

EXPERIMENT MANUAL

ENGINEERING MAKERSPACE

OFF-ROAD ROVERS



 THAMES & KOSMOS

Franchh-Kosmos Verlags-GmbH & Co. KG, Pfizerstr. 5-7, 70184 Stuttgart, Germany | +49 (0) 711 2191-0 | www.kosmos.de
Thames & Kosmos, 301 Friendship St., Providence, RI, 02903, USA | 1-800-587-2872 | www.thamesandkosmos.com
Thames & Kosmos UK LP, 20 Stone Street, Cranbrook, Kent, TN17 3HE, UK | 01580 713000 | www.thamesandkosmos.co.uk

»»» SAFETY INFORMATION

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

Keep the packaging and the instructions as they contain important information.

Warning! Do not aim at eyes or face.

Store the experiment materials and assembled models out of the reach of small children.

The models are intended for indoor use. Do not use your models in a sandbox.

Safety Advice for Batteries

- »» Two AA batteries (1.5-volt, type LR6) are required for operation.
- »» The supply terminals are not to be short-circuited. A short circuit can cause the wires to overheat and the batteries to explode.
- »» Different types of batteries (e.g., rechargeable and standard) 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.
- »» Batteries are to be inserted with the correct polarity. Press them gently into the battery compartment. See page 2.
- »» Always close the 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.
- »» Dispose of used batteries in accordance with environmental provisions, not in the household trash.
- »» Be sure not to bring batteries into contact with coins, keys, or other metal objects.
- »» Avoid deforming the batteries.
- »» Please remove the batteries if the toy is likely to be unused for a long time.

Dear Parents and Adults,

Before starting the experiments, read through the instruction manual together with your child and discuss the safety information. Check to make sure the models have been assembled correctly, and assist your child with the experiments.

We hope you and your child have a lot of fun with the experiments!

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.



Kosmos Quality and Safety

More than one hundred years of expertise in publishing science experiment kits stand behind every product that bears the Kosmos name. Kosmos experiment kits are designed by an experienced team of specialists and tested with the utmost care during development and production. With regard to product safety, these experiment kits follow European and US safety standards, as well as our own refined proprietary safety guidelines. By working closely with our manufacturing partners and safety testing labs, we are able to control all stages of production. While the majority of our products are made in Germany, all of our products, regardless of origin, follow the same rigid quality standards.

1st Edition 2018 © 2018 Franckh-Kosmos Verlags-GmbH & Co. KG, Pfizerstrasse 5–7, 70184 Stuttgart, Germany

This work, including all its parts, is copyright protected. Any use outside the specific limits of the copyright law without the consent of the publisher is prohibited and punishable by law. This applies specifically to reproductions, translations, microfilming, and storage and processing in electronic systems and networks. We do not guarantee that all material in this work is free from copyright or other protection.

Technical product development: Genius Toys Taiwan Co., Ltd.; Dr. Petra Müller

Author: Thames & Kosmos, and Rainer Köthe

Manual Layout: Peggy Bertram and Annabell Goldacker, 599media GmbH, Freiberg, Germany

Manual design concept: Atelier Bea Klenk, Berlin

Manual illustrations: Genius Toy Taiwan Co., Ltd., Taichung, Taiwan, R.O.C., and Thames & Kosmos

Manual photos:

© shutterstock: plantic, 4, 38; JITD, 4, 38

All remaining images: Thames & Kosmos, Franckh-Kosmos Verlags-GmbH & Co. KG, and Genius Toy Taiwan Co., Ltd.

The publisher has made every effort to locate the holders of image rights for all of the photos used. If in any individual cases any holders of image rights have not been acknowledged, they are asked to provide evidence to the publisher of their image rights so that they may be paid an image fee in line with the industry standard.

1st English Edition © 2018 Thames & Kosmos, LLC, Providence, RI, U.S.A.

® Thames & Kosmos is a registered trademark of Thames & Kosmos, LLC.

Author: Thames & Kosmos, and Rainer Köthe

Manual Layout: Mark Geary

Editing: Camille Duhamel, Ted McGuire

Additional Graphics and Packaging: Dan Freitas

Distributed in North America by Thames & Kosmos, LLC.

Providence, RI 02903

Phone: 800-587-2872; Web: www.thamesandkosmos.com

Distributed in United Kingdom by Thames & Kosmos UK LP.

Cranbrook, Kent TN17 3HE

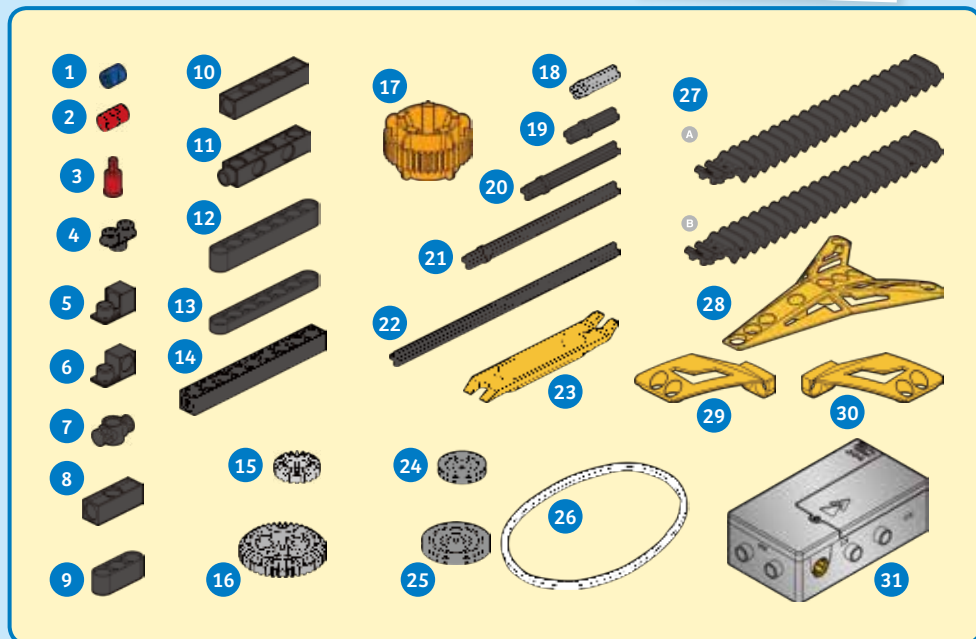
Phone: 01580 713000; Web: www.thamesandkosmos.co.uk

We reserve the right to make technical changes.

Printed in Taiwan / Imprimé en Taiwan

>>> KIT CONTENTS

You will also need: 2 x AA batteries (1.5 Volt, type LR6)



Checklist: Find – Inspect – Check off

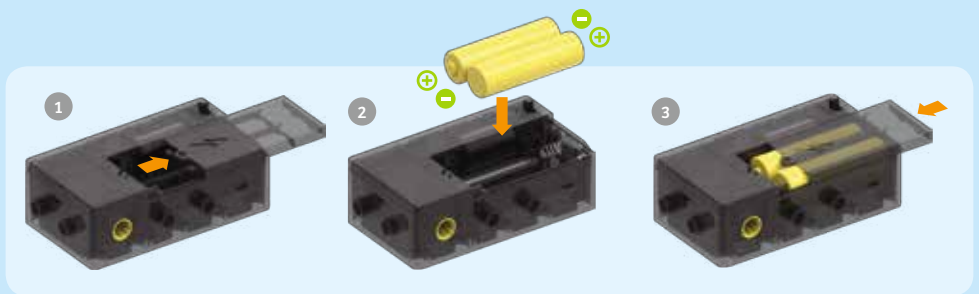
✓	No.	Description	Qty.	Item No.
<input type="radio"/>	1	Short anchor pin	30	717767
<input type="radio"/>	2	Anchor pin	10	702527
<input type="radio"/>	3	Shaft pin	2	702526
<input type="radio"/>	4	Two-to-one converter	6	716889
<input type="radio"/>	5	90-degree converter - Y	4	716884
<input type="radio"/>	6	90-degree converter - X	4	716682
<input type="radio"/>	7	1-hole connector	6	719233
<input type="radio"/>	8	3-hole cross rod, black	3	717899
<input type="radio"/>	9	3-hole rod	2	716872
<input type="radio"/>	10	5-hole cross rod	4	716677
<input type="radio"/>	11	5-hole dual rod, black	2	720583
<input type="radio"/>	12	7-hole wide rounded rod	2	716878
<input type="radio"/>	13	7-hole flat rounded rod	2	716879
<input type="radio"/>	14	9 hole rod	4	717806
<input type="radio"/>	15	Small gear	2	716885
<input type="radio"/>	16	Medium gear	2	716890

✓	No.	Description	Qty.	Item No.
<input type="radio"/>	17	Wheel frame	4	720788
<input type="radio"/>	18	Axle, 27 mm	1	717962
<input type="radio"/>	19	Axle, 30 mm	2	716860
<input type="radio"/>	20	Axle, 60 mm	1	718278
<input type="radio"/>	21	Axle, 100 mm	2	716901
<input type="radio"/>	22	Axle, 150 mm	1	703518
<input type="radio"/>	23	Anchor pin Lever	1	702590
<input type="radio"/>	24	Small pulley wheel	2	716030
<input type="radio"/>	25	Medium pulley wheel	2	720783
<input type="radio"/>	26	Rubber band, small	4	702596
<input type="radio"/>	27	Belt A	4	720787
		Belt B	2	720982
<input type="radio"/>	28	Large body piece A	2	720784
<input type="radio"/>	29	Small body piece left	2	720785
<input type="radio"/>	30	Small body piece right	2	720786
<input type="radio"/>	31	Motor and battery box	1	719861

THE ANCHOR PIN LEVER

Side A of the lever can be used to easily remove anchor pins.

Side B can be used to loosen firmly inserted parts, such as axle plugs.

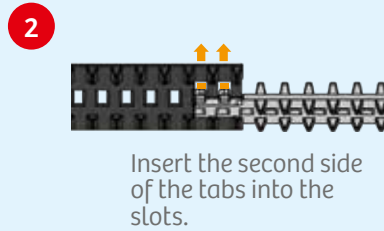
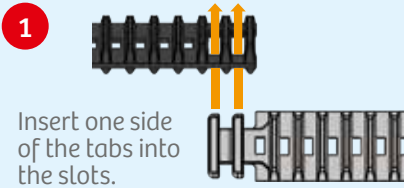
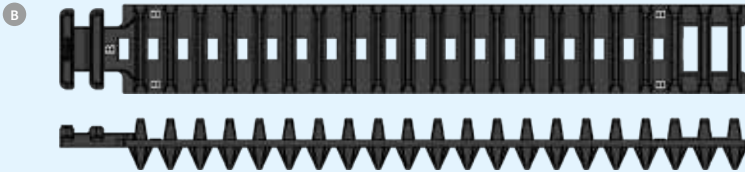
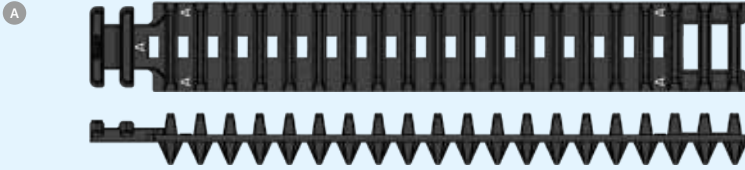


BATTERIES **How to insert and remove the batteries**

Open the battery compartment by sliding the lid open. Insert two batteries. Make sure you fit the positive and negative ends into the compartment in the direction indicated (with the correct polarity). Then close the compartment. When it is time to replace the batteries, remove the old batteries and insert the new ones with the correct polarity.

>>> TIPS FOR ASSEMBLY

HOW TO CONNECT THE BELTS



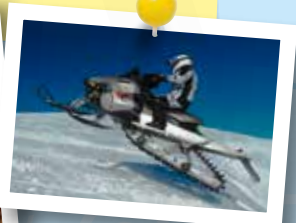
>>> TABLE OF CONTENTS

Kit Contents	1
Tips for Assembly	2
Table of Contents.....	4
Overview.....	5
1. ATV 4WD	7
2. Dune Racer	10
3. Snowcat Plow.....	13
4. Stair Walker	16
5. Snow Scooter	19
6. Future Truck	22
7. Conveyor Belt	25
8. Bandsaw Machine.....	28
9. Belt Sander.....	31
10. Paper Plane Launcher	34
Check It Out.....	38

On pages 5–6 you can see all the models at a glance.



On page 38 Learn interesting facts about tracked vehicles.



>>> OVERVIEW

ATV
4WD



7

10



Dune Racer

Stair
Walker



16

Snowcat
Plow



13

Snow Scooter



19

Build these
functional models
one at a time!

Future Truck



22

Bandsaw Machine



28

Conveyor Belt



25

Belt Sander



31

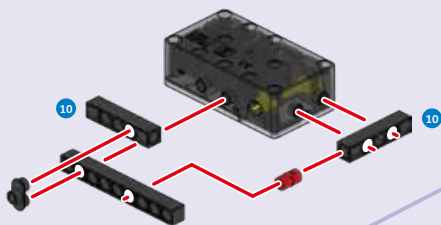
34

Paper Plane Launcher

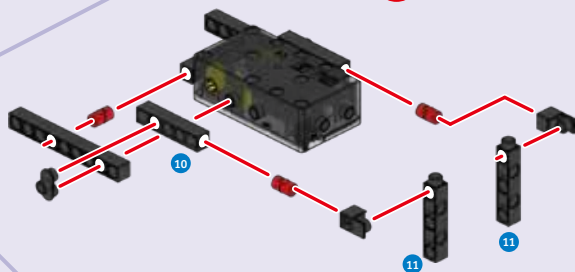


ATV 4WD

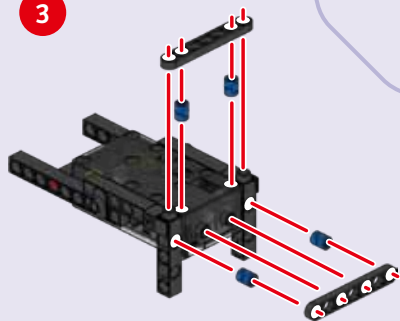
1



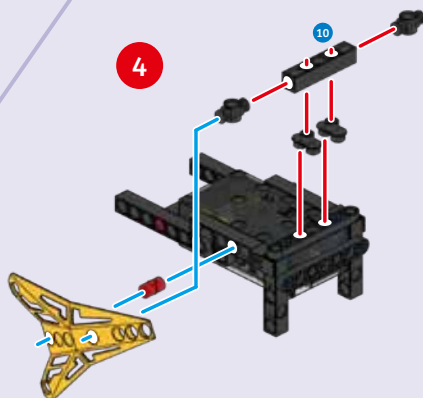
2



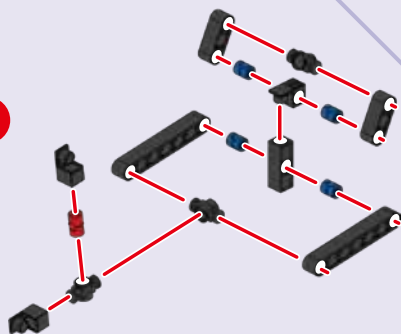
3



4



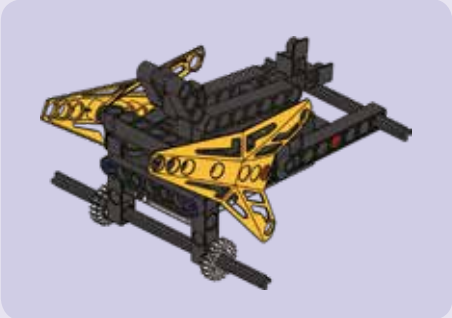
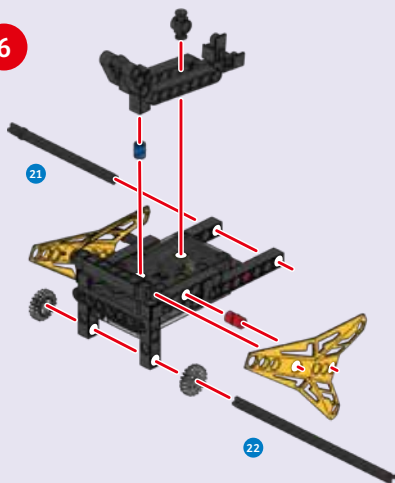
5



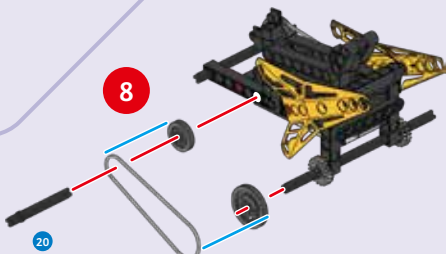
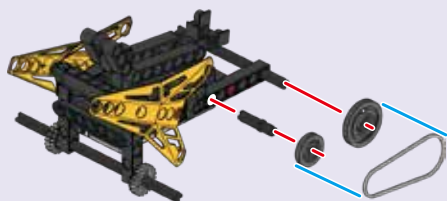


ATV 4WD

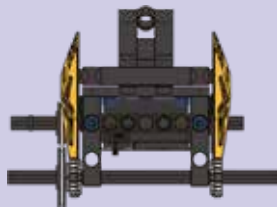
6



7



Rear view



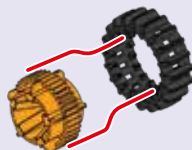
Keep a 1-mm gap between the gears and the rods on each side.

9

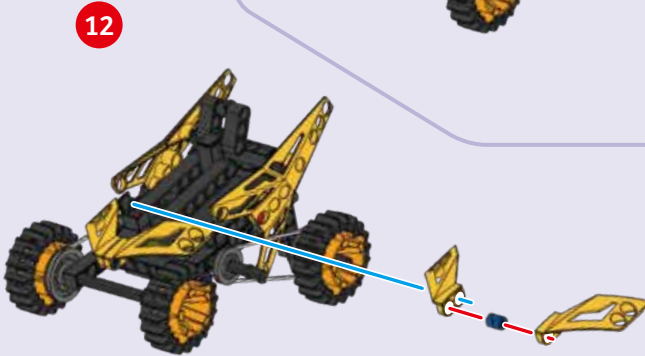
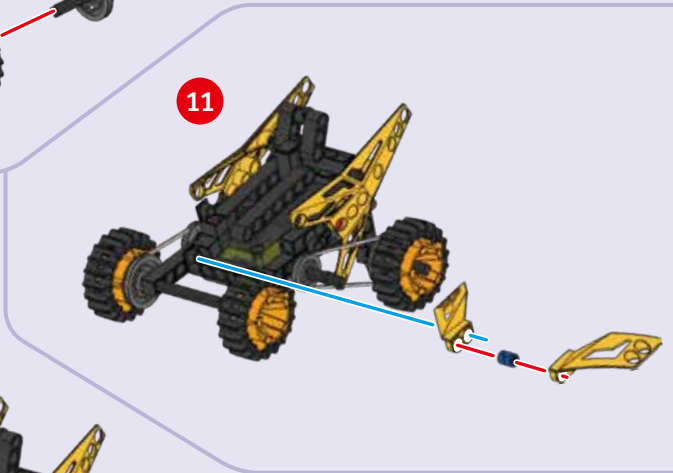
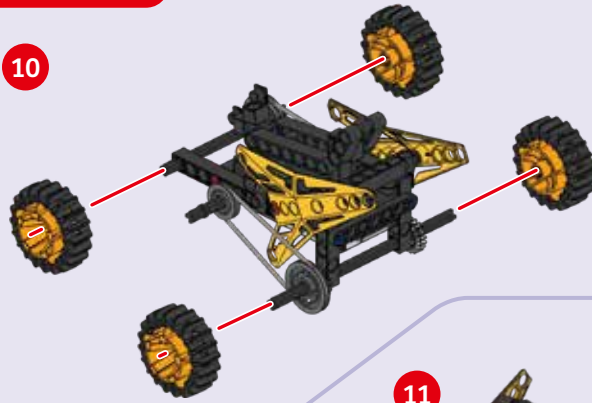
x4

x1

A



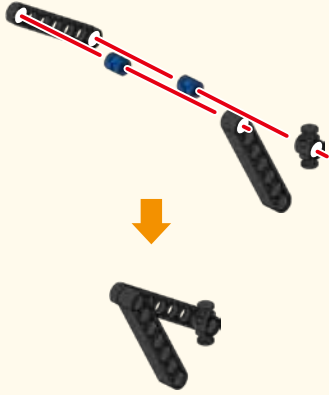
ATV 4WD



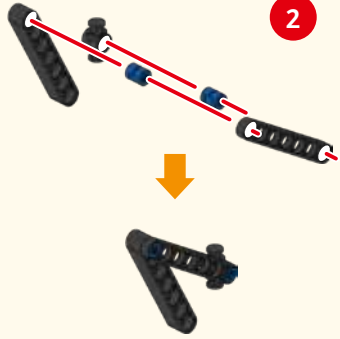
Done!

DUNE RACER

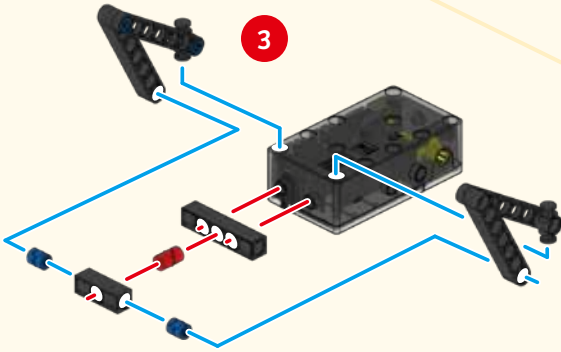
1



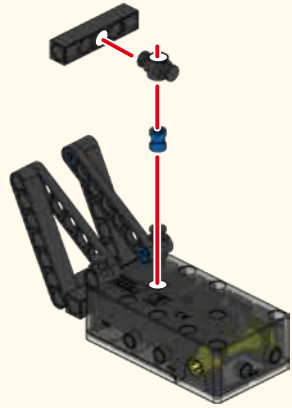
2



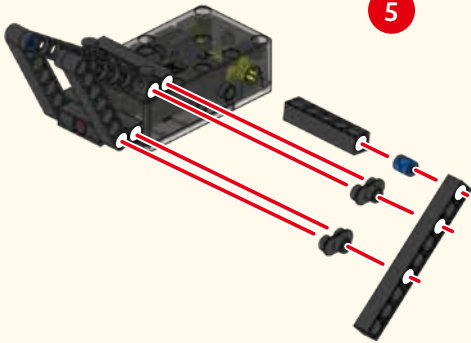
3



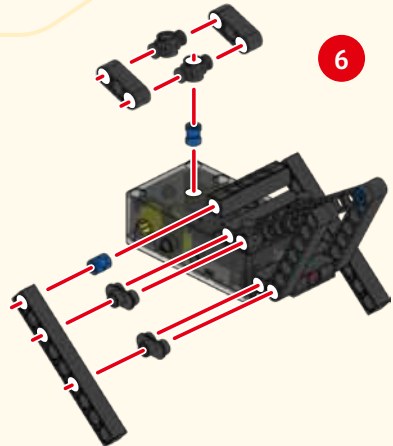
4



5

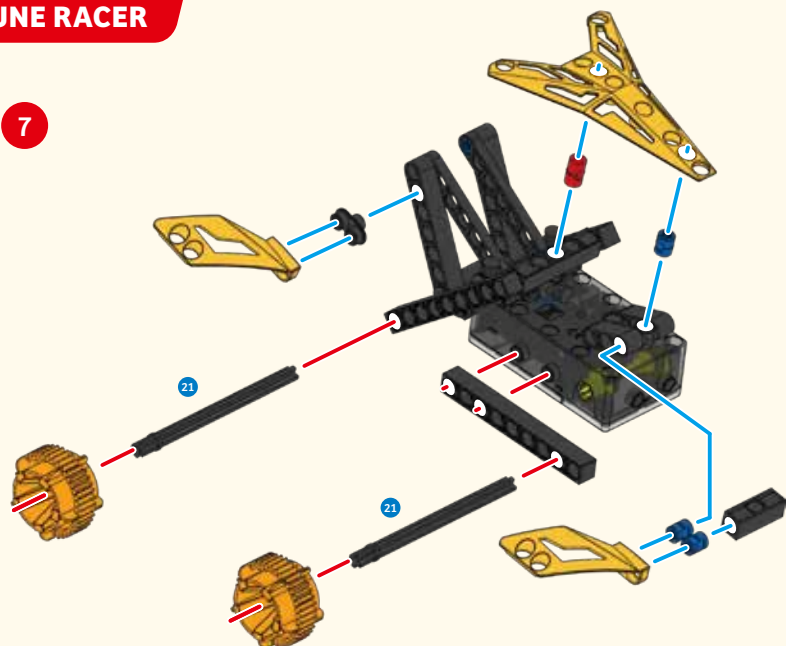


6

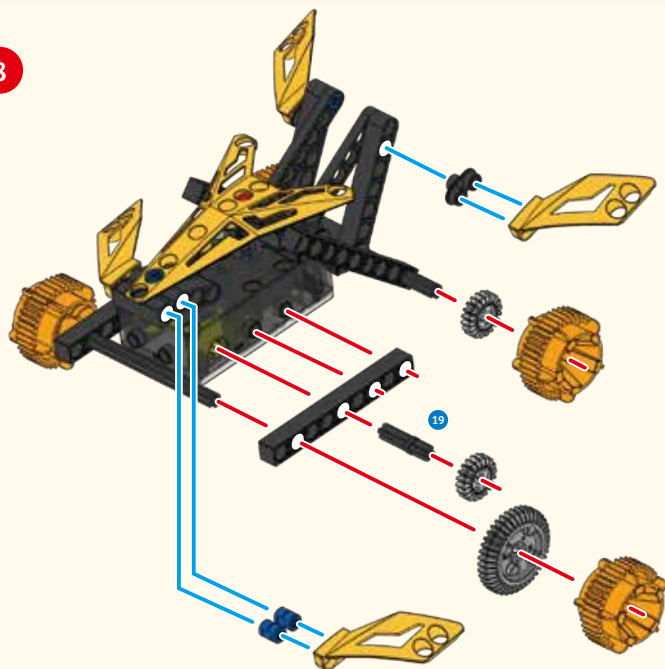


DUNE RACER

7



8





DUNE RACER

x2

A



x2

B



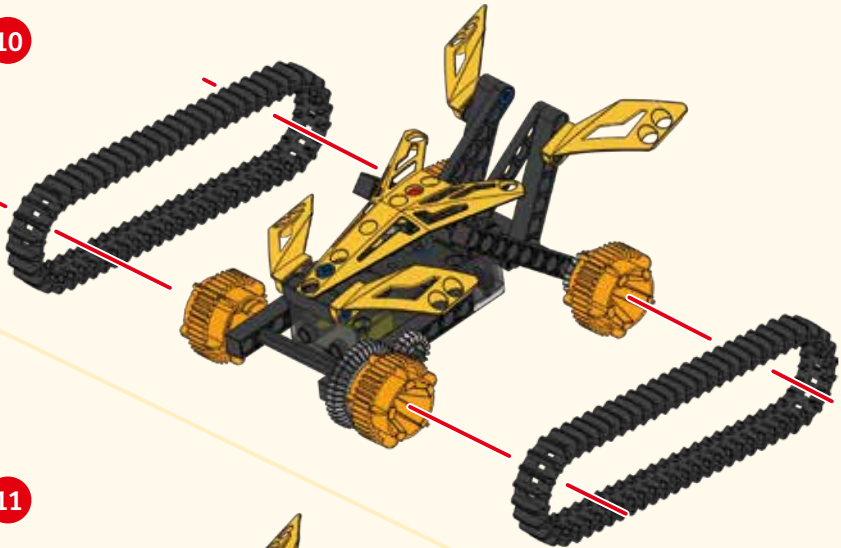
x1



9

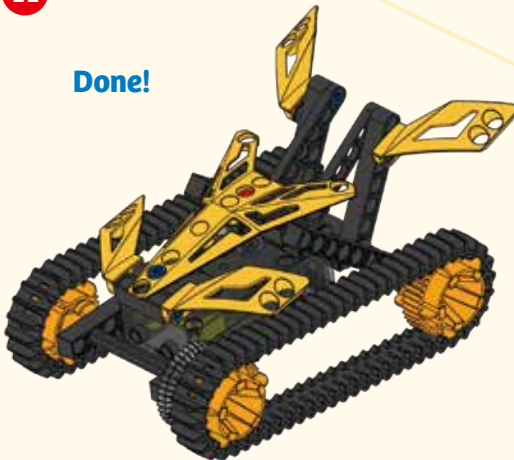


10



11

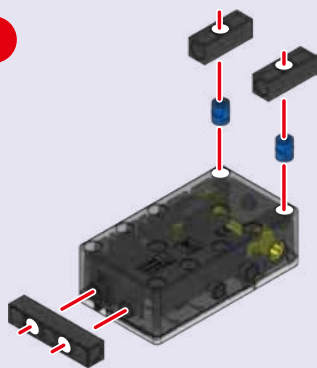
Done!



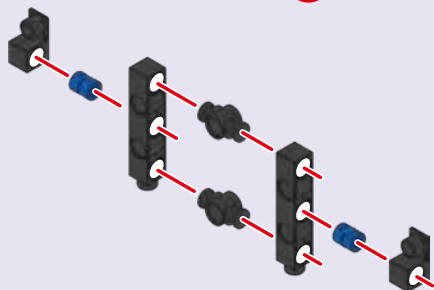
Set up a ramp and experiment to see if your dune racer can drive up the ramp. At what angle is the ramp too steep for your dune racer to climb the ramp?

SNOWCAT PLOW

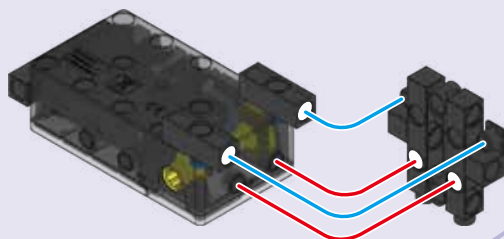
1



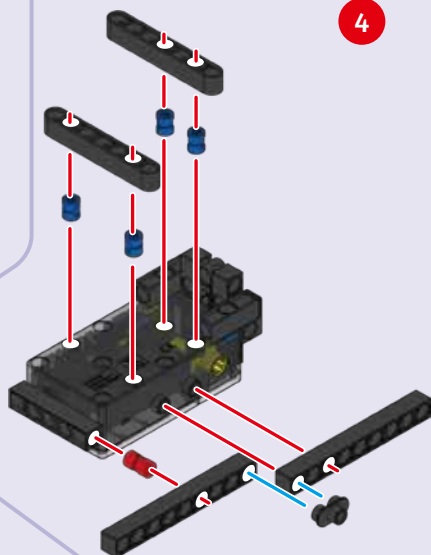
2



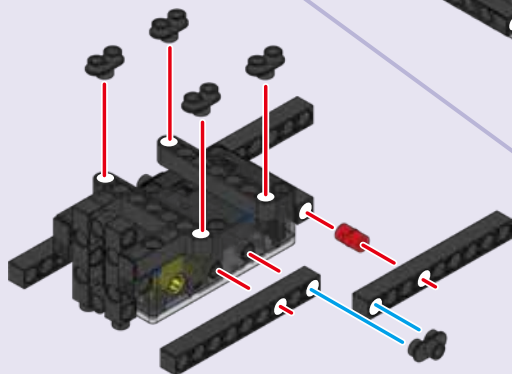
3



4

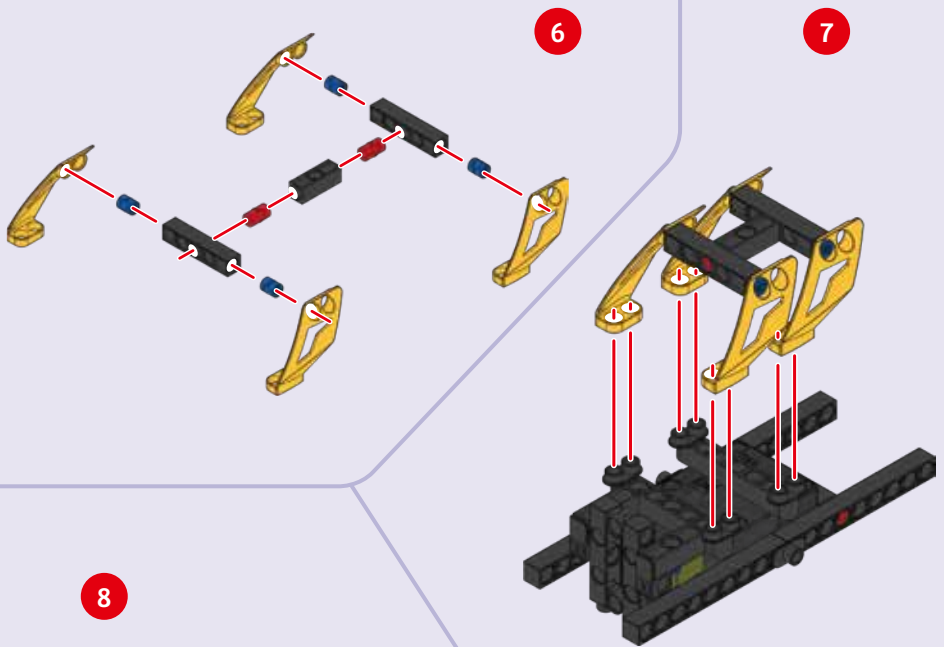


5

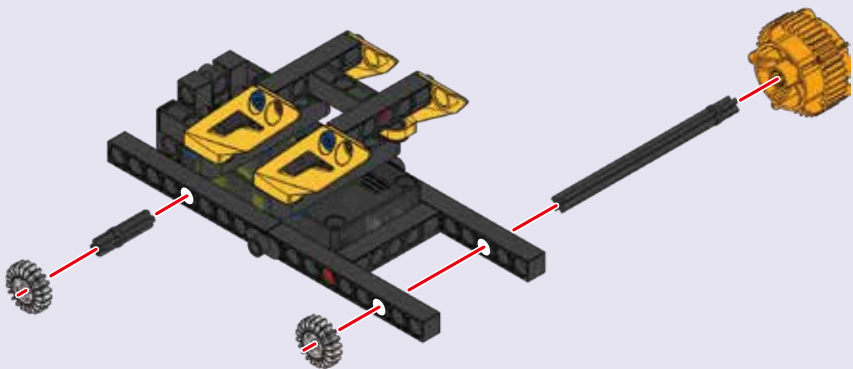




SNOWCAT PLOW



8



9 **x2**



x2

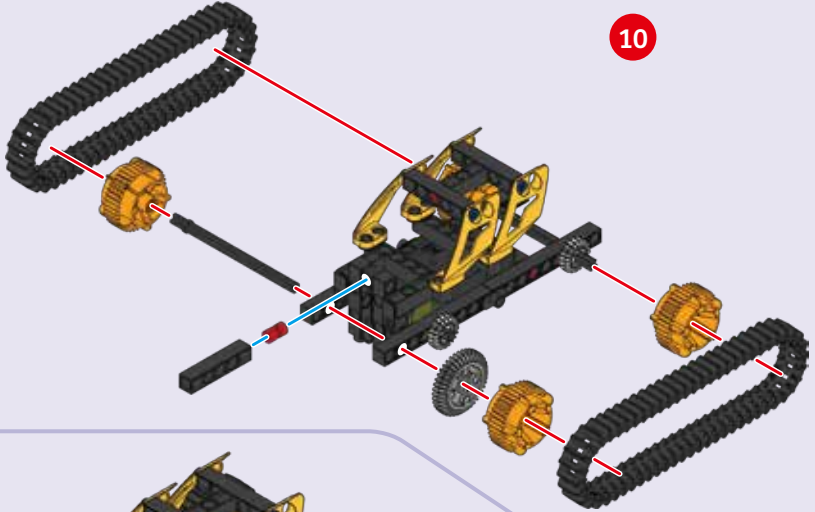


x1

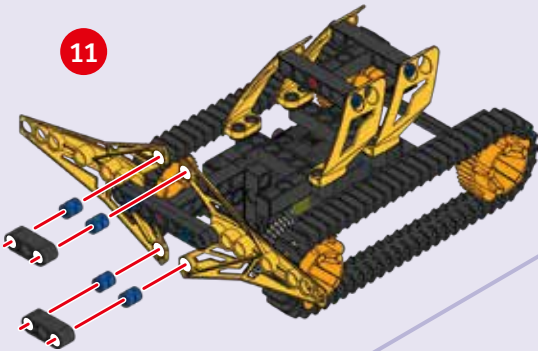


SNOWCAT PLOW

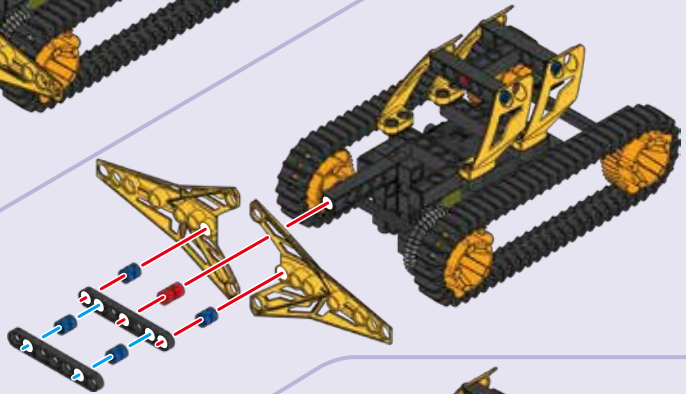
10



11



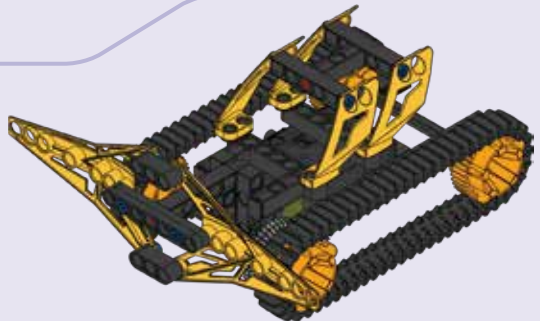
12



13

Done!

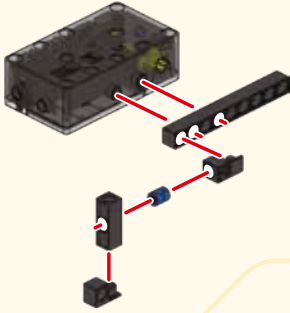
Place small objects in front of your snowcat plow!



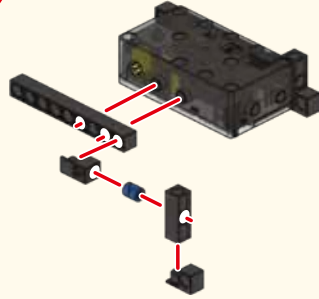


STAIR WALKER

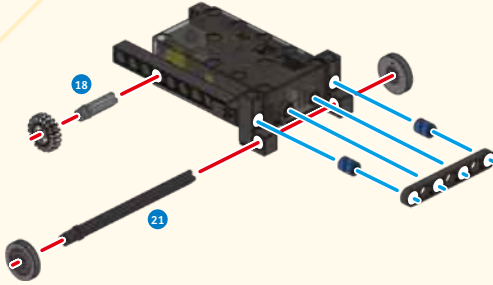
1



2

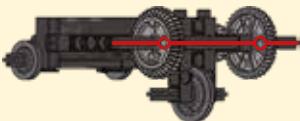
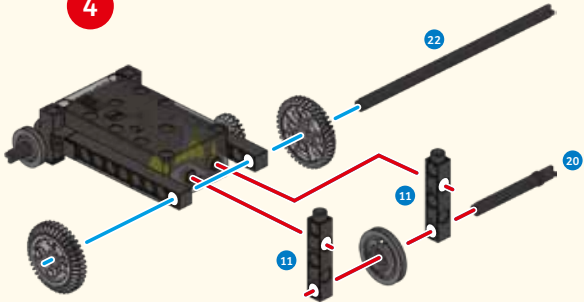


3



4

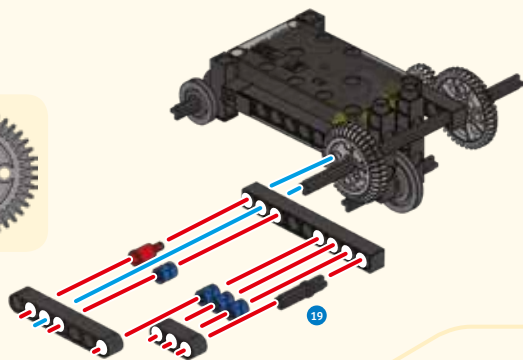
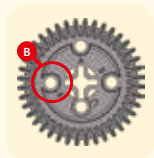
Perform the steps with the red lines first!



Align the holes marked B on the same level.

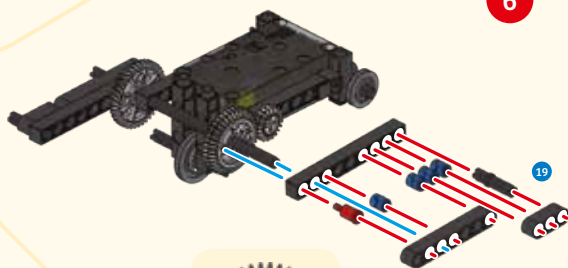
STAIR WALKER

5

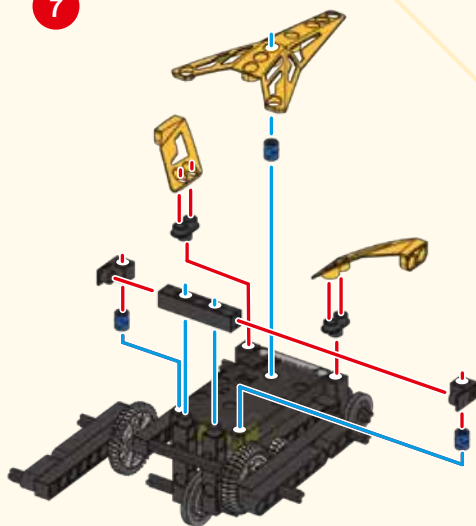


Perform the steps with the red lines first!

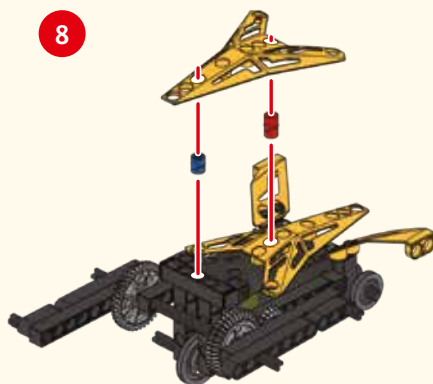
6



7



8



STAIR WALKER

9

x2



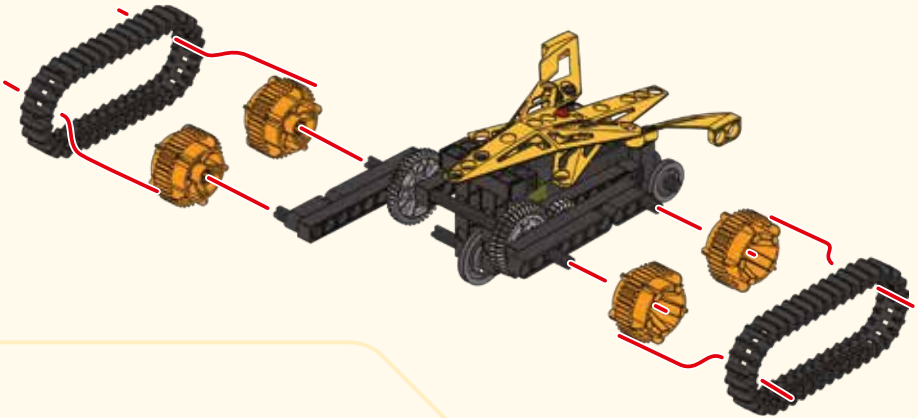
x1



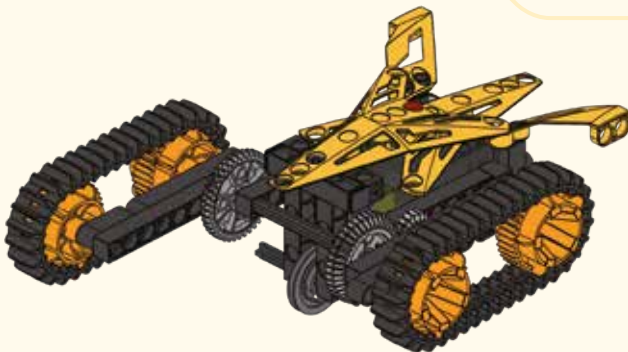
x1



10



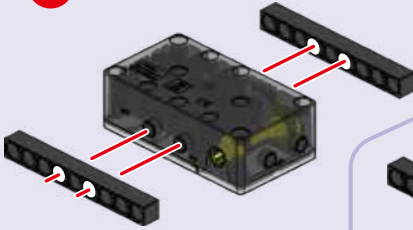
11



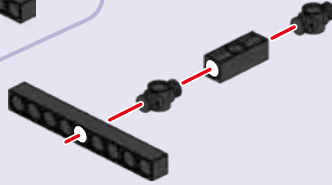
Done!

SNOW SCOOTER

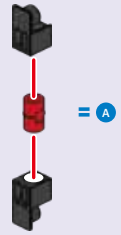
1



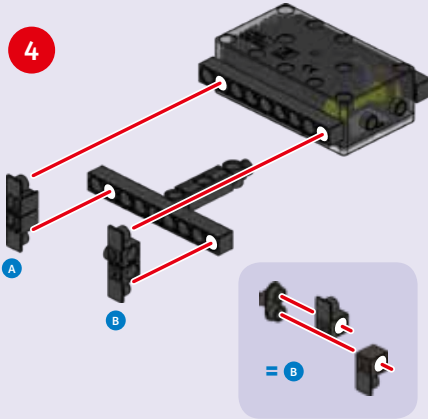
2



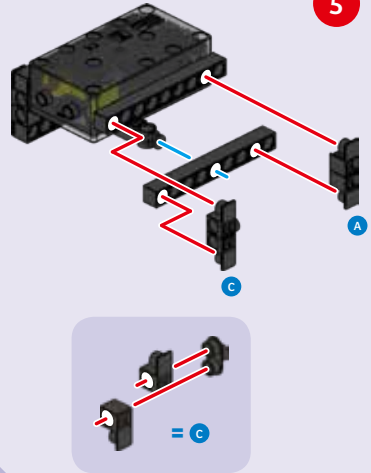
3 x2



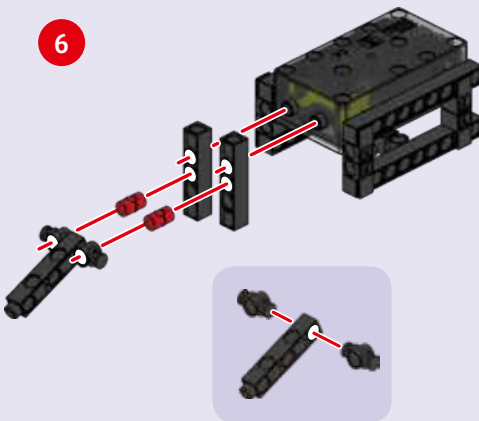
4



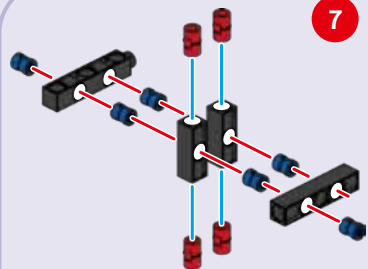
5



6



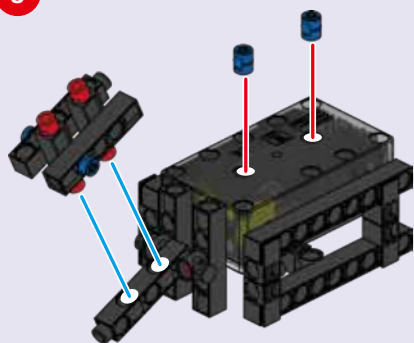
7



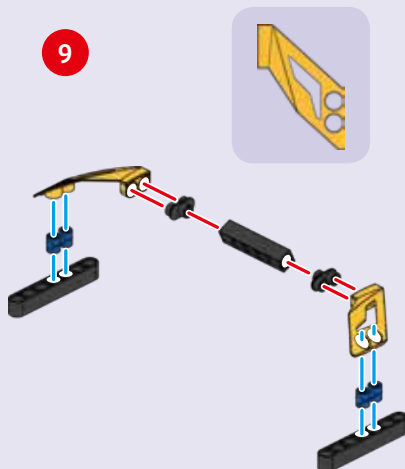


SNOW SCOOTER

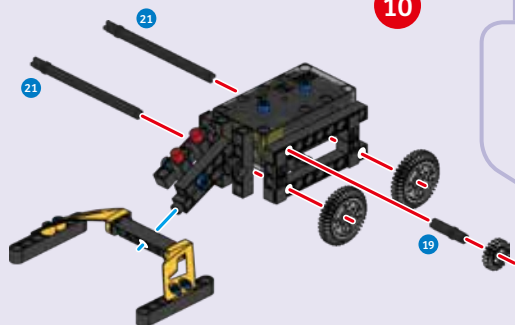
8



9



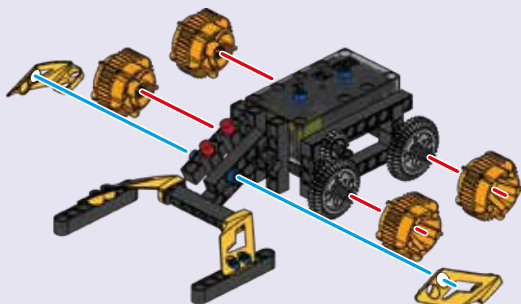
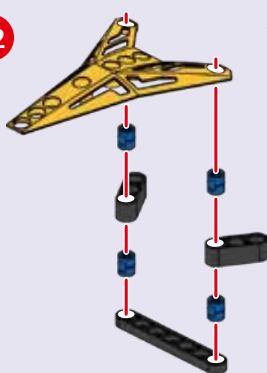
10



11

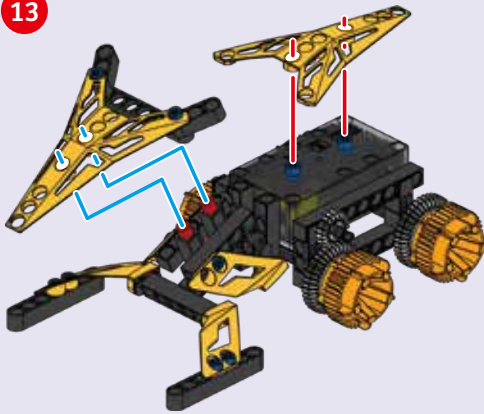


12



SNOW SCOOTER

13



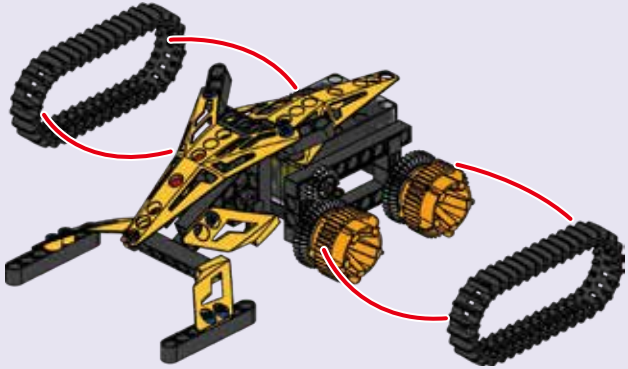
14 **x2**

A  **x1**

B  **x1**



15



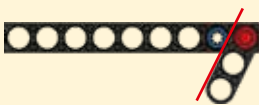
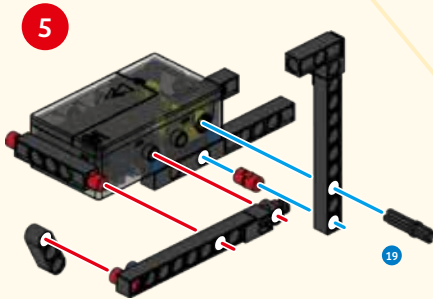
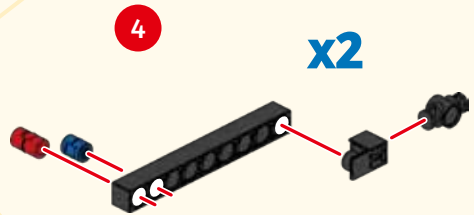
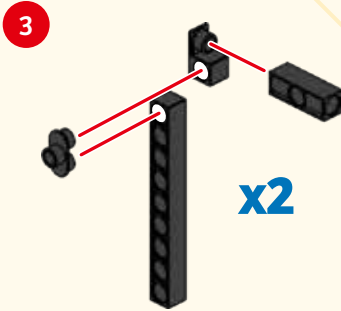
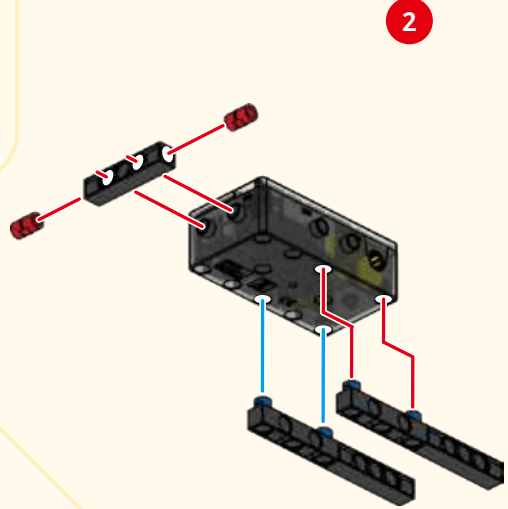
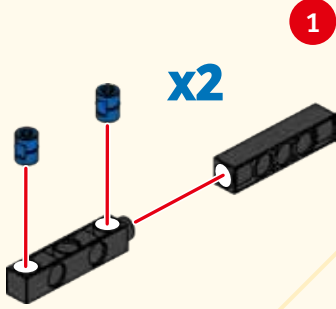
16



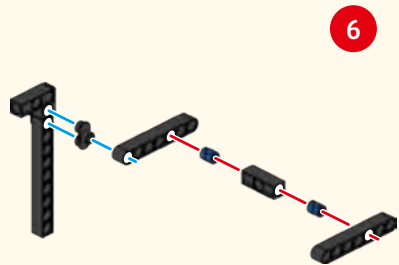
Done!



FUTURE TRUCK

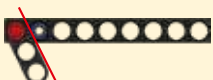
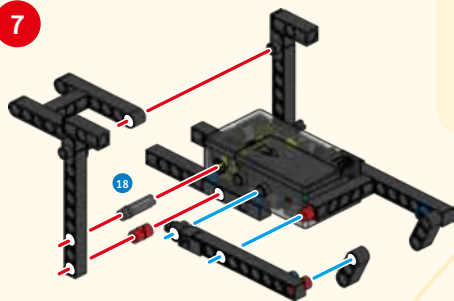


Lean the 3-hole wide rounded rod on the short anchor pin.



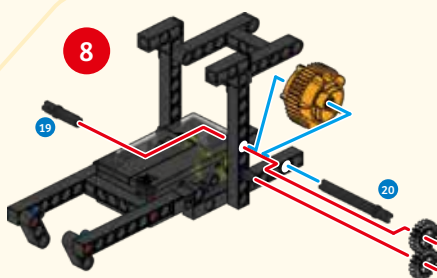
FUTURE TRUCK

7

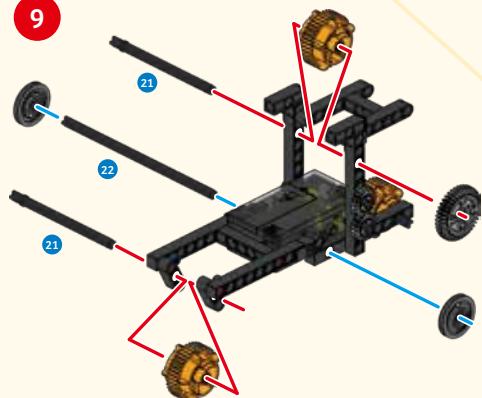


Lean the 3-hole wide rounded rod on the short anchor pin.

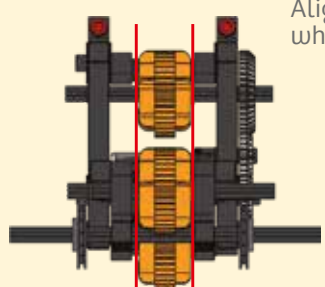
8



9



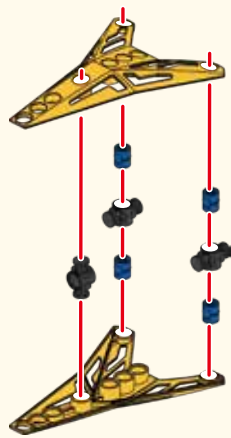
Rear view



Align the three wheels.

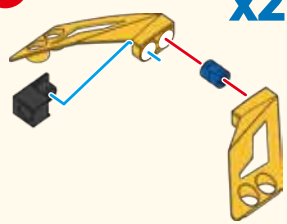
Pay attention to the gaps, so that the wheels can turn freely.

10



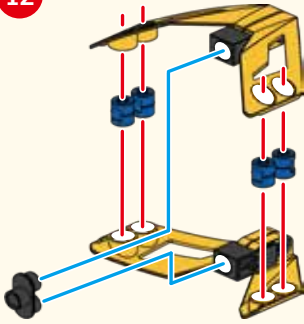
11

x2

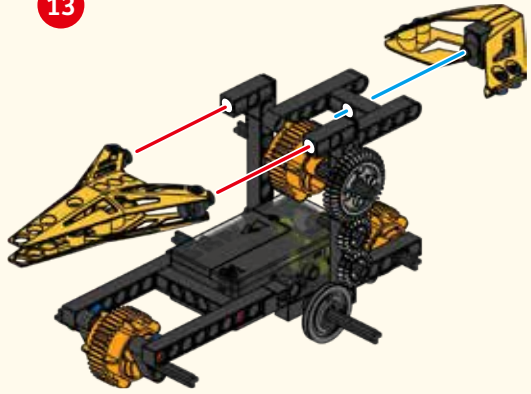


FUTURE TRUCK

12



13

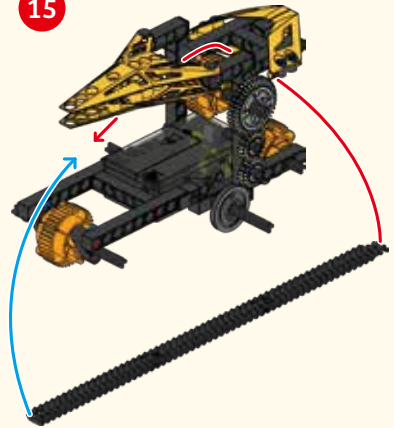


14

A  x4



15



16



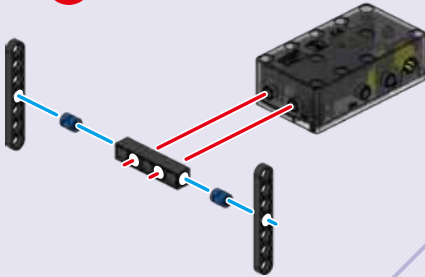
17

Done!



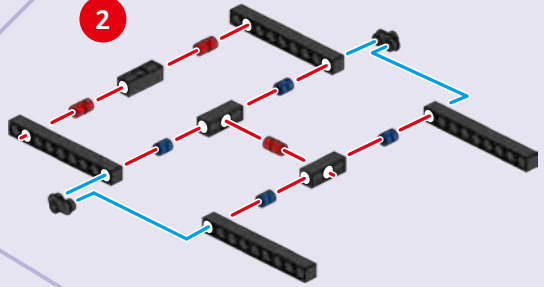
CONVEYOR BELT

1

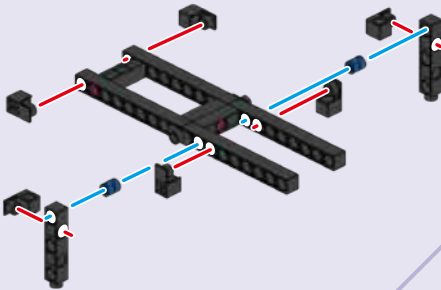


Perform the steps with the red lines first!

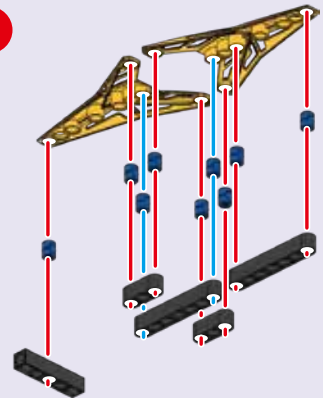
2



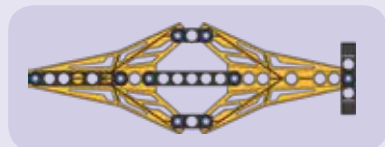
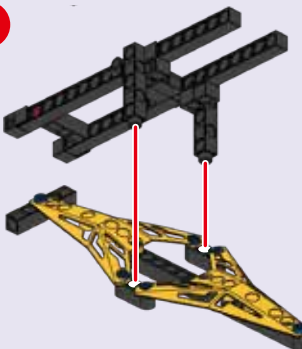
3



4



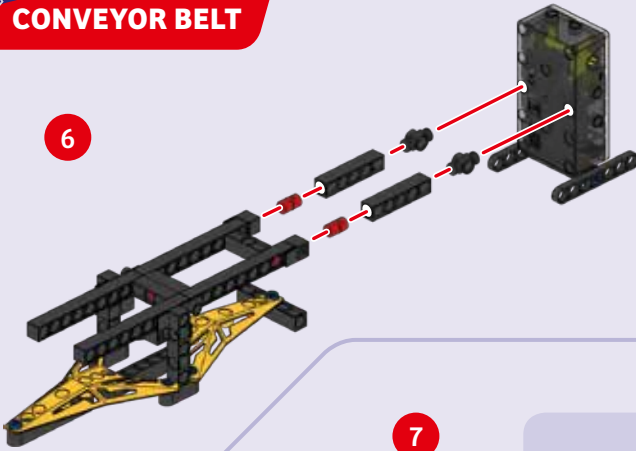
5



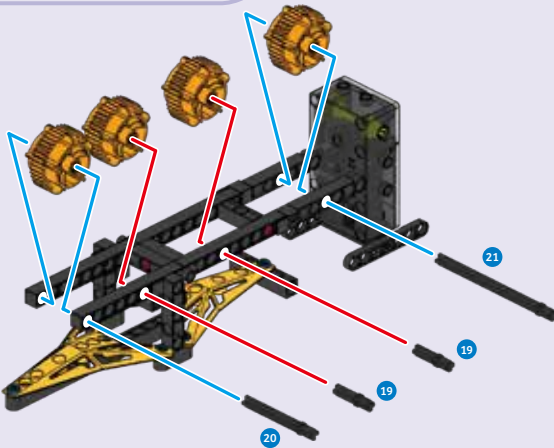


CONVEYOR BELT

6



7

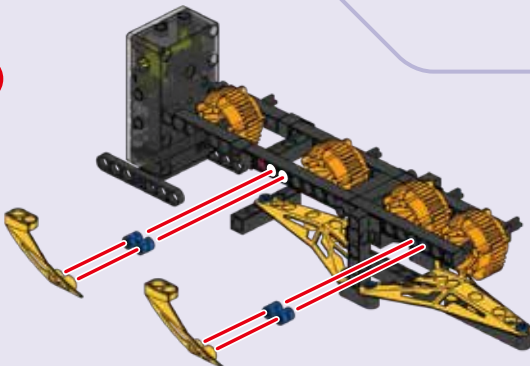


Align all four wheels!



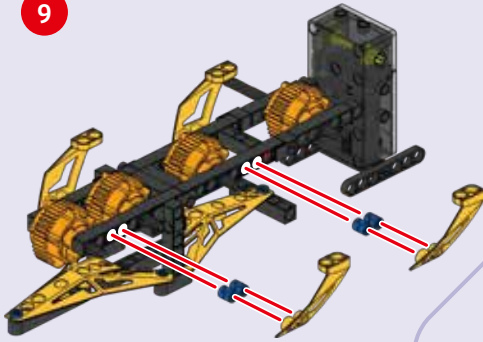
Pay attention to the gaps, so that the wheels can turn freely.

8



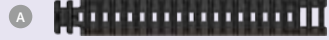
CONVEYOR BELT

9

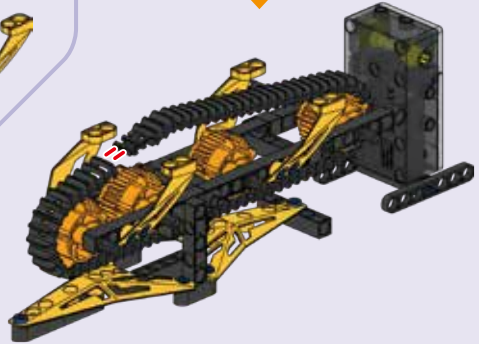


10

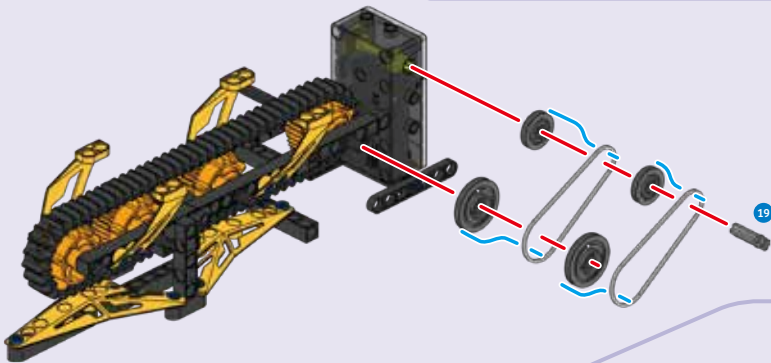
x2



x2



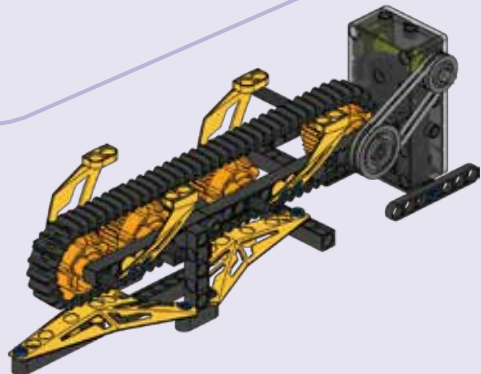
11



12

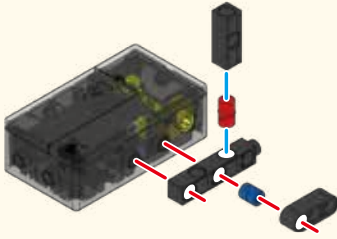
Done!

Put a few small objects on your assembly line!

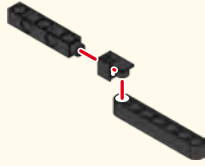


BANDSAW MACHINE

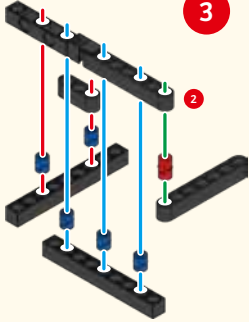
1



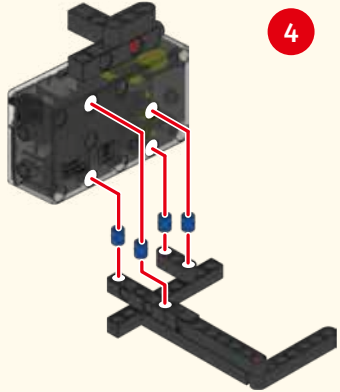
2



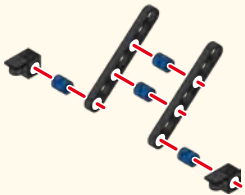
3



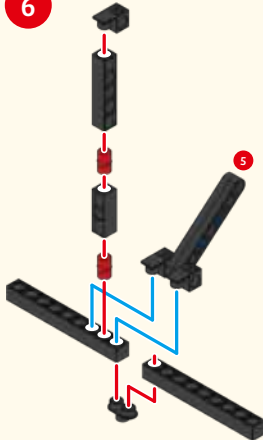
4



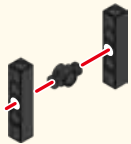
5



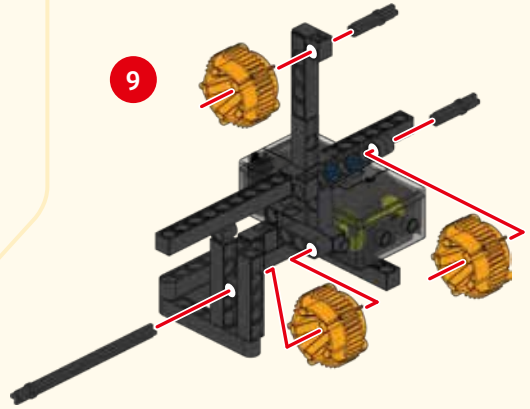
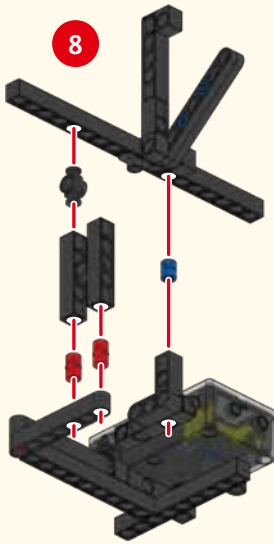
6



7



BANDSAW MACHINE



10

A



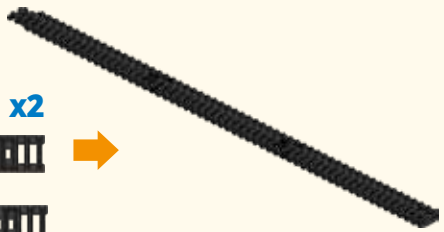
x2



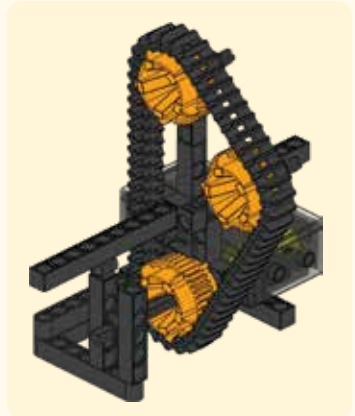
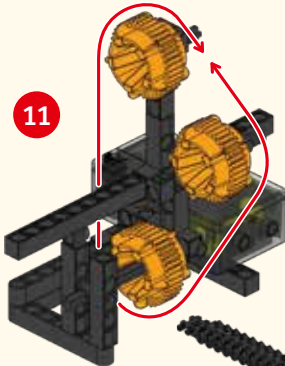
B



x1



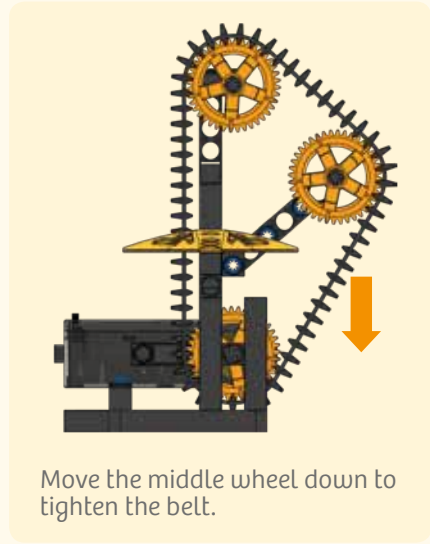
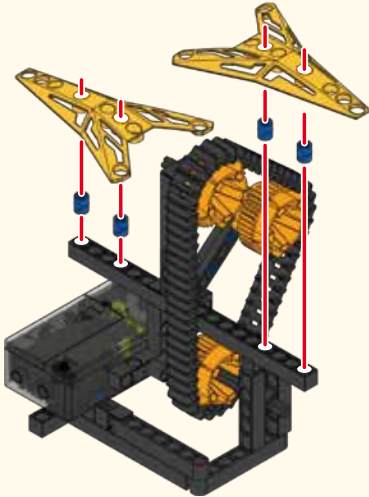
11





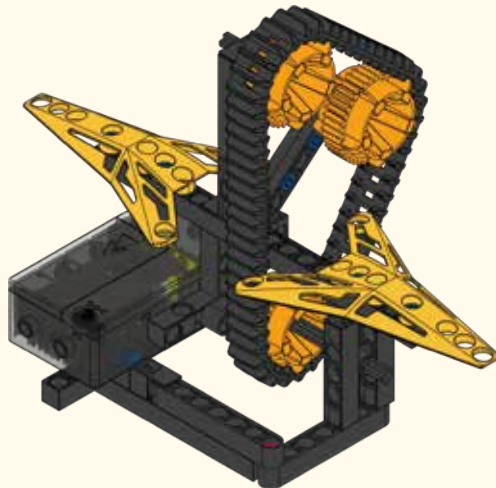
BANDSAW MACHINE

12



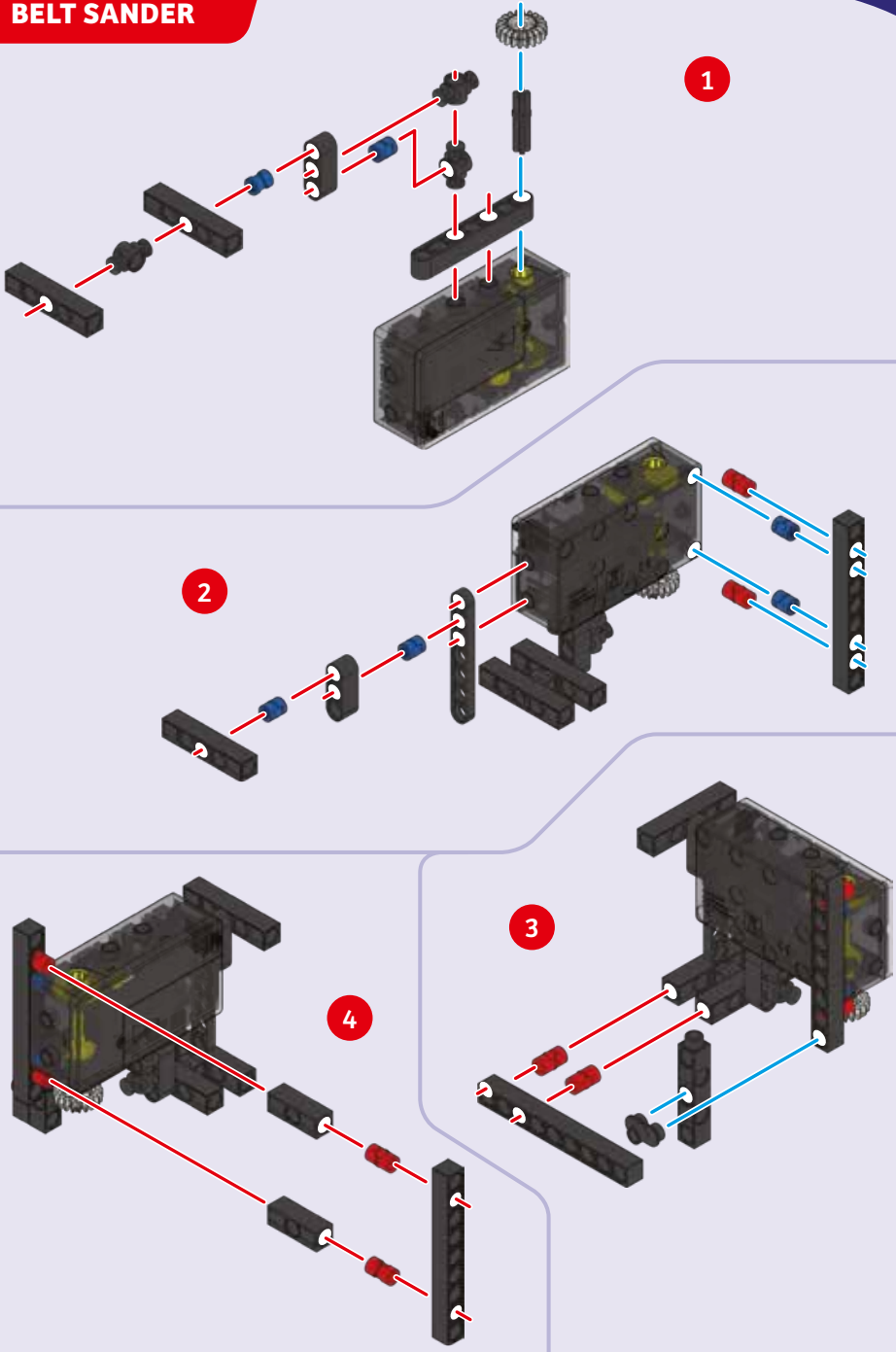
Move the middle wheel down to tighten the belt.

13



Done!

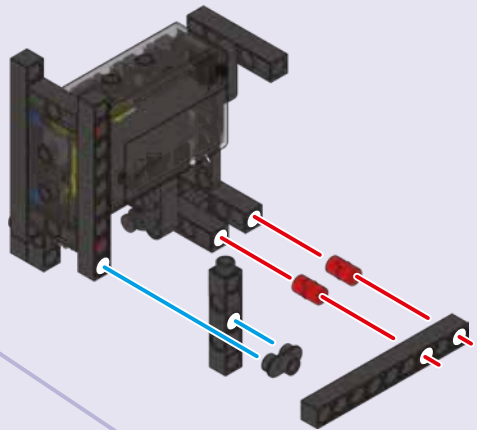
BELT SANDER



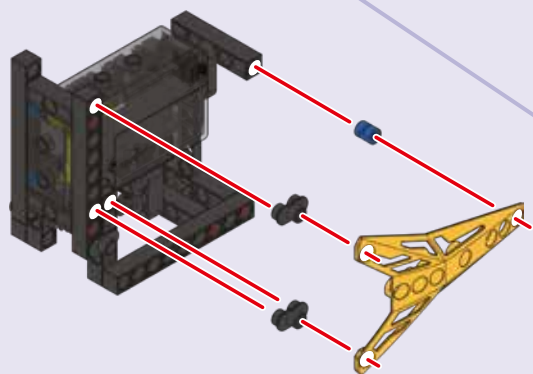


BELT SANDER

5



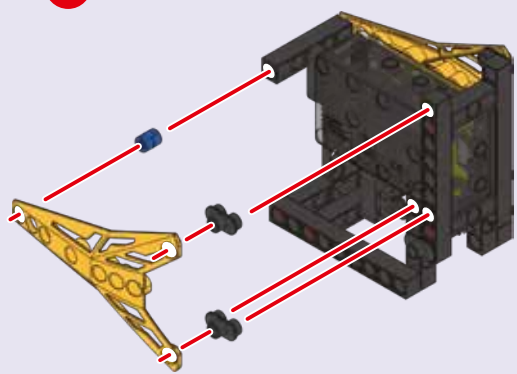
6



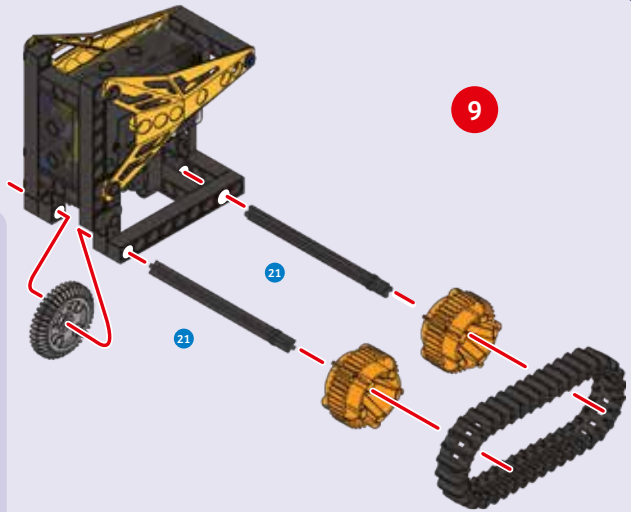
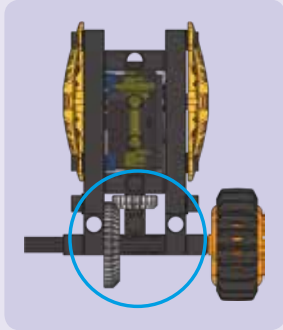
8 x2



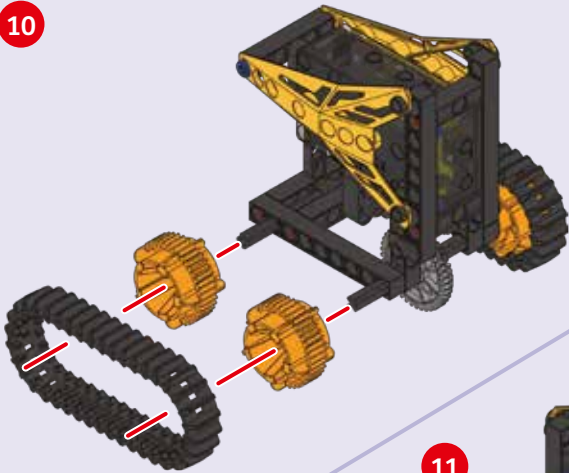
7



BELT SANDER

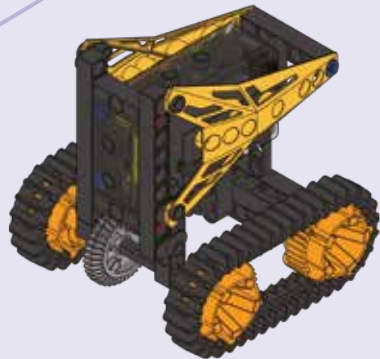


10



11

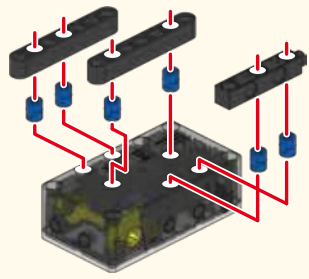
Done!





PAPER PLANE LAUNCHER

1

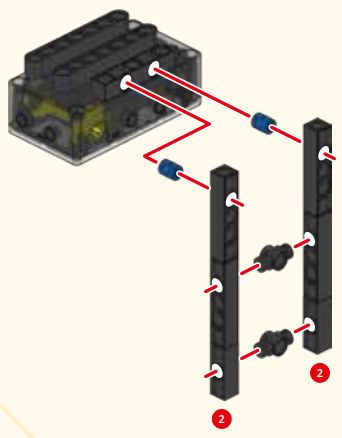


2

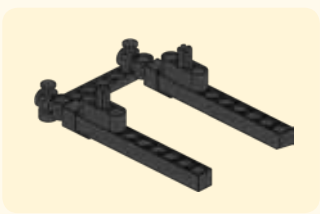
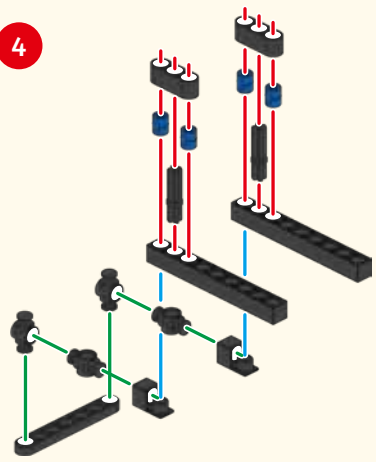
x2



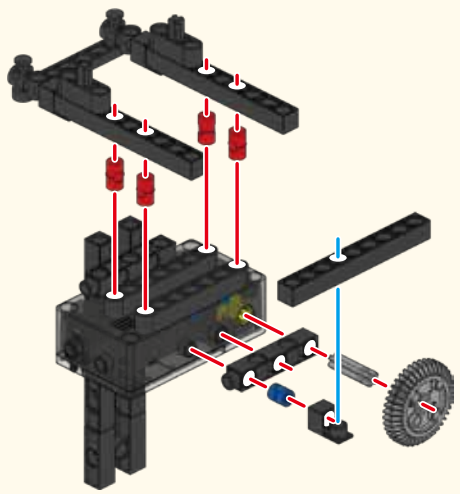
3



4

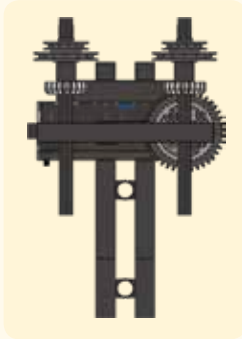
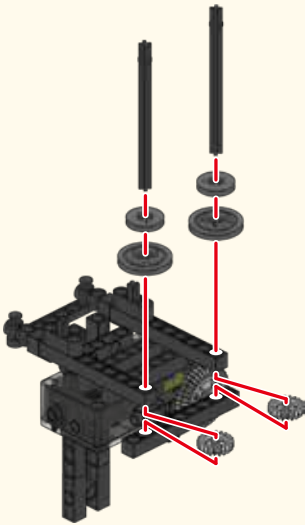


5

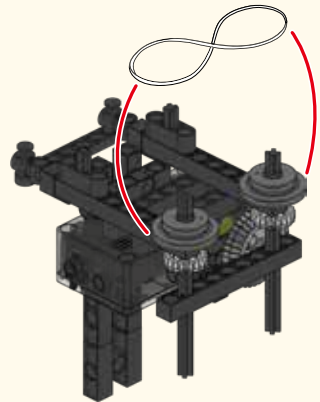
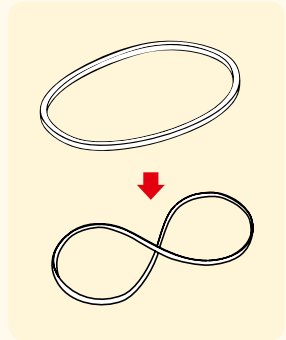


PAPER PLANE LAUNCHER

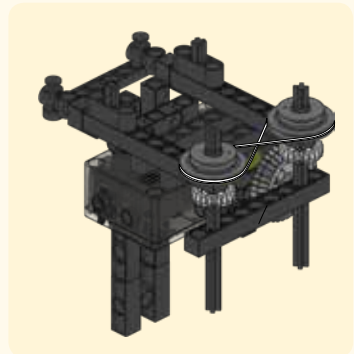
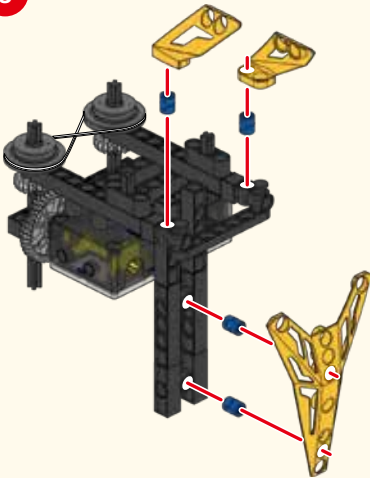
6



7



8

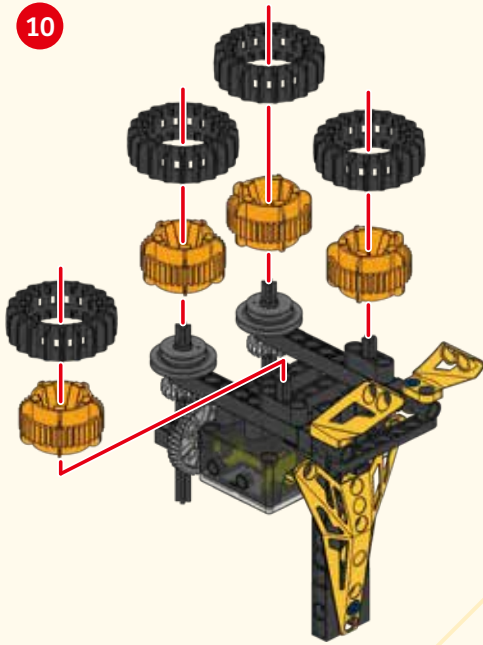


PAPER PLANE LAUNCHER

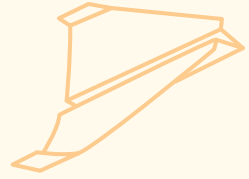
9 **x4**



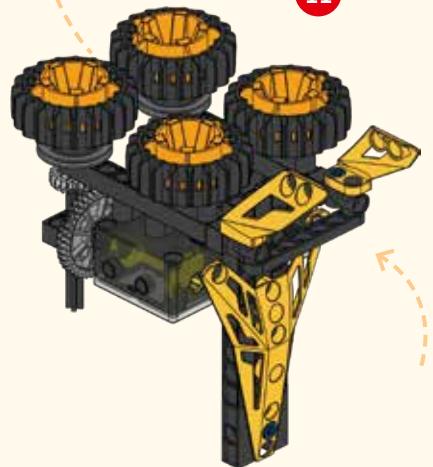
10



Important! Make sure the trajectory of your plane is clear — do not aim at people or objects!



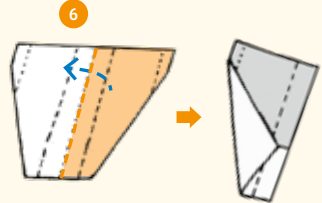
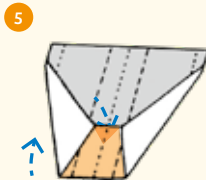
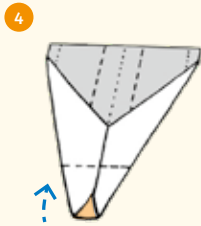
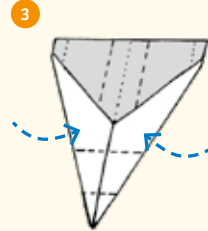
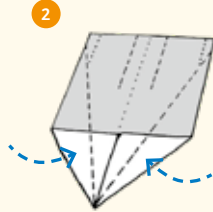
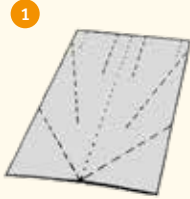
11



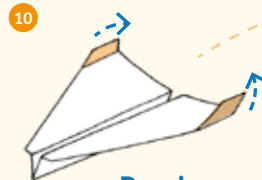
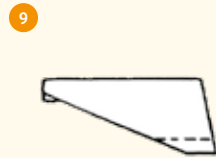
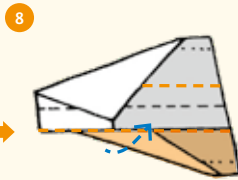
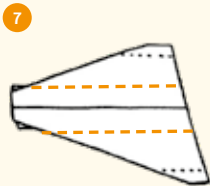
Done!

Switch on the motor and push the paper plane through the wheels from the back. Let go and watch the plane take off!

INSTRUCTIONS FOR MAKING A PAPER AIRPLANE



Turn the plane over and fold down the middle.





>>> CHECK IT OUT




Riding a bike on a smooth road surface is much more fun than riding on a sandy path, because on sand the tires sink in and get stuck.

The same is true for any type of vehicle with wheels. Unless it carries its own “road” along with it — like a **tracked vehicle** does. Its wheels roll along on two tracks that turn in an endless loop.

The lower part of these wide tracks rests firmly on the ground and supports the wheels — and thus the load of the vehicle. At the rear, the track’s chain links, which are usually made of metal, are lifted off the ground and carried to the front to be used again.

>>> Tracked vehicles have many advantages in off-road locations.

The weight of a wheeled vehicle without tracks can push its wheels deep into soft ground. The tracks, on the other hand, have a much larger surface area than the wheels. This spreads the weight of



the vehicle over a larger surface area, so it does not sink in as easily. This large surface area also transfers the driving force to the ground better, so tracked vehicles can move forward more easily on slippery surfaces and can even climb over small obstacles.

>>> However, tracked vehicles are much more technically complicated than ordinary vehicles.

They have more drive wheels and rollers, need an especially powerful motor, and the heavy track needs to be guided by stabilizing wheels. They are steered by controlling the running speed of each track individually. This means that a tracked vehicle can even turn around on the spot. A tracked vehicle can also brake very effectively.

Today, chain-drive tracks are commonly found on numerous **construction vehicles** that have to drive on soft ground, such as **excavators, bulldozers, and dump trucks**. Thanks to their crawler tracks, **snowmobiles** can also drive on ice and snow. And last but not least, **tanks** take advantage of chain-drive tracks because they need to be able to drive on any terrain despite weighing dozens of tons thanks to their thick metal bodies and ammunition.

ENGINEERING DESIGN

Draw your own
model ideas on
these pages!



