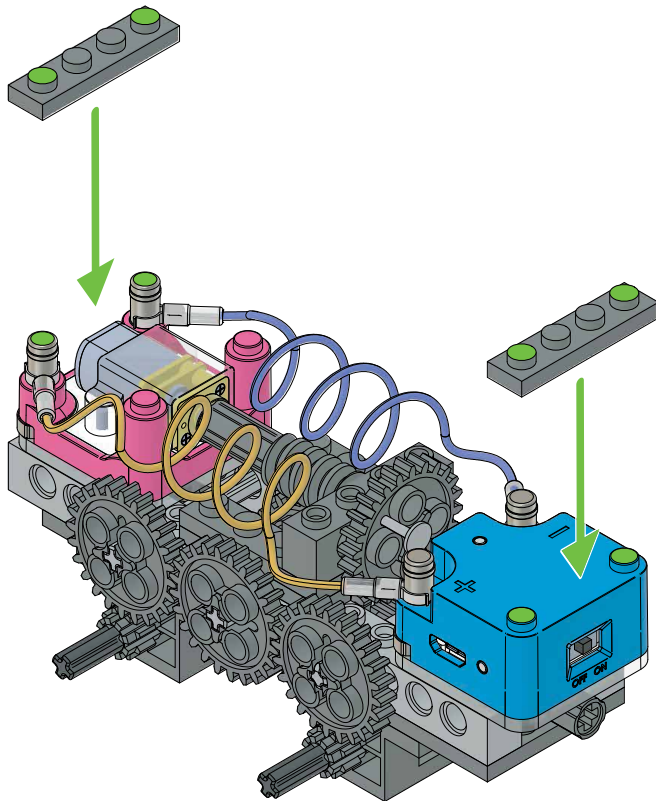
- 2
- 2
- 2



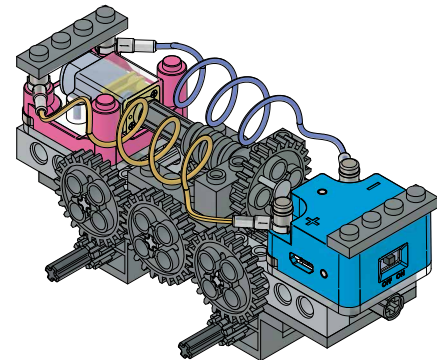
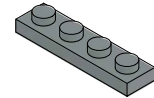
13



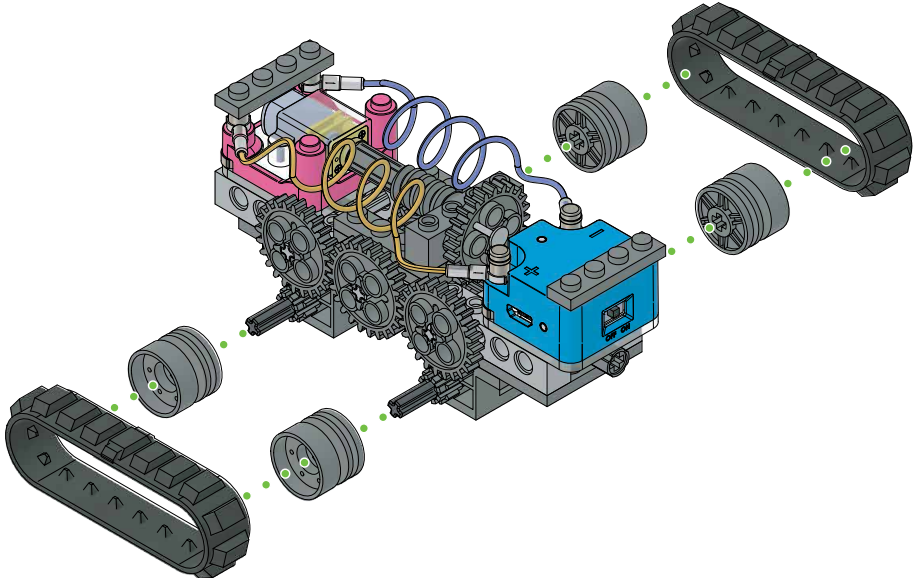
14



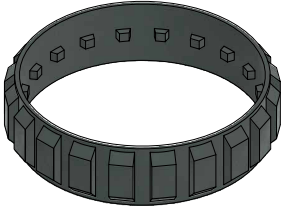
2



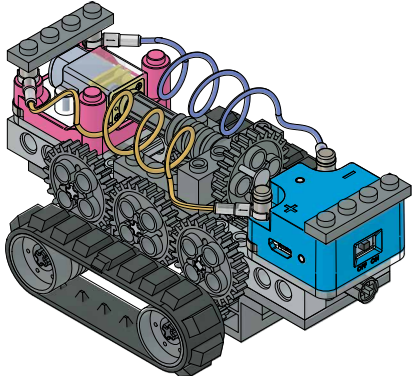
15



2

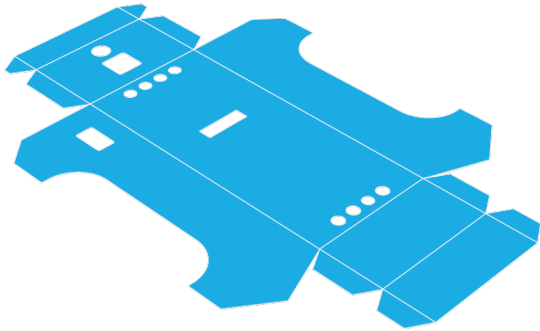


4

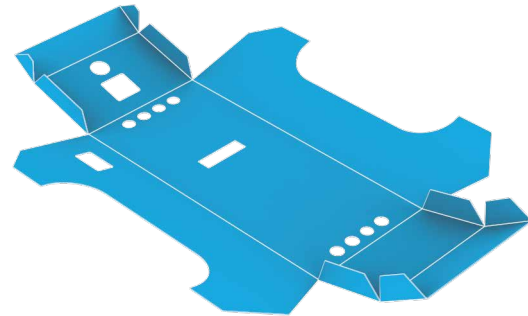


16

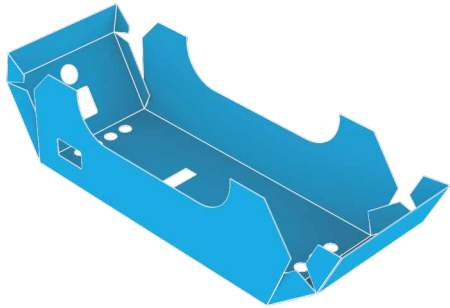
USE DOUBLE SIDED TAPE OR A GLUE STICK ON THE SHADED AREAS OF THE VEHICLE CUTOUTS



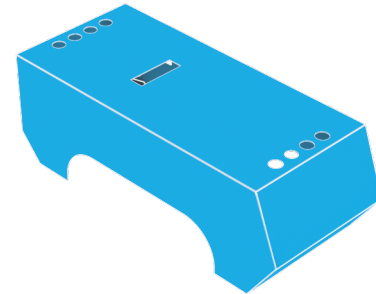
1



2

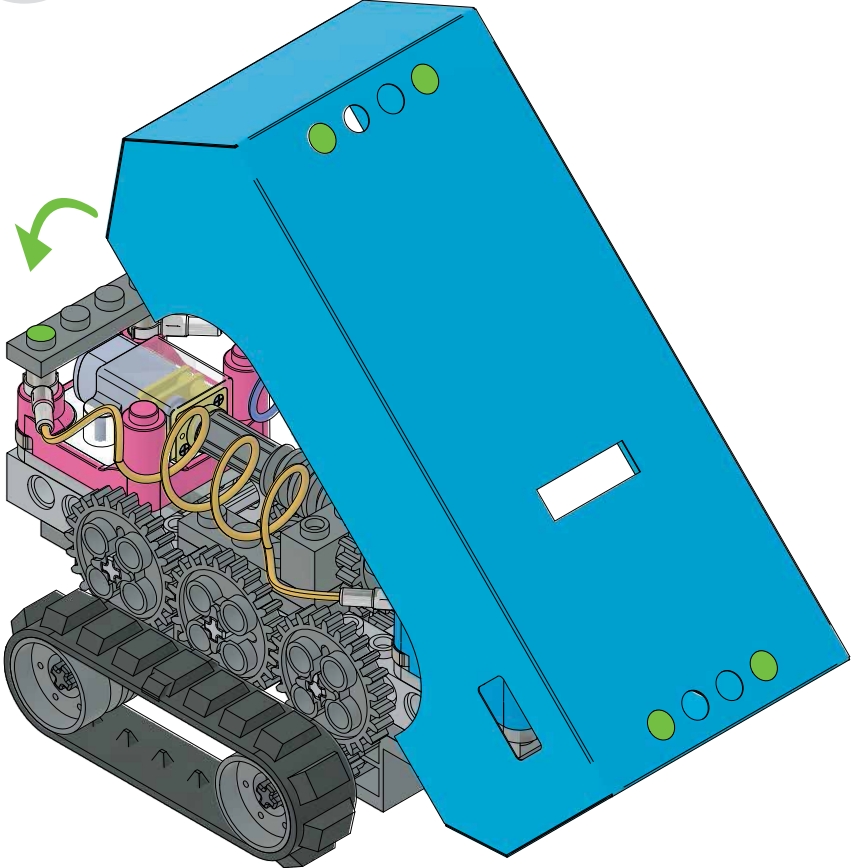


3

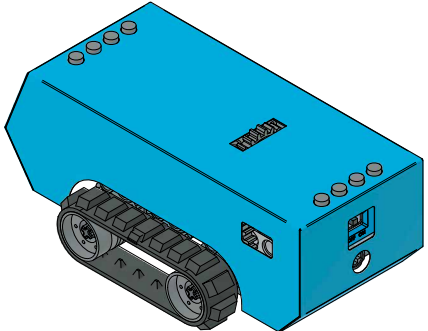
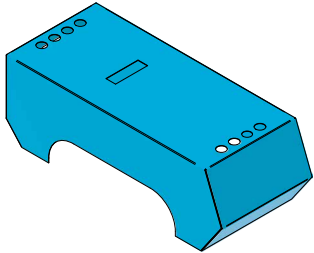


4

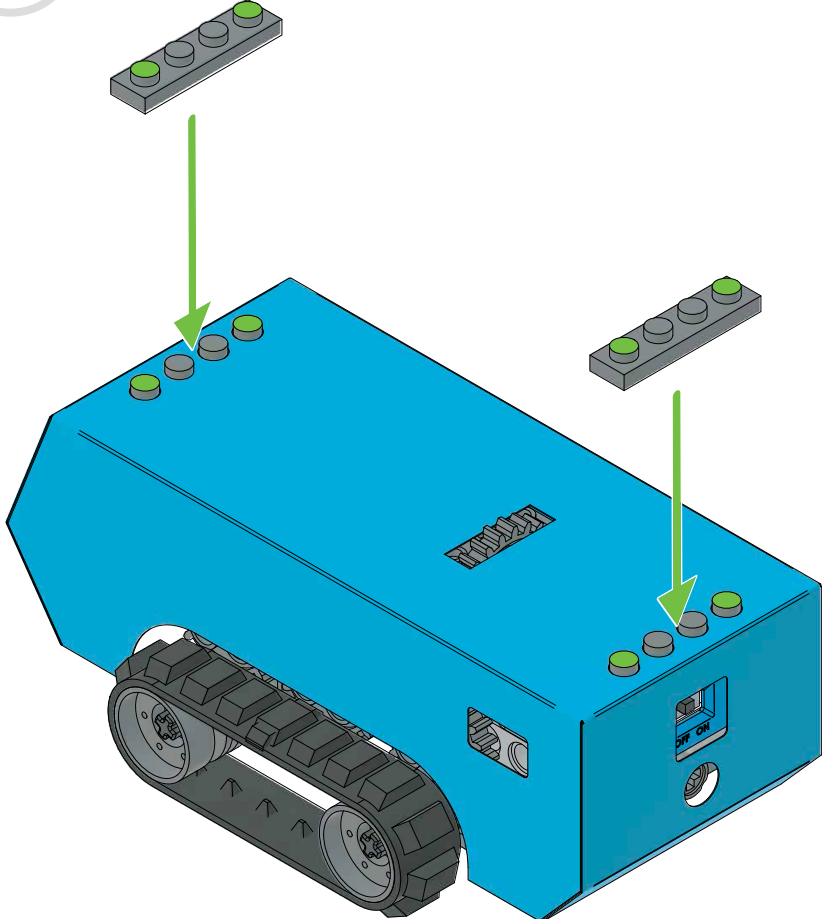
17



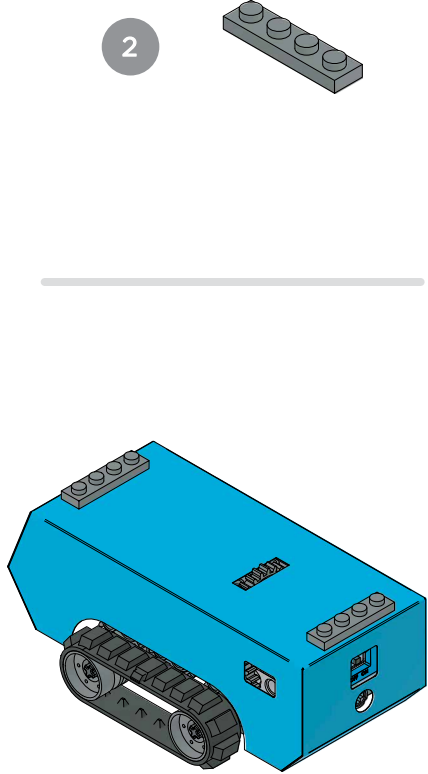
1



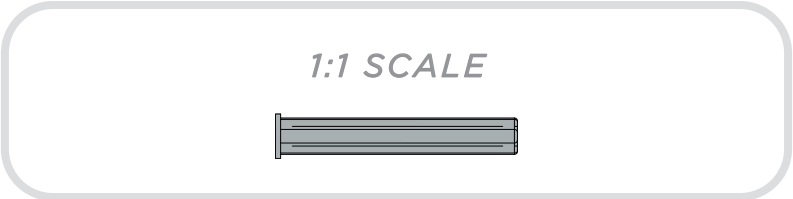
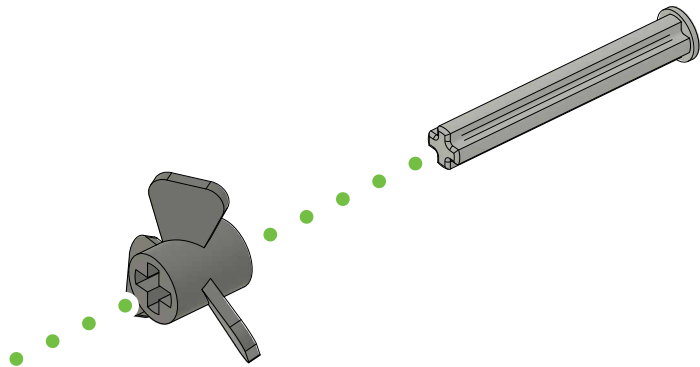
18



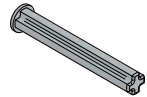
2



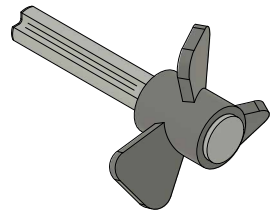
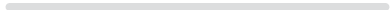
19



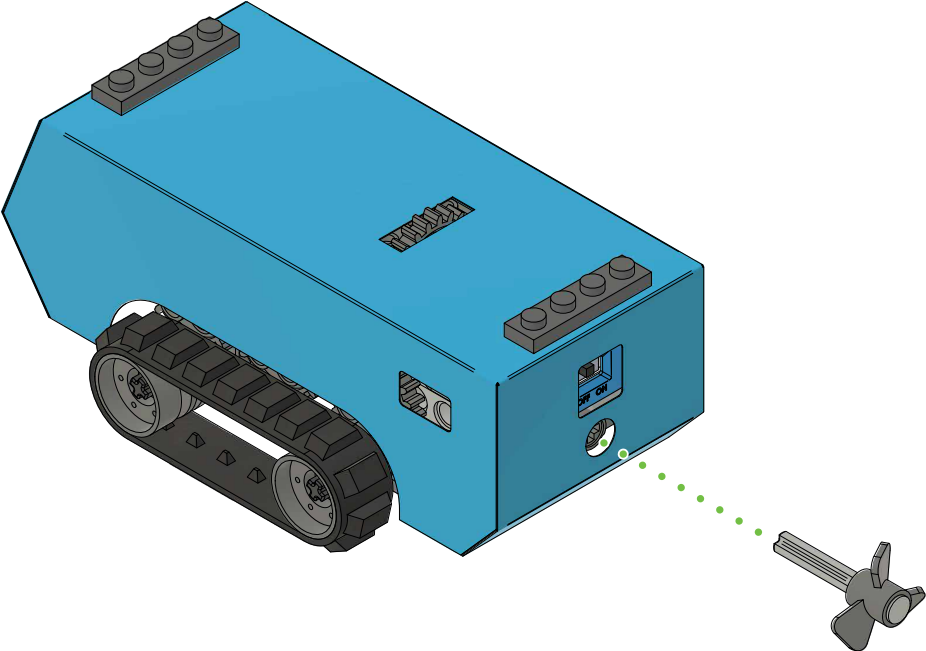
1



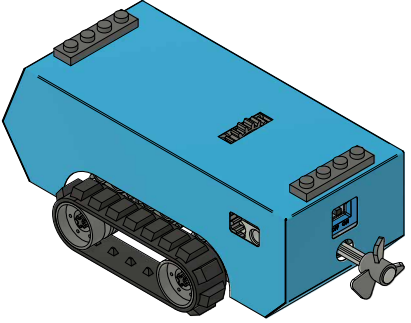
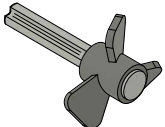
1



20

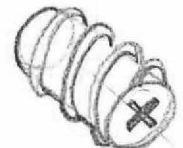
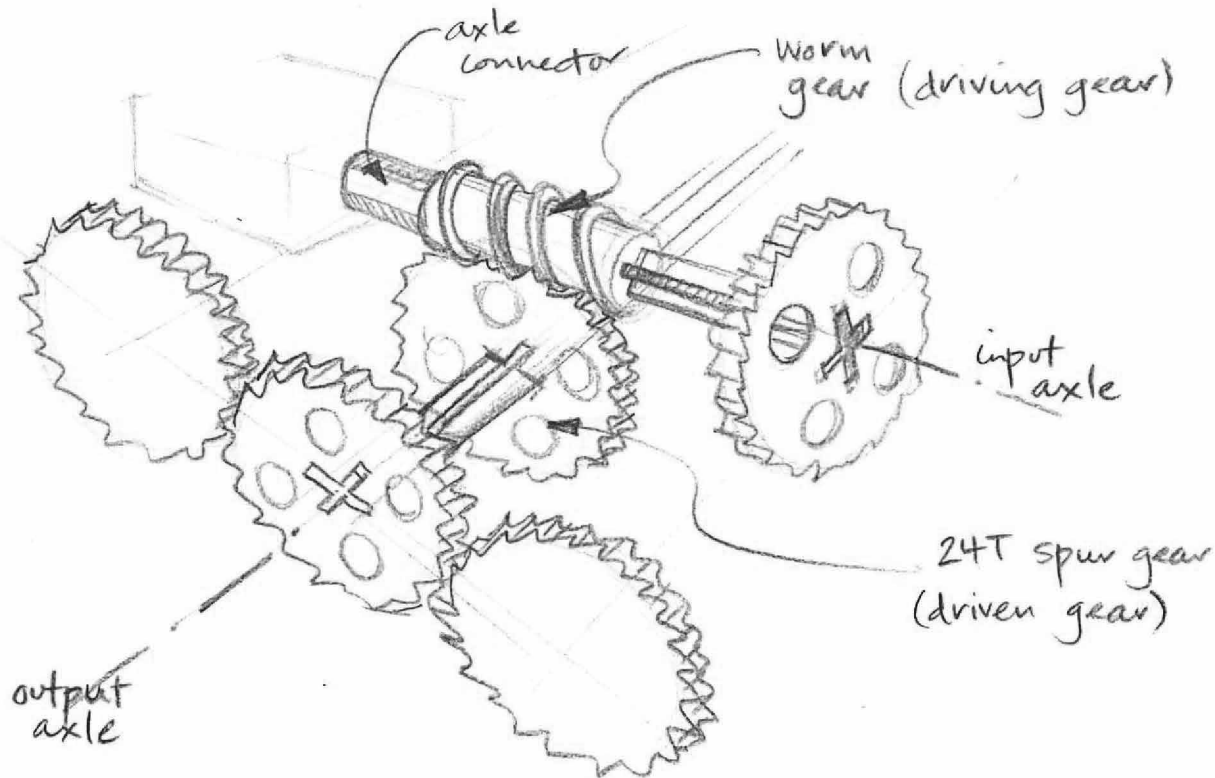


1



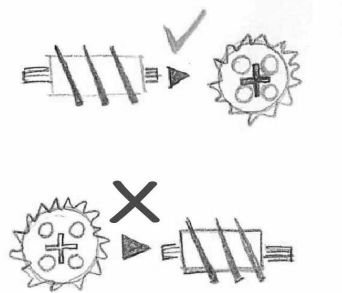
GATOR

THE SLOW BUT MIGHTY WORM GEAR



LT
WORM

WORM GEAR

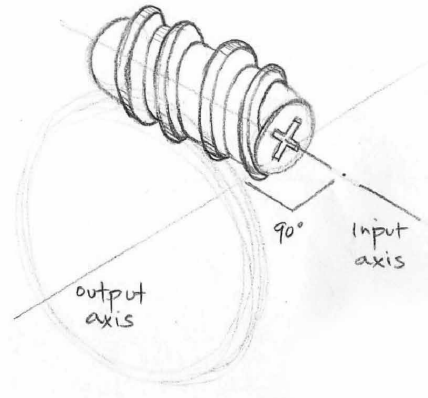


Worm gears can easily turn other gears, but other gears cannot turn worm gears.

Worm gears drive axles and are perpendicular to the input axle.

The worm gear is effectively a 1-tooth gear, used to increase torque.

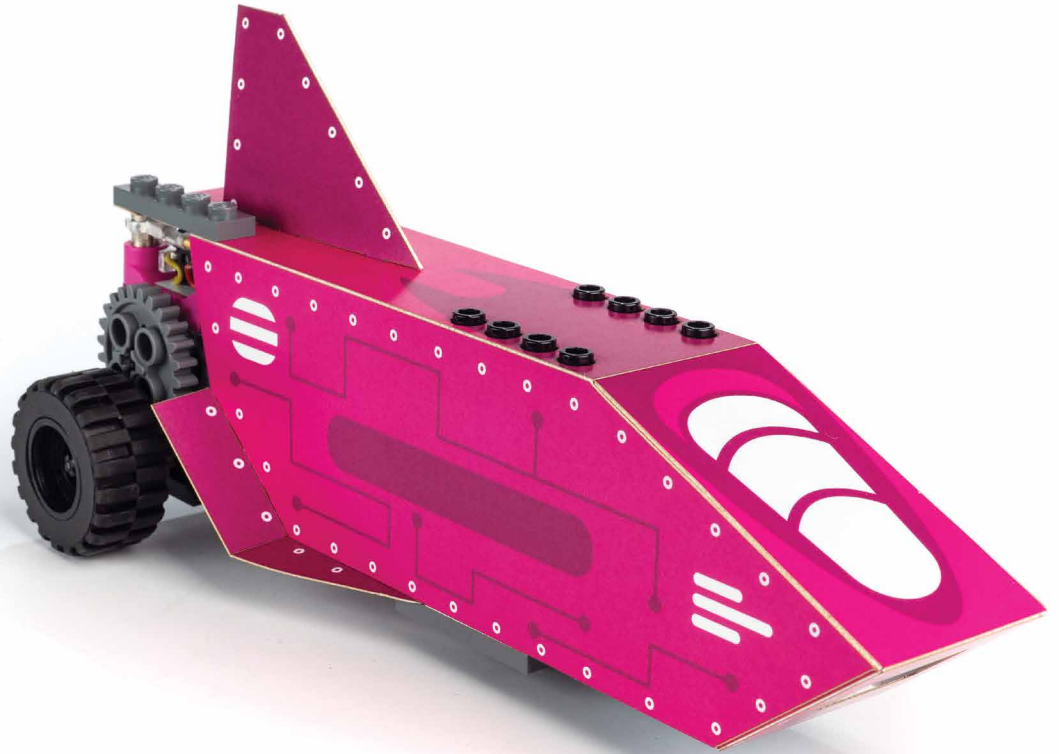
Gator may not be the fastest, unless in an uphill race.



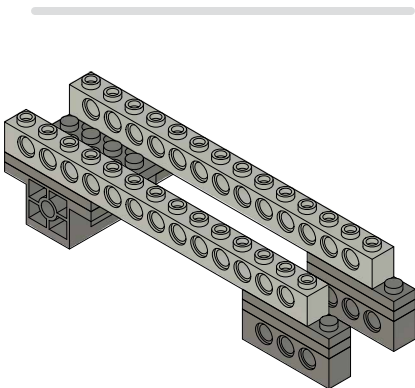
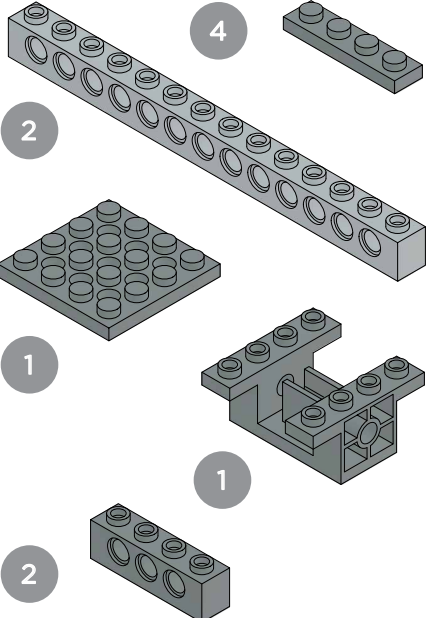
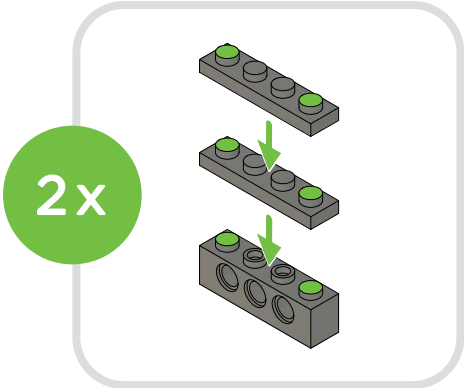
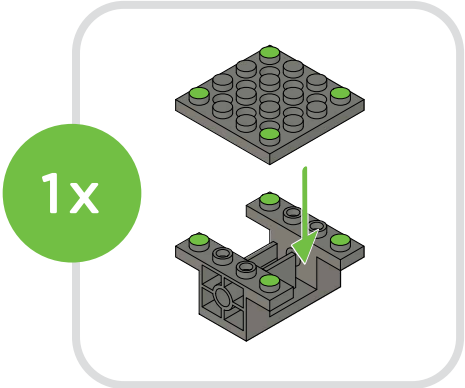
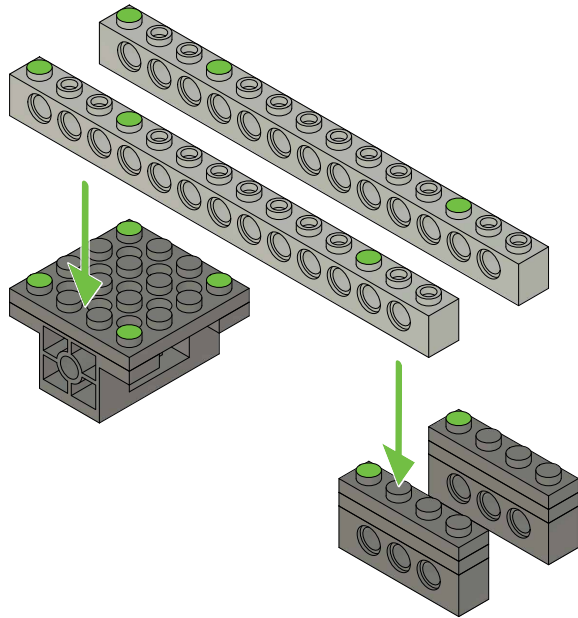
$$\text{gear ratio} = \frac{\# \text{teeth driving gear}}{\# \text{teeth driven gear}} = \frac{1}{24} \quad 1:24$$

BLUR

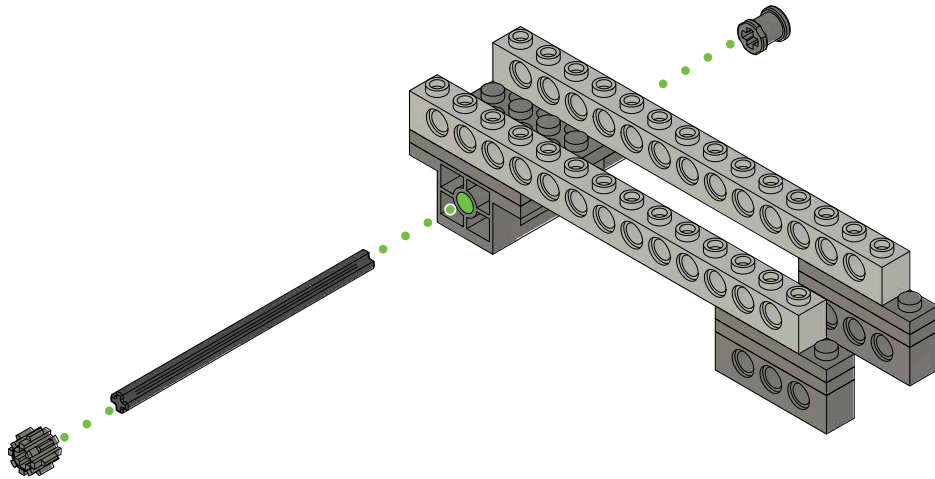
A GEARED-UP JET DRAGSTER, BUILT FOR SPEED



1



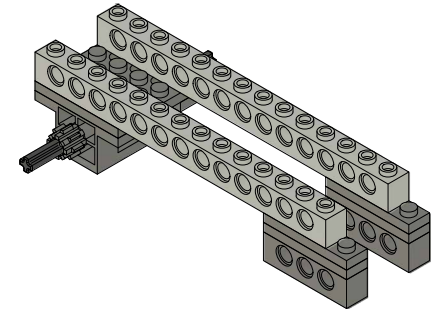
2



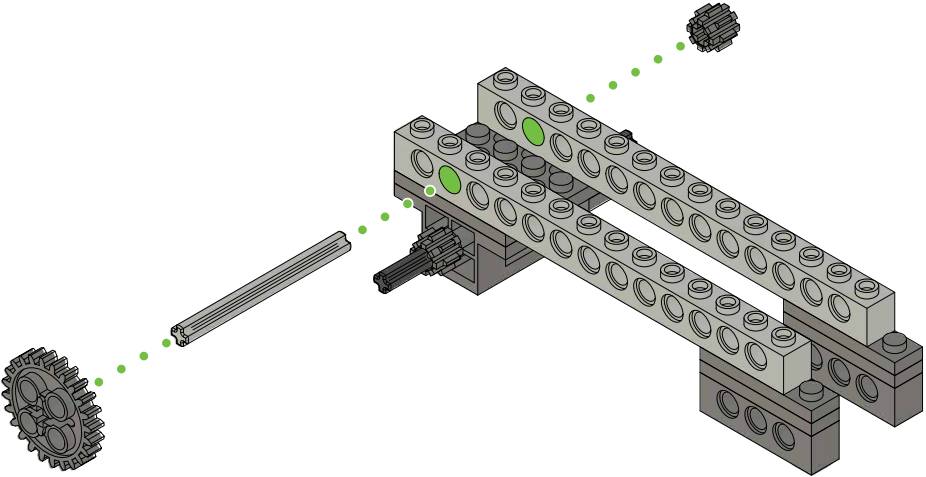
1:1 SCALE



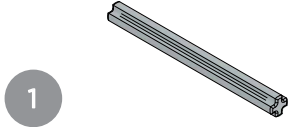

- 1
- 1
- 1



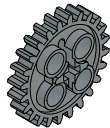
3



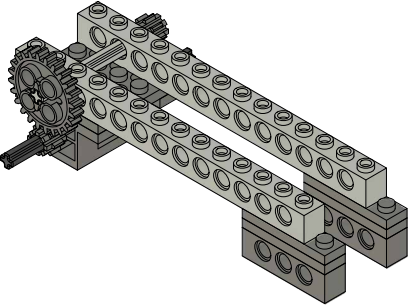
1:1 SCALE



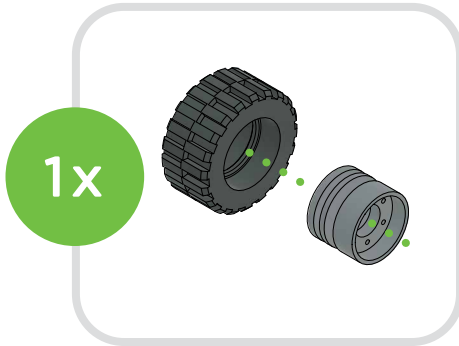
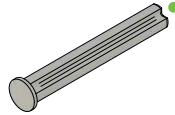
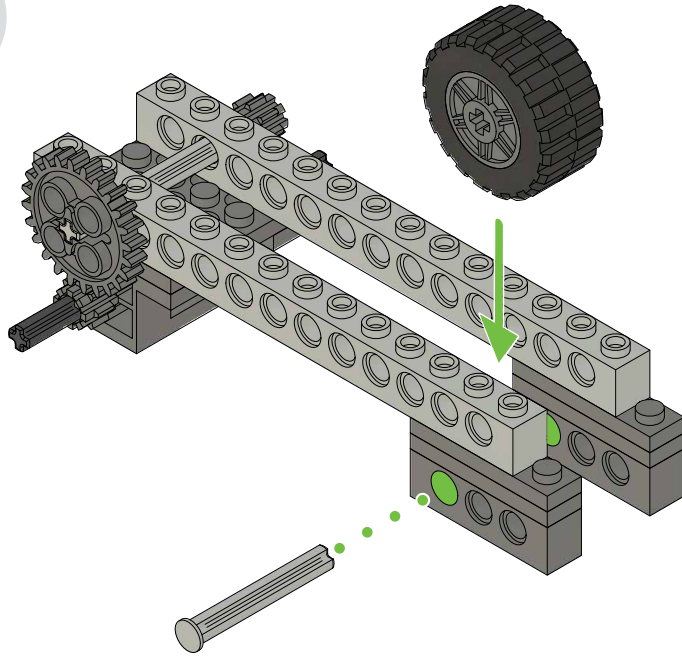
1



1



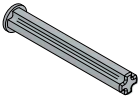


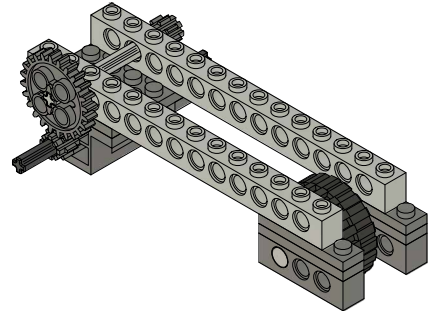
4



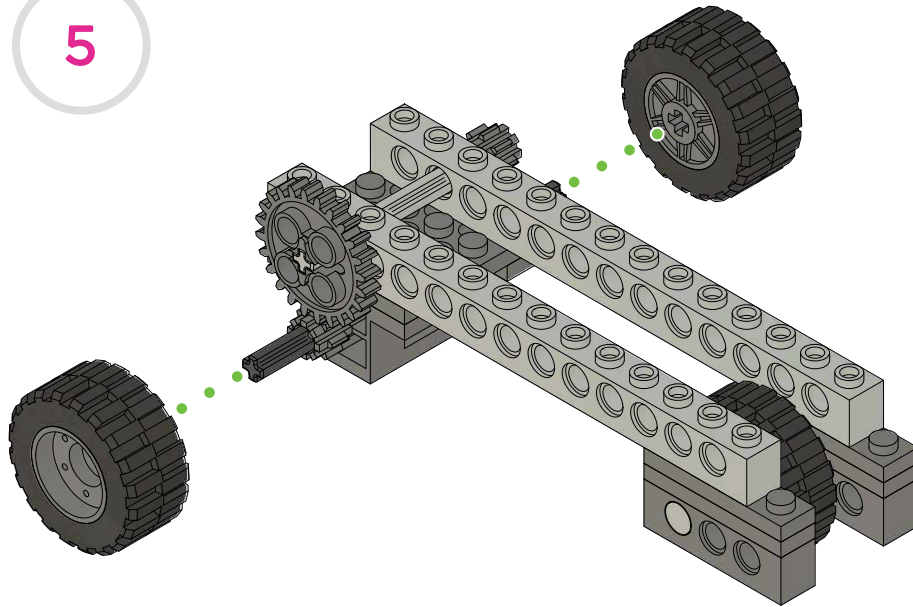
1:1 SCALE



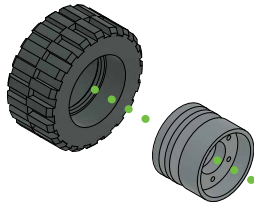
- 1 
- 1 
- 1 



5



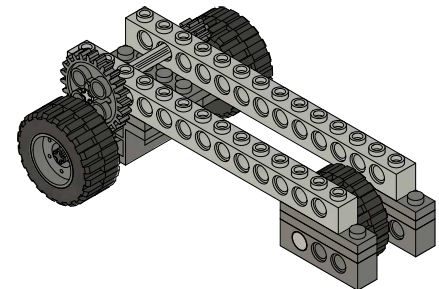
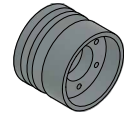
2x



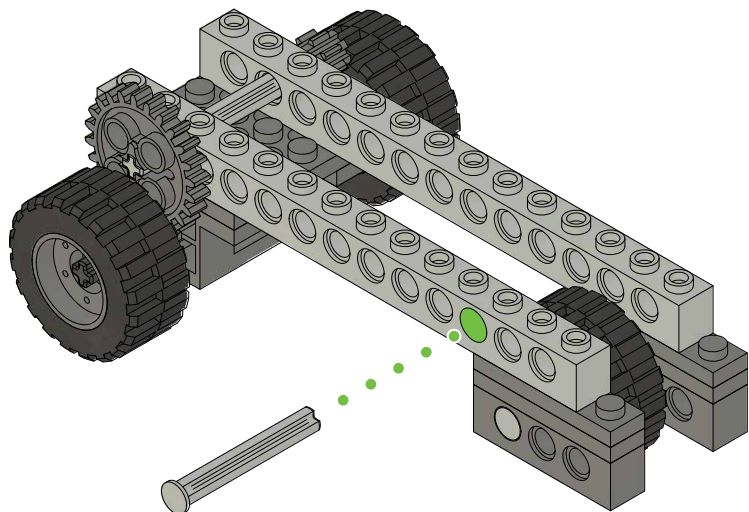
2



2



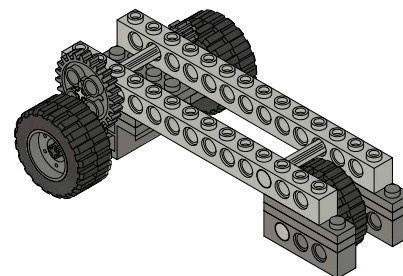
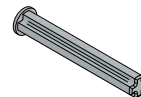
7



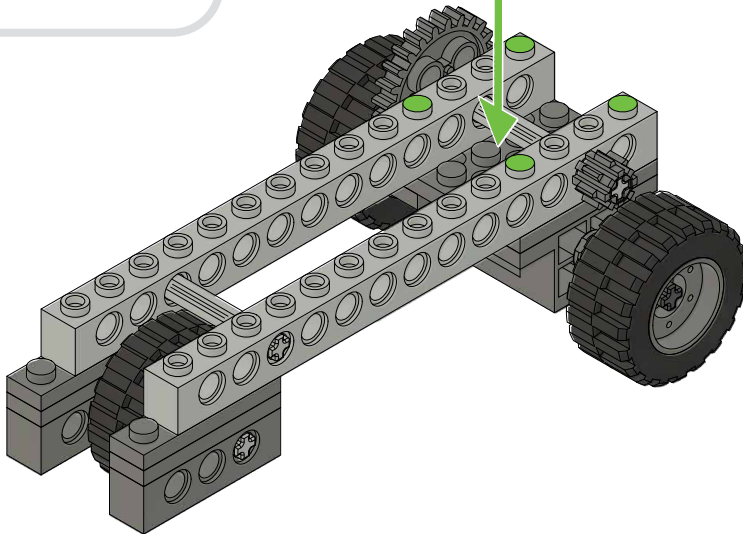
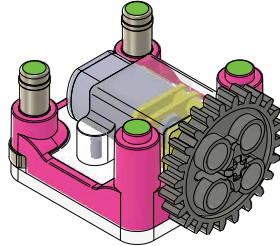
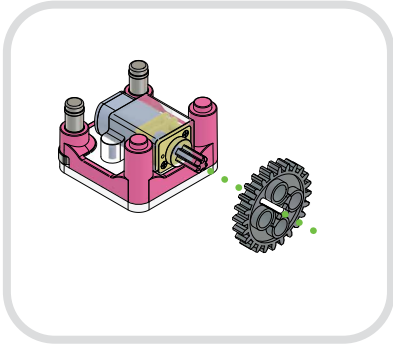
1:1 SCALE



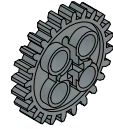
1



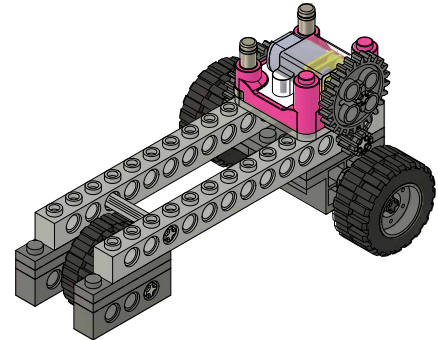
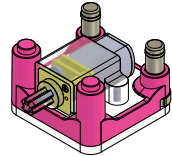
8



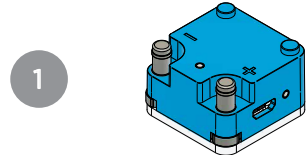
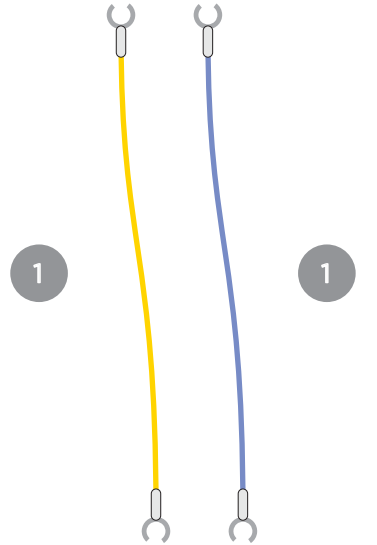
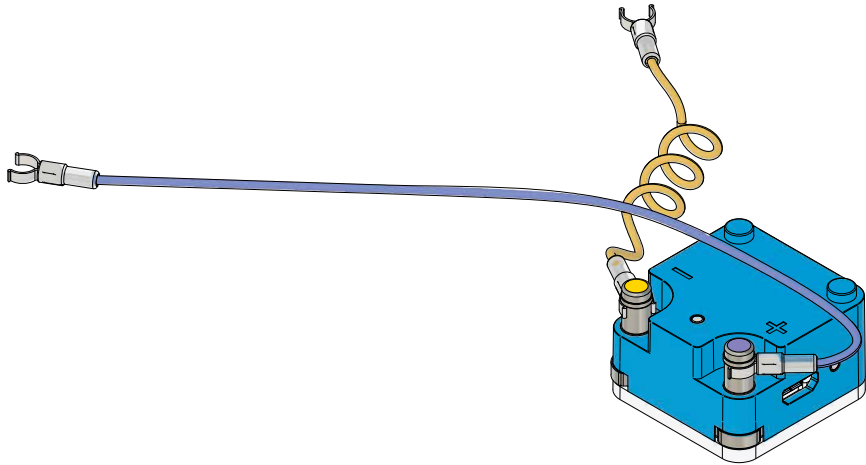
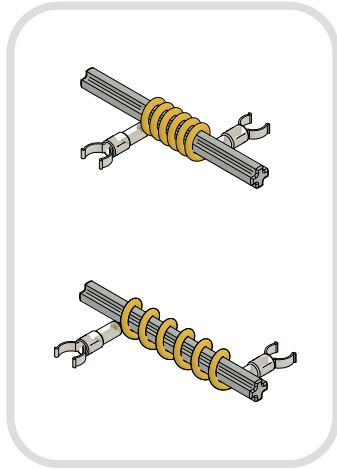
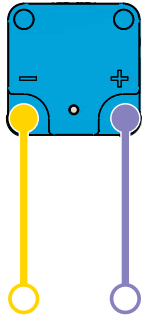
1



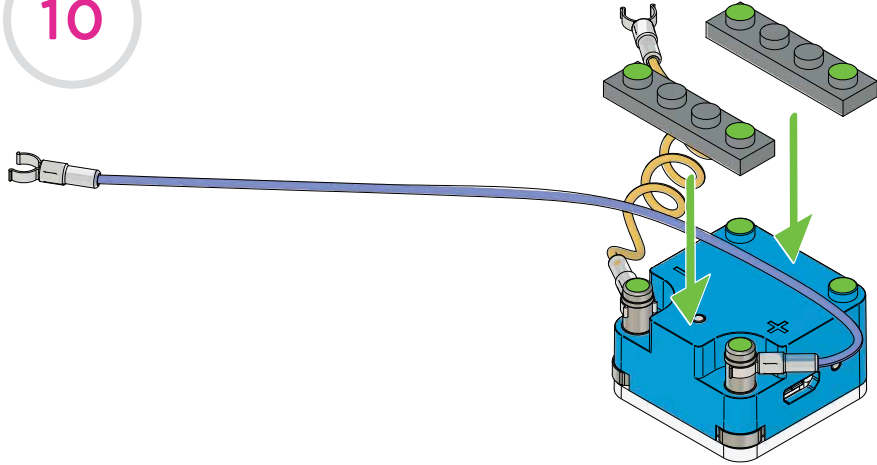
1



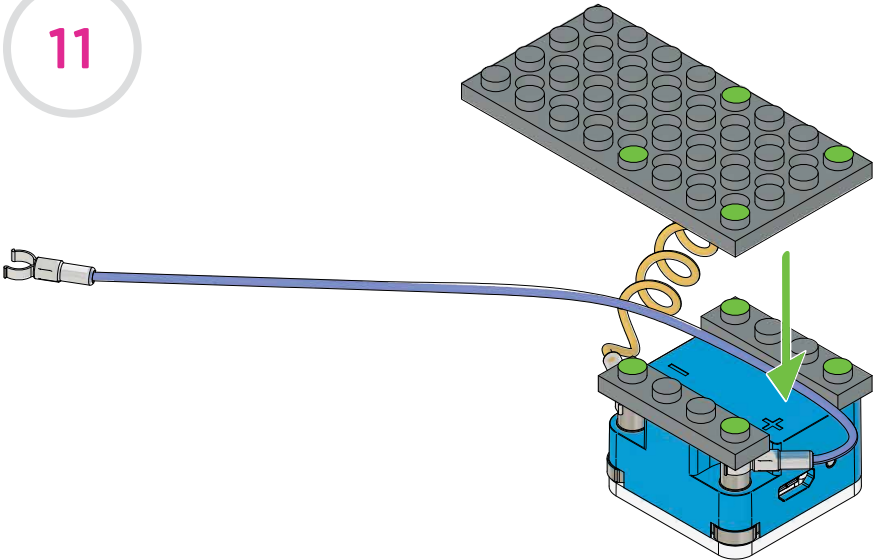
9



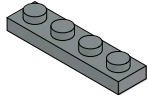
10



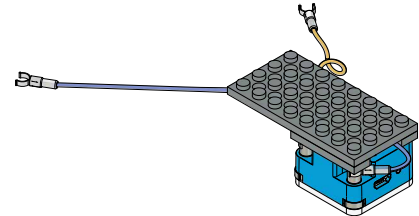
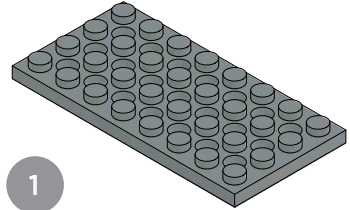
11



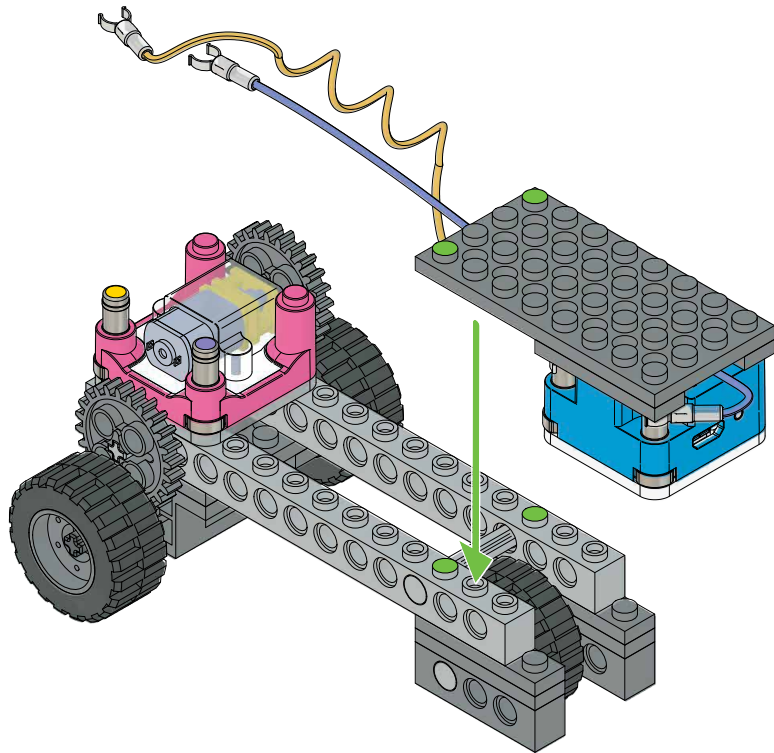
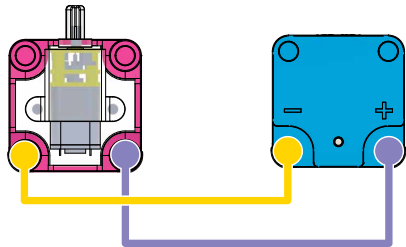
2



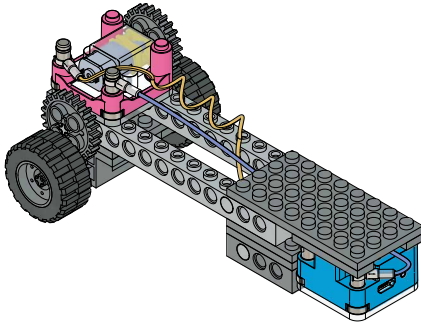
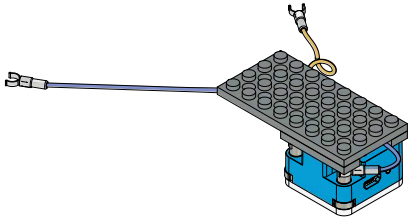
1



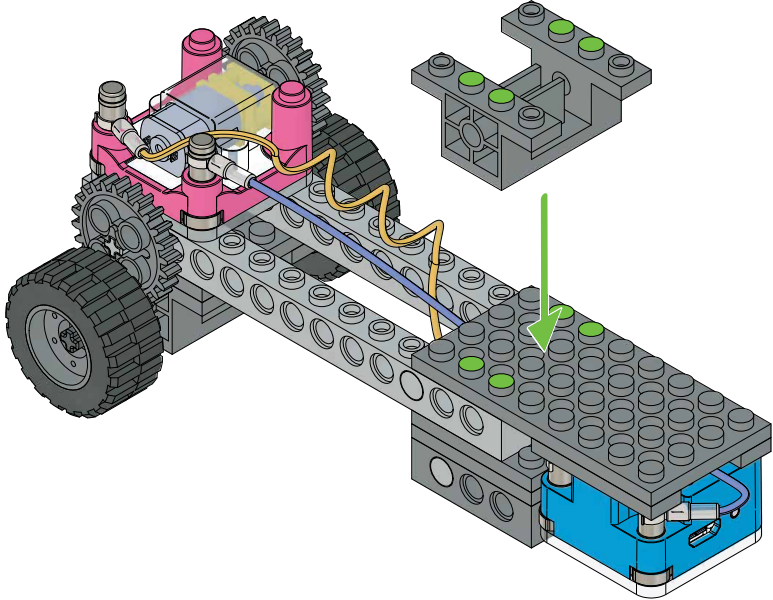
12



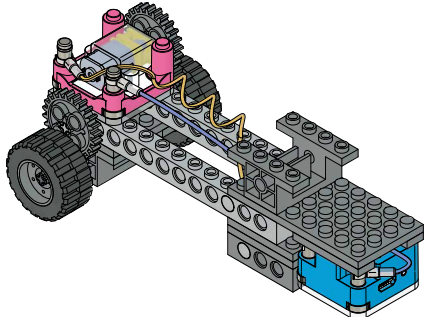
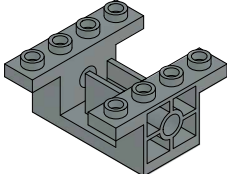
1



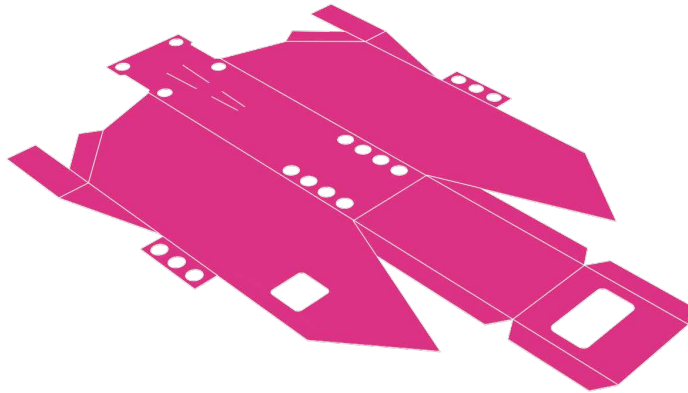
13



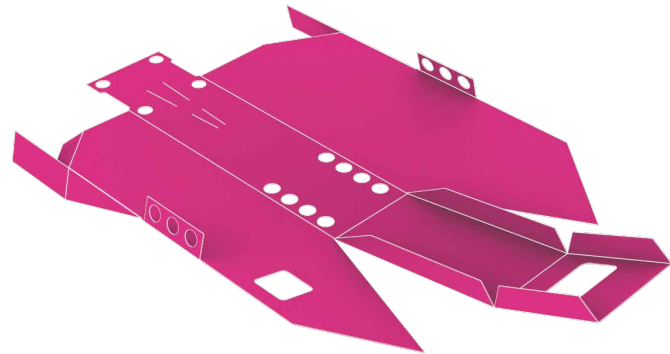
1



6

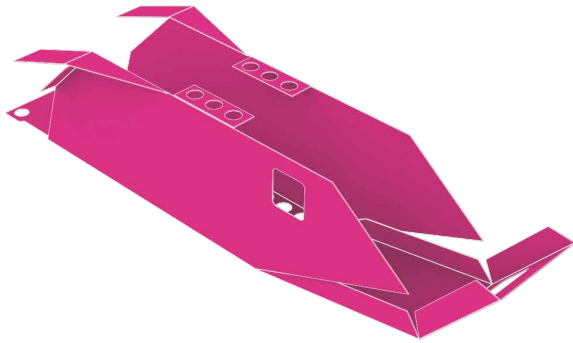


1

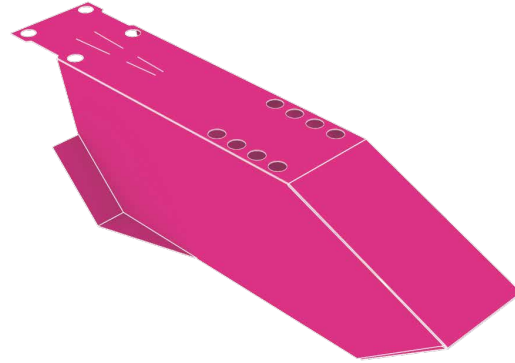


2

USE DOUBLE SIDED TAPE OR A GLUE STICK ON
THE SHADED AREAS OF THE VEHICLE CUTOUTS



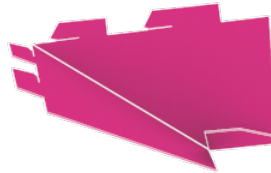
3



4



1

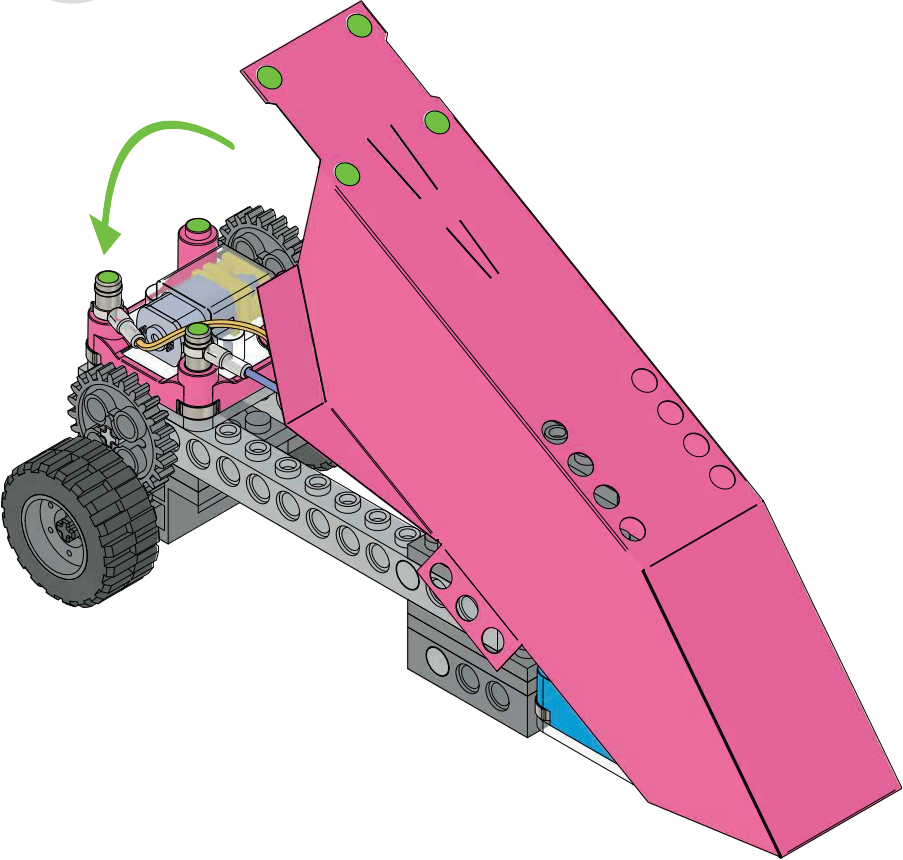


2

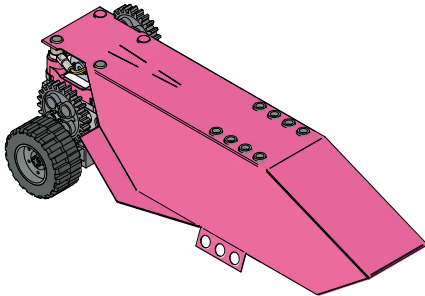
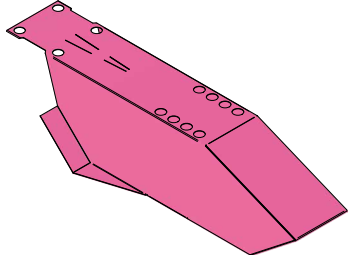


3

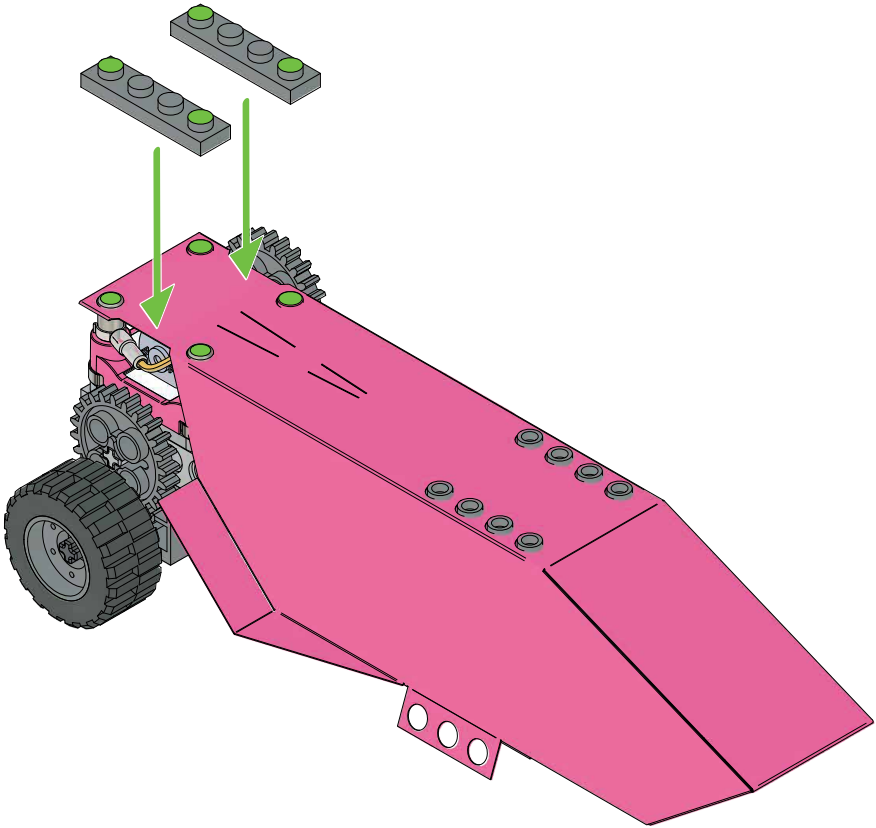
14



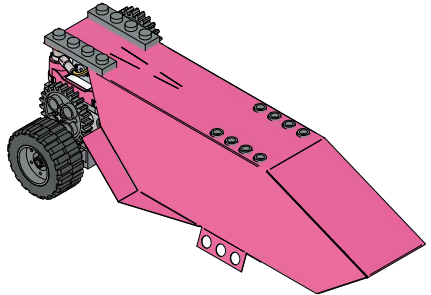
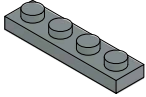
1



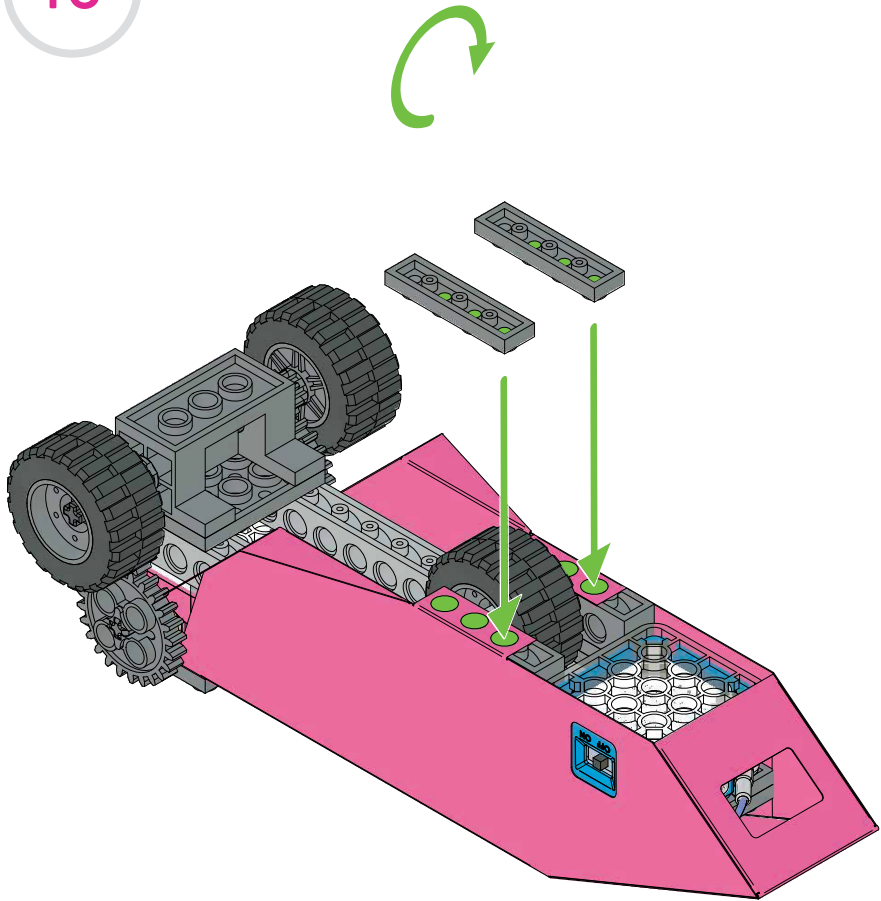
15



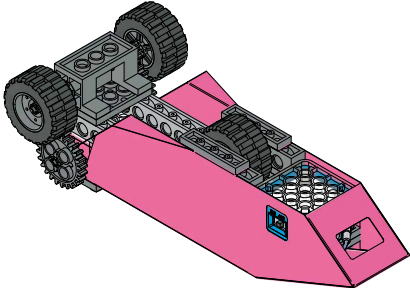
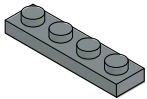
2



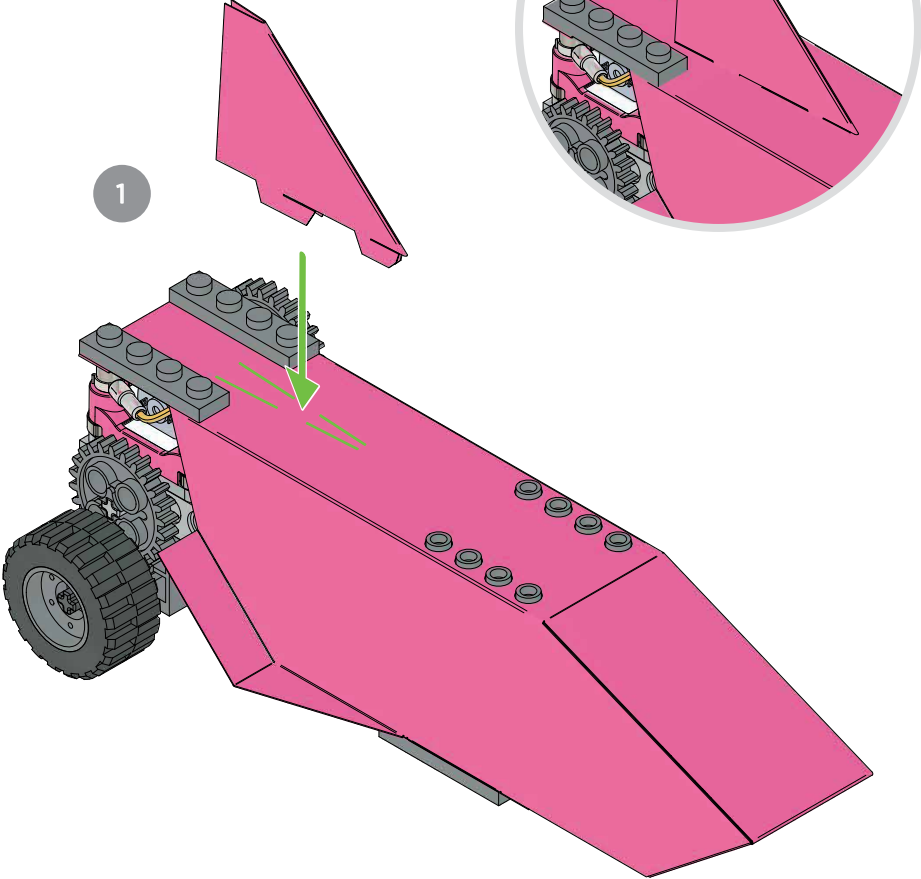
16



2

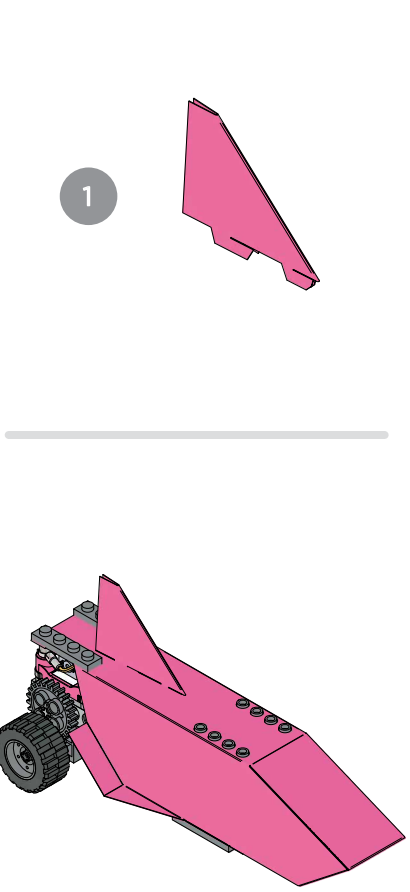


17



1

2

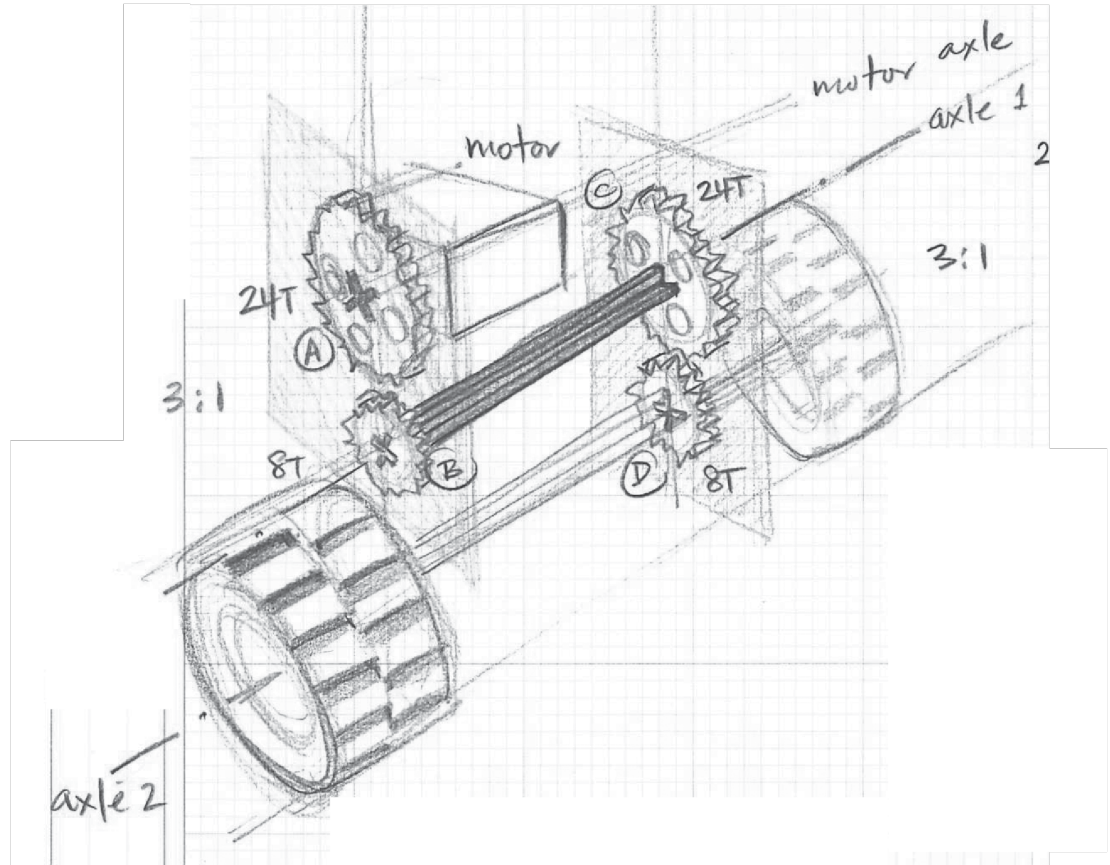


1

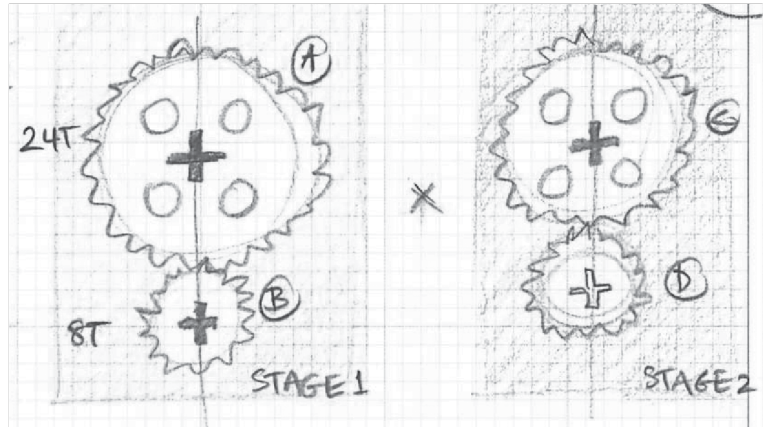
BLUR

MULTI-STAGE MULTIPLICATION GEAR TRAIN FOR MAXIMUM SPEED

Blur uses two stages to get two speed increases. Each stage has a 24-tooth driving gear and an 8-tooth driven gear.



For each stage, the 8-tooth axle is spinning 3 times faster than the 24-tooth axle. The axle from the first stage, now 3 times faster, is the input to the second stage. Again, the speed is increased 3 times, for a total gear ratio of 9:1.



The gear ratio for stage 1 is:

$$\text{gear ratio}_{\text{stage 1}} = \frac{\# \text{ teeth on driving gear}}{\# \text{ teeth on driven gear}} = \frac{24T}{8T} = \frac{3}{1} \Rightarrow 3:1$$

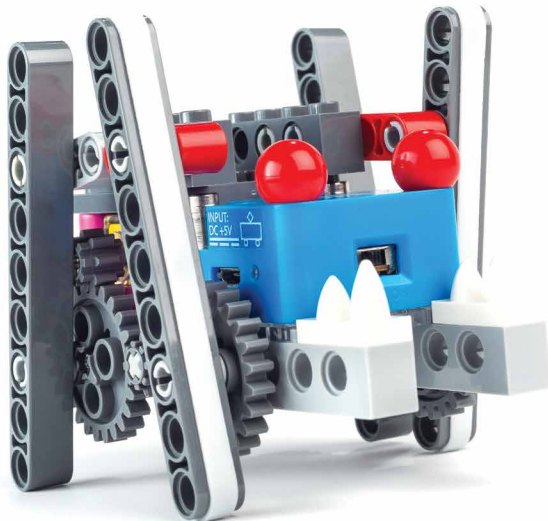
The wheels are spinning 9 times faster than the motor!

$$\text{gear ratio}_{\text{overall}} = \left(\frac{3}{1} \right) \cdot \left(\frac{3}{1} \right) = \frac{9}{1} \Rightarrow 9:1$$

stage 1 gear ratio
stage 2 gear ratio

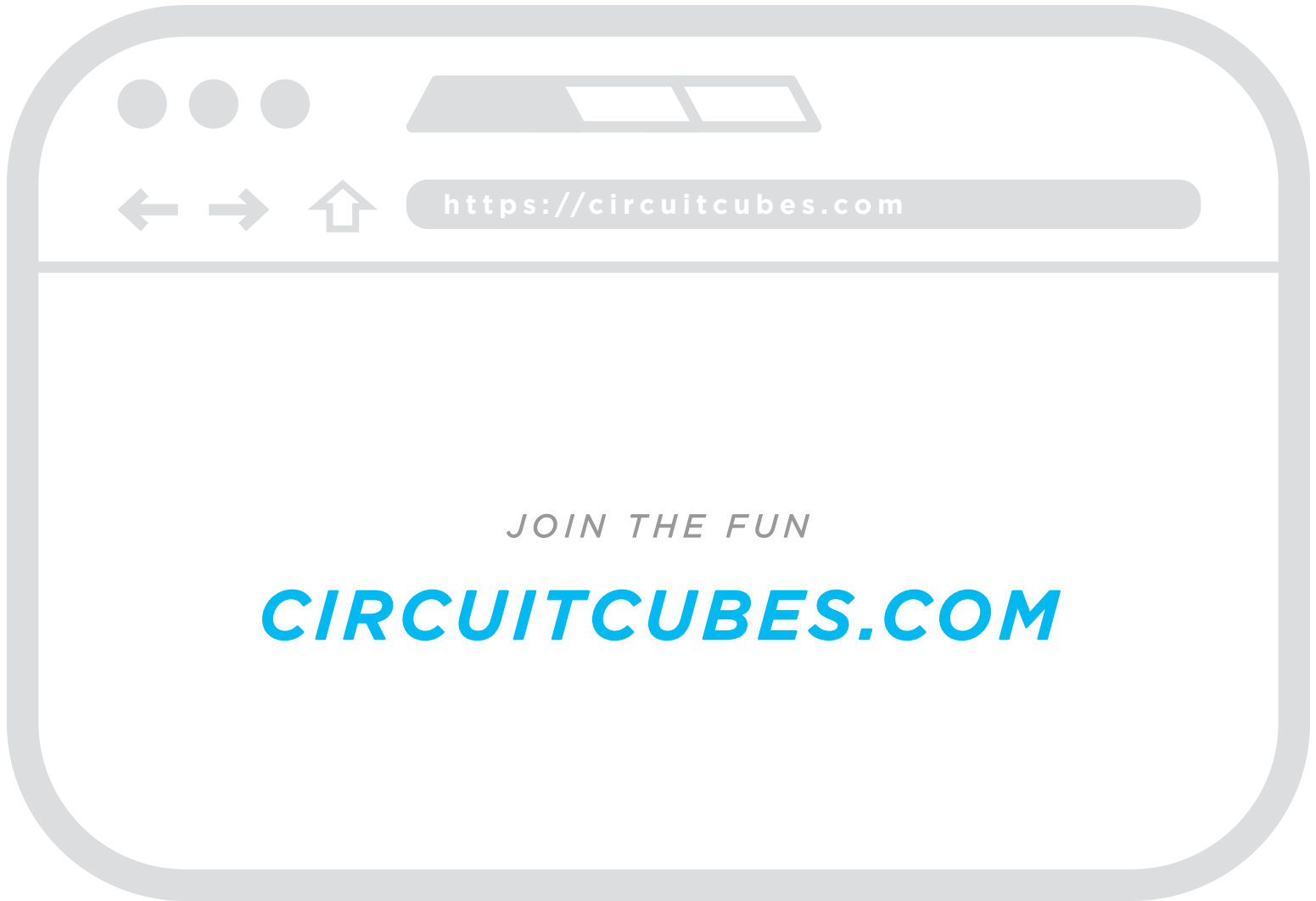
NEW BUILDS ONLINE!

We're always making new things, and we want to see what you've made too!



MECHS MOVE

Love making things move? Now that you've mastered gears, try out our Mechs Move Kit & learn about another form of locomotion!



JOIN THE FUN

CIRCUITCUBES.COM

LEGAL

Tenka Inc. / 291 School Street, Suite 3 / Willits, CA 95490.
Designed by Tenka Inc. in California, USA. Assembled in China.
Please retain this information for future reference. Images for illustration purposes only. Actual product may differ.

PATENTS Circuit Cubes is a registered trademark of Tenka Inc. © 2020 Tenka Inc. All rights reserved. Patent approved. For details visit: circuitcubes.com/patents

IMPORTANT SAFETY INFORMATION Handle Circuit Cubes with care. They contain sensitive electronic components, including batteries, and can be damaged or cause injury if dropped, burned, punctured, crushed, disassembled, or if exposed to excessive heat or liquids. Do not use damaged Circuit Cubes.

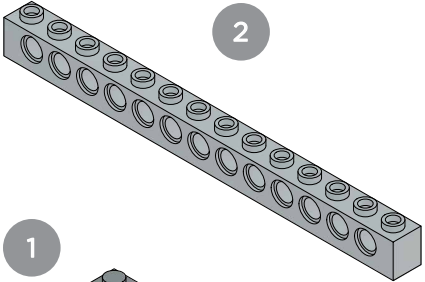
BATTERIES The battery is non-replaceable. Do not attempt to replace the batteries yourself. You may damage the batteries, which can overheat and cause injury. Do not expose battery to water or allow the battery to get wet. Circuit Cubes are only intended to work with one Battery Cube in a circuit — parts may fail if you add multiple Battery Cubes in a circuit.

DISPOSAL The lithium-ion polymer in your Battery Cube should be recycled by Tenka Inc. or an authorized service provider. For more information about Tenka Inc. lithium-ion polymer batteries, go to: circuitcubes.com/pages/cubecare

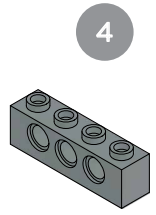
WARNING This product contains chemicals known to the State of California to cause cancer and birth defects (or other reproductive harm). **WARNING** Choking hazard — small parts. Not for children under 3 years. **WARNING** This product contains small magnets. Swallowed magnets can stick together across intestines, causing serious injuries. Seek immediate medical attention if magnets are swallowed or inhaled. **WARNING** This toy is only intended for use by children over the age of 8 years.

CONTACT For help with your Circuit Cubes or other questions, please email: support@circuitcubes.com





2



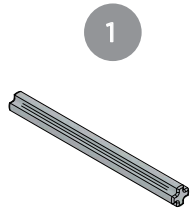
4



4



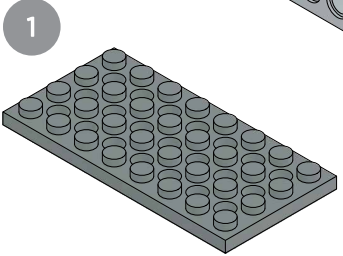
2



1

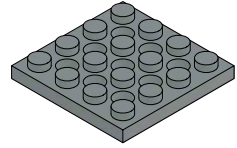


2

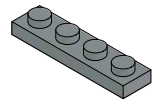


1

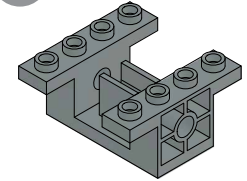
2



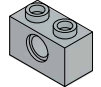
10



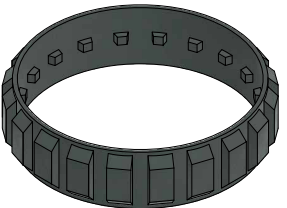
2



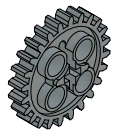
2



2



5



4



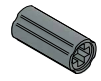
4



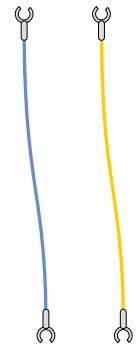
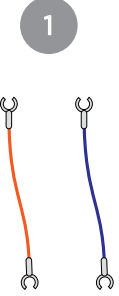
1



2



1



1



2



4



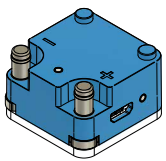
1



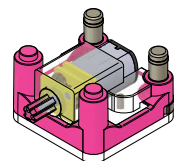
2



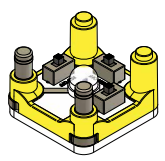
1



1



1





circuit
CUBES